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Parental Transfers and Fertility: Does the Recipient's Gender Matter?[*]

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This paper examines the role of parental transfers on family size. We introduce a simple theoretical model of fertility decision where preferences towards children may differ between female and male spouses. Parental transfers increase both the household income and the bargaining power of the recipient spouse. Therefore, transfers from wife's and husband's parents may have dissimilar effects on the number of children. We empirically test and confirm this hypothesis using a unique household-level data for Japan. In particular, received transfers from the wife's parents reduce the demand for children. In contrast, both received and expected transfers from the husband's parents increase the demand for children. These results hold important policy implications.

JEL Classification Codes: D10, D64, J13

Key Words: Family Size, Fertility, Parental Transfers, Bargaining power, Collective Framework, Quantity-Quality Model

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1. Introduction

Since Becker's (1960) influential study on household decision-making and family size, economists have taken growing interest in understanding determinants of fertility. One strand of literature concerns the role of women labor market opportunities, technological changes, and other socio-economic factors in determining the number of children. Another line of inquiry focuses on the impact of wealth on the optimal family size.[1] However, we are not aware of an empirical work that examines how transfers from parents to married children influence the recipients' fertility decisions. As we show in our theoretical model, the fertility consequence of this exogenous change in spouses' non-labor income goes beyond a pure wealth effect and depends on the gender of the transfer-recipient. The purpose of our study is to fill this gap in the literature.

First, following seminal contributions of Chiappori (1988; 1992), and Apps and Rees (1988), we develop a simple theoretical model of fertility choice under the standard collective household utility maximization framework. We differentiate between the wife's and the husband's intrinsic preferences on the quality versus the quantity of children (Becker 1960; Becker and Lewis 1973). We show that an increase in the wife's transfer-income could improve her bargaining power within the family such that the household fertility decision-making better represents the wife's preferences. Therefore, the optimal number of children depends on whether female spouse or male spouse receives parental transfers.

Second, we utilize a unique Japanese micro data from the Preference Parameters Study of Osaka University's 21st Century COE Program "Behavioral Macrodynamics Based on Surveys and Experiments" and its Global COE project "Human Behavior and Socioeconomic Dynamics" to test the predictions of our theory. Our results confirm that the effects of transfers from the wife's parents and that of the husband's parents differ. Transfers received from female-spouses' parents have a negative effect on the number of children, whereas transfers – received or expected – from husbands' parents have a positive association with the number of children.

[1] See Section 2 for a detailed survey of the relevant theoretical and empirical studies.

Japan, similar to other developed countries, has been facing severe demographic challenges (Ogawa 2003). According to an estimate, the old-age dependency ratio can reach 85 percent – the highest among major developed economies – by 2050 owing to aging population and low birth rates (Kitao 2015). At the same time, Sánchez-Romero, et. al (2013) estimate that the annual flow of bequest as a fraction of output in Japan will increase from 4-6 up to 13 percent during 2000-2100. Our analysis implies that government policies that affect intergenerational transfers and bequests have consequences on fertility; the direction of the outcome depends on the relative share of transfers from spouses' parents.

The remainder of the paper is organized as follows: Section 2 reviews the theoretical and empirical literature. We introduce the theoretical model in Section 3 followed by the description of data in Section 4 and the presentation of results in Section 5. Section 6 provides further discussion of results and Section 7 concludes.

2. Literature Review

In the following two subsections, we aim to briefly inform the reader about the main theoretical and empirical results on the household fertility decisions. We also briefly describe how family decision-making is traditionally modelled. Our aim is not to provide an exhaustive summary of the theoretical and empirical contributions.[2]

2.1 A Brief Review of the Conventional Theoretical Studies on the Family Decision-Making

There are a large number of theoretical models that aim to explain household decision-making. In this section we focus on the so-called unitary, cooperative (collective), and non-cooperative frameworks. Under cooperative frameworks we also discuss the bargaining models.[3]

[2] For excellent reviews, refer to Bergstrom (1997), Hotz, et al. (1997), Schultz (1997), Ermisch (2003), Browning, et al. (2004; 2014).

[3] Browning, et. al. (2014, pp. 127-130) review additional approaches, the so-called equilibrium models, separate-spheres approach, and inefficient bargaining framework.

A typical theoretical assumption that most models share is that decisions are made by "adults-in-charge" who have well-defined individual preferences (which may or may not be interdependent) over optimal spending. One approach is to assume that family members act as if a *unitary* household, where individual preferences are embedded in a single household utility function. Individual preferences may depend on private and possibly public goods but not on income and prices. The stable household utility function is then maximized subject to the family resource constraints. A fundamental feature of traditional common-preference models is that the family aggregate demand satisfies Slutsky regularity conditions,[4] and the demand depends on total family resources – not on the income distribution within the family. This income pooling hypothesis in the context of unitary approach has been subject to many tests and empirical scrutiny; yet there have been a number of solid evidences against it.[5]

Nevertheless, unitary models conveniently fit empirical cross-sectional data that are primarily based on aggregate household information. Suppose commodity prices and total family income do affect household consumption, indirect utility is of the Gorman polar form, and preferences in a household are convex. Then econometricians who only observe the time paths of the household income, consumption, and commodity prices, would not be able to reject the hypothesis that a single consumer makes all household decisions, implying that a household acts as if a single utility-maximizer (Bergstrom 1997). In addition, as emphasized in Browning, et al. (2014), one person may be given a full control of resources due to customs or strong social traditions. Samuelson (1956) and Varian (1984) show that the unitary approach is valid under a very general individual preferences as long as income within a family is optimally reallocated by a benevolent dictator, and each member of the household is given a certain amount of income to purchase an optimal bundle (Bergstrom 1997).

Evidently, "common preference" models are tractable, easy to interpret, and are not without merit. Therefore, the theoretical approaches that share some common features with it are widely popular. Yet it is often argued that assuming a many-person household has stable and transitive preferences is not innocuous (Browning, et al. 2006). This leads us to another popular strand in the literature, where

[4] These are homogeneity, additivity, symmetry and negativity of the Slutsky matrix (Browning, et al. 2014, p. 90).

[5] See, for example, Ermish (2003, pp. 43-49) and the references therein.

household decision-making is modelled in the context of the so-called *cooperative* (e.g., collective) framework à la Chiappori (1988; 1992), and Apps and Rees (1988). Within the collective framework, it can be shown that the household will achieve a Pareto-optimal allocation of utilities by maximizing a member's utility subject to the family budget constraints and a reservation-utility level of another member. In the collective framework, a Lagrange multiplier associated with the reservation-utility constraint (the so-called "Pareto weight"), can be a function of income, prices, total expenditures, and variables that do not enter individual preferences ("environmental parameters" or "distribution factors"). When that weight is always constant, the approach collapses to a standard unitary model. Further, Browning, et al. (2006) emphasize that in the presence of private goods, the outcomes of the collective model can be achieved via decentralization. The authors systematize the notations to come up with a "hybrid" between a standard unitary approach and a standard collective model depending upon *what* enters the Pareto weight. The resulting household market demand may or may not fail the Slutsky conditions and/or be independent of any distribution factors. The authors stress that whether the demand satisfies the Slutsky conditions is important because it will affect whether the outcomes of a collective framework can be rationalized by a conventional household preference function.

Efficiency concept is a crucial focus of many models of intra-household decision-making, and has often been assumed or implied under Samuelson-type single household, or Beckerian "benevolent dictator" framework. However, families in some developing countries may not achieve efficient allocation of tasks owing to the lack of freedom, biased social norms, and prejudice. Nevertheless, the efficiency argument can serve as a reasonable first-degree approximation to reality in modernized developed countries like Japan.

In the context of a broad cooperative framework, the decision-making process can be further specified. A significant progress along this dimension is achieved within cooperative game-theoretic *bargaining models* which also presume Pareto efficiency. Assuming that the couple has already formed a union, one can define individual preferences for each adult, as well as the "threat points" (or, disagreement payoffs). Distribution factors that play a crucial role in a collective framework can also be thought of affecting the threat points. It is worth emphasizing that if the threat points are constant then the model is essentially unitary.

The solution to the bargaining process, which is typically a Nash solution, leads to the specific point on the Pareto frontier. The Nash solution satisfies the requirements of Pareto optimality, symmetry, independence of irrelevant alternatives and linear transformations of the utility functions.[6] Under certain assumptions, this solution rule is consistent with the maximization of the product of the differences between the utility function of each agent and its respective threat point.[7] The Nash bargaining solution involves the maximization of the objective function that contains a product of the utility functions. This may complicate solving the household optimization in closed form. Further, Browning, et. al (2014, pp. 126-127) cautions the reader about additional challenges associated with the nature and type of a threat.

An alternative theoretical approach assumes a *non-cooperative* decision process, whereas each adult independently maximizes its objective function subject to the resource constraints. In contrast to collective and bargaining models, Pareto-efficiency is not guaranteed in a non-cooperative framework. A non-cooperative allocation is Pareto efficient if there is no direct economic interaction between the agents and there are no externalities and public goods. Efficiency can also be achieved under symmetric information. Furthermore, Slutsky conditions or income pooling are satisfied only under certain restrictions (Browning, et al. 2014, p. 91). Therefore, it is generally more difficult to justify non-cooperative models under the assumption of efficient cooperation within a household.[8] As stressed in Browning and Chiappori (1998), it is reasonable to assume the household members ultimately share a great deal of common information about each other's preferences; due to the repetitiveness of non-cooperative "games" and bargaining processes, an efficient allocation can be achieved. The authors thus regard the collective framework as a natural "umbrella" for all existing models of cooperative nature.

[6] The solution rule is symmetric if for a symmetric bargaining game (where the disagreement payoffs are equal, and the set of utility allocations is symmetric and compact), the agreement payoffs of the players, receiving the same disagreement payoffs, match. Independence of linear transformations means that the solution rule is invariant to the change of the scale and the units of the utility functions. Independence of irrelevant alternatives means that the solution rule remains valid even when the payoff space of the original game is restricted to eliminate the undesirable alternatives for the players (Aliprantis and Chakrabarti, 2000, pp. 190-203; Browning, et al. 2014, pp. 122-127).

[7] A popular alternative to the Nash bargaining rule, especially when the bargaining game is asymmetric, is the Kalai-Smorodinsky solution rule.

[8] As argued in Browning, et al. (2014, pp. 92-97), in the presence of altruism, a non-cooperative process may display a "unitary-like" behavior.

2.2 A Brief Review of the Conventional Models of the Marital Fertility Decisions

Earlier studies on the demand for children within married couples adopted a unitary-like approach to modelling fertility and treated children as any other normal good within a static neoclassical framework (Hotz, et. al. 1997). Under such assumption, the demand for children goes up with the family's income. Since this generally does not jibe with most empirical evidence, many alternatives have been suggested.

In pioneering studies, Becker (1960) and Becker and Lewis (1973), model parental preferences where the quantity and quality of children are equally important. The family's budget constraint is non-linear due to interaction of the quantity and quality. The size of the income elasticity of child quality now plays a crucial role in the determination of the sign of the comparative statics. As a result, an outward shift in the family's budget constraint may lead to a reduction in the quantity of children and to a rise in the quality of children. Intuitively, an increase in the total household income (irrespective of the source) may reduce the family's fertility because of the "induced substitution effect" – i.e., higher desired quality increases the cost of an additional child.

Further studies also focus on other possible sources of the negative relationship between income level and family size. For example, Willis (1973) endogenize the wife's labor supply, as well as her supply of home time. The author assumes that raising children is relatively more time intensive activity, thus affecting the costs of child quality. Adults' standards of living and satisfaction from children ("child services") are produced according to the household production function via time contributions and the purchased goods and services. The relative cost of raising children depends on children's quality, and varies directly with the opportunity cost of mother's time. Consequently, the higher female wage would raise the relative cost of time-intensive activity thereby reducing fertility despite a positive income effect.

Alternatively, one can assume that some childcare can be purchased in the market, although such care may not be a perfect substitute for the mother's time (Ermisch 1989; Ermisch 2003, pp. 117-122). Both parental time and purchased goods and services are used to deliver a quality component of a child. Consumption time of the mother is also used to supply home-produced commodity. When mothers are assumed to work sometime, the optimal amount of purchased childcare is chosen such that the marginal benefit of childcare matches the ratio of the price of the childcare to the value of the mother's time. On the other hand, the

optimal family size is determined such that the marginal cost of children equals the marginal rate of substitution between children and purchased commodities. No childcare may be purchased in the market when the mother's wage is low or childcare is expensive. In this case, an increase in the mother's wage would reduce fertility due to a large substitution between other commodities and children.

In a recent study, Córdoba and Ripoll (2016) develop a discrete-time, three-period model of fertility choice, and introduce altruistic parents who take into account the cost of raising children and the present value of the child's future income. Parents may financially benefit from having children. However, raising children is costly due to time costs, goods costs, and bequests. Parents are facing nonnegative bequest constraints so that they cannot legally enforce debt contracts on their children. Otherwise, parents might borrow to raise children and then leave negative bequests to their children. Higher parental wages are associated with higher relative marginal costs of rearing children and this lowers the demand for children. In addition, with binding constraints, income-fertility link can be negative when parental consumption is a superior good, which means that richer parents are less willing to sacrifice their own consumption for children.

Alternative dynamic models of fertility consider a wide range of issues, including the determination of the optimal timing of births and the spacing between them, and even the optimal contraceptive strategies. Like their static counterparts, most dynamic models also incorporate some form of child quality component (child services) that can be enhanced via parental time investment and the purchases of specific market goods.[9] For example, Mira (2007) models a perfect fertility control and infant mortality. It is assumed that producing children incurs costs in the form of foregone consumption by mothers net of avoidable contraception costs. The model focuses on the fertility response to an unexpected death of an infant with corresponding Bayesian learning of the family-specific infant mortality risk. More recently, Canning, et. al. (2016), use a dynamic model of labor supply and consumption with endogenous fertility effort by women. Fertility effort ultimately determines the likelihood of birth. One of the main findings is that better educated women delay the probability of fertility as they prefer to gain work experience earlier.

[9] This line of literature is voluminous. An interested reader may refer to Hotz, et. al (1997), Ermicsh (2003), Ueda (2007), and Canning, et al. (2016).

A number of studies model the enjoyment the household receives from the mother's leisure time and benefits from the mother's human capital accumulation. The latter can be enhanced via the mother's participation in the labor market. Moffitt (1984) shows that if the opportunity cost of human capital accumulation or enjoyment from the mother's leisure is high earlier in life, the childrearing can be postponed.

Heckman and Willis (1976) focus on the uncertainty due to the imperfect costly contraception control and pregnancy. Households receive satisfaction from children and from the consumption of other services, while the efficiency of contraception (and thus the probability of conception) is chosen endogenously. This leads to precautionary contraception strategy earlier in life. This line of research (see also Wolpin 1984; Newman 1988) presumes that there are economic incentives to have children at times when incomes are high. Yet between the births, the couple optimally engages in contraception and spaces births.

Kim (2005) endogenizes abortion decision in a dynamic framework of selective or unselective abortions with stochastic conception and imperfect control over pregnancy. Contrary to a popular view that cheap sex selection may lower family size (in the absence of wealth effect), the author finds that a reduction in the cost of gender selection may increase fertility by expanding the number of sex-selected abortions at the expense of unselected abortions.

Ueda (2007) endogenizes a woman's labor supply, marriage and childrearing decision within the quantitative-theoretical life-cycle model, where marriage is subject to the economy of scale and career interruption is costly. The key finding – based on estimated utility gains for the Japanese households – is that having the first child generates a utility loss presumably due to a lack of childrearing experience and costs of infant-care.

2.3. A Brief Review of the Empirical Literature on the Family Income, Fertility and Children

A large body of empirical work tested Becker's predictions on the relationship between household income and fertility. Cross-country and country-level evidence suggests that an increase in income lowers family size (e.g., Galor, 2011; Strulik and Vollmer, 2015; Wang and Sun, 2016; Weil, 2016). These studies mainly

dwell on the factors and dynamics of demographic transitions with an increase in a country's GDP. Studying the fertility pattern for women who were born between 1826 and 1960, Jones and Tertilt (2008) find that much of the decline in fertility in the US is explained by income alone.

On the other hand, several recent studies find support for the positive fertility-income relationship. Bruckner and Schwandt (2015) show that population growth increased with increase in income growth for 139 countries spanning the period 1960-2007. In a micro-level analysis, Black, et. al (2013) examine the relationship between income and fertility among non-Hispanic white married women at different age groups and socioeconomic characteristics in the US. Their findings suggest that fertility of married couples who lived in coal-rich counties increased and that increase was mainly driven by the increase in the husband's income. In addition to the income effect, the concern for old-age support has also shown to be a deriving factor in increasing the number of offspring by parents (e.g., Oliveira, 2016).

A separate line of literature questioned the validity of the unitary theory of household. Thomas (1990) argues that if household resources are not pooled, then each parent can allocate different resources to the number and health of children. Using a household survey data from Brazil, he finds that non-labor income in the hands of the mother has a bigger effect on family health than the same amount of income given to the father. Similarly, Schultz (1990) shows that non-labor incomes of men and women have dissimilar effect on female labor supply in Thailand. In particular, women with more "bargaining power" increase their time in nonmarket activities and prefer to have more children. Duflo (2003) shows that pension received by women improve the health and nutrition of girls, while such transfer has no discernible effect if it is received by men. Therefore, the consequences of transfer programs for the nutrition of children depends on whether husband or wife receives these payments.

Lower childcare costs may also increase the demand for children as it reduces the net costs of having children. Mörk, et. al (2013) examine the impact of Swedish childcare reform that imposed a cap on childcare charges. They find that the reduction of childcare costs increased the probability of first births for the childless couples by 9.8 percent. Studying the period 1983-2012 in the US, Hazen and Zoabi (2015) show that childcare has become more expensive for women with less than a college degree and cheaper for those with a college degree. They find a negative relationship between the probability of giving birth

and the costs of childcare; however, highly educated women have more children as they substitute a significant amount of their own parenting with childcare. In similar vein, Kremer and Chen (2002) show that the fertility differential among educated and uneducated women is greater in countries with more income inequality. Since fertility typically falls with education and children of educated workers are more likely to attain education, this fertility differential creates a vicious circle of low wages and low education. Likewise, Al-Qudusi (1998) shows a differential in rural-urban fertility rates in Arab countries that largely results from a combination of low wages of women and illiteracy rate.

Given the demographic challenges of aging populations and declining birth rates in developed countries, the governments have been encouraging more births by subsidizing the costs of rearing children (Sleebos 2003). However, efficacy of these programs in meeting such objective is an empirical question. Gauthier and Hatzius (1997) argue that the potential effect of any policy intervention to instigate fertility would be doubtful if a child bearing decision is perceived to be an entirely a private affair. They find a small positive effect of cash benefits on fertility in 22 industrialized countries: a 25 per cent increase in family allowance increase fertility by 0.6 and 4 percent in the short-run and the long-run, respectively. This translates into 0.07 children per women on average. Kim (2014) finds a little positive effect of the Allowance for Newborn Children program on fertility in Canada. He also argues that this increase in birth could mainly be due to the shift in the timing of childbirth, rather than increase in lifetime fertility level. Fiscal incentives such as tax credit for working mothers, tax exemptions for children and family allowances are also found to have a significant and positive effect on fertility (e.g., Azmat and Gonzalez, 2010; Milligan, 2005; Zhang, et. al, 1994).

3. A Simple Model of Fertility Choice in a Collective Framework

We augment the standard collective household utility model that is based on the seminal contributions of Chiappori (1988; 1992), and Apps and Rees (1988),[10] with the classic quantity-quality of children approach developed by Becker (1960) and Becker and Lewis (1973). We deliberately keep the model simple in order

[10] The framework is thoroughly discussed in Chiappori et al. (1998), and Browning et al. (2014). We will mostly follow the terminology and the assumptions used in Browning et al. (2014).

not to confound a link between an "unearned" income of the wife (parental transfer received) and the decision on the family size. Our approach is consistent with the way a public good consumption choice is often modelled within a collective framework (Browning, et al. 2014, p. 160-163; Ermish 2003, pp. 25-29).[11]

We start by assuming that the decisions are made by two agents only: a "husband" (denoted by symbol H) and a "wife" (denoted by symbol W). There is only one private good, x, that can be divided between husband and wife, such that $x = x^H + x^W$. Assume the lifetime income of the husband (I^H) consists of the bequest income ($B^H > 0$) received from his parent, and some other income ($w^H > 0$), so that

$$I^H = w^H + B^H \tag{1}$$

Similarly, the lifetime income of the wife (I^W) consists of the bequest income ($B^W > 0$) received from her parent, and some other income ($w^W > 0$), so that

$$I^W = w^W + B^W \tag{2}$$

Remark 1. A person's "bargaining power" or "relative importance" can be affected by many factors, including those that do not enter individual preferences. As emphasized in Browning, et al. (2006), such factors can be interpreted as "extraenvironmental parameters" or "distribution factors". Browning and Chiappori (1998), and Browning, et al. (2006; 2014) cite as possible examples the sex ratio in the relevant population (that may impact the likelihood of remarriage), the level of single-parent benefits, the individual incomes of the two partners, the intrahousehold distribution of income, the wealth contribution of each partner upon marriage, to name a few. Let vector $\boldsymbol{z}$ capture those distribution factors that may also be affected by the wife's bequest level, B^W.

[11] Fisher (2012) also models the fertility decision within a collective framework, with a specific focus on the expenditure on children, and the Pareto weight depending on that variable. The author carefully distinguishes the commitment and non-commitment scenarios, i.e., whether or not the couple can commit to child investment and private consumption with a possibility to renegotiate, and investigates the impact of the custody laws on fertility and consumption.

Suppose each partner has "egoistic" preferences over his/her own consumption of the goods.[12] Associated utility functions are assumed to be well-behaved as in Browning and Chiappori (1998, p. 1245). The Pareto-efficient allocation can be obtained by maximizing the welfare of, say, the husband, so that the welfare of the wife does not fall below a given level, say $\bar{U}^W$.

Thus, the problem is to

$$\max_{\{n,q,x^H,x^W\}} U^H(n,q,x^H) \tag{3}$$

subject to

$$U^W(n,q,x^W) \geq \bar{U}^W(p_n,p_x,I,\boldsymbol{z}) \tag{4}$$

$$p_n n + p_q q + pnq + p_x(x^H + x^W) \leq I^H + I^W \tag{5}$$

where U^H and U^W are the respective utility functions of the husband and wife. Note $\bar{U}^W$ may be a function of p_n, p_x, I, and $\boldsymbol{z}$, where $I \equiv I^H + I^W$. The budget constraint in (5) is consistent with the generalized one presented in Becker and Lewis (1973, p. 283), where some costs associated with the number of children are not associated with the costs of child quality and vice versa.[13] Here p_n is the price of a child, p_q is the price of the independent quality component, p_x is the price of the parental consumption of the private good, p is the price of nq, n is the number of children, q is the quality per child. The interaction term nq in the budget constraint implies that the cost of an extra child depends on the quality per child and vice versa.

Now, let the Lagrange multiplier associated with (4) be

$$\mu = \mu(p_n,p_x,I,\boldsymbol{z}) \tag{6}$$

which is nonnegative and continuously-differentiable. If the utility functions are strongly concave, the above optimization exercise is equivalent to

$$\max_{\{n,q,x^H,x^W\}} \{U^H(n,q,x^H) + \mu U^W(n,q,x^W)\} \tag{7}$$

[12] We do not explicitly focus on children's well-being, which is typically modelled as entering parents' preferences as a public good.

[13] For instance, a reduction of the cost of an oral contraceptive pill would raise the marginal cost of a birth but will not affect the marginal cost of the child quality.

subject to (5).

Remark 2. The coefficient μ is called *Pareto weight* for W, or *distribution of power* function (Chiappori 1988, 1992; Browning, et al. 2006; 2014). It is important to re-emphasize that "Pareto weights may depend on prices, wages, incomes, and distribution factors and that this fact explains why collective households do not generally behave as unitary ones" (Browning, et al. 2014, p. 116).

In what follows, we just assume that

$$\mu'_{B^W} \equiv \frac{d\mu}{dB^W} > 0 \tag{8}$$

We are not concerned about the exact mechanism that generates (8), which is likely to be at least partly shaped by socio-economic and cultural considerations. It may be that an increase in relative total income of the wife (I^W/I^H) due to a rise in her bequest income is the source of the betterment of her position within the household.

Finally, the preferences of the adults are assumed to be logarithmic in the form of

$$U^H(n, q, x^H) = \alpha_x^H \log x^H + \alpha_n^H \log n + \alpha_q^H \log q \tag{9}$$

$$U^W(n, q, x^W) = \alpha_x^W \log x^W + \alpha_n^W \log n + \alpha_q^W \log q \tag{10}$$

where α-s are all positive, and $\alpha_x^H + \alpha_n^H + \alpha_q^H = 1$, $\alpha_x^W + \alpha_n^W + \alpha_q^W = 1$.

Remark 3. We obtained a general solution to (7) under the generalized budget constraint (5), but the solutions are extremely lengthy (available upon request). Therefore, we present the solution to the model for the special case ($p_q = 0$) considered by Becker and Lewis (1973, p. 284).

When $p_q = 0$, the optimal number of children are consequently given by

$$n = \frac{\alpha_n^H - \alpha_q^H + (\alpha_n^W - \alpha_q^W)\mu(p_n, p_x, I, \boldsymbol{z})}{p_n(\alpha_n^H + \alpha_x^H + (\alpha_n^W + \alpha_x^W)\mu(p_n, p_x, I, \boldsymbol{z}))}(I^H + I^W) \tag{11}$$

Differentiating with respect to B^W leads to

$$\frac{dn}{dB^W} = \frac{V_1 - V_2 + V_3}{p_n(\alpha_n^H + \alpha_x^H + (\alpha_n^W + \alpha_x^W)\mu)^2} \tag{12}$$

where

$$V_1 \equiv (\alpha_n^H - \alpha_q^H + (\alpha_n^W - \alpha_q^W)\,\mu)(\alpha_n^H + \alpha_x^H + (\alpha_n^W + \alpha_x^W)\mu) \tag{13}$$

$$V_2 \equiv (I^H + I^W)(\alpha_n^W + \alpha_x^W)(\alpha_n^H - \alpha_q^H + (\alpha_n^W - \alpha_q^W)\mu)\mu'_{B^W} \tag{14}$$

$$V_3 \equiv (I^H + I^W)(\alpha_n^W - \alpha_q^W)(\alpha_n^H + \alpha_x^H + (\alpha_n^W + \alpha_x^W)\mu)\mu'_{B^W} \tag{15}$$

Note when $\mu'_{B^W} = 0$,

$$\frac{dn}{dB^W} = \frac{\alpha_n^H - \alpha_q^H + (\alpha_n^W - \alpha_q^W)\mu}{p_n(\alpha_n^H + \alpha_x^H + (\alpha_n^W + \alpha_x^W)\mu)} \tag{16}$$

Remark 4. It is clear from (16) that if the wife puts a sufficiently strong weight on the quality, *and* her *existing* bargaining power is sufficiently strong, then the family will still have *fewer* kids with an increase in the wife's bequest income, i.e., $dn/dB^W < 0$.

Thus, to generate a negative relationship between the wife's bequest income and the family's fertility, it is sufficient that two assumptions hold: 1) wife puts high enough weight on the quality of the children, and 2) her *existing* bargaining power within the household is sufficiently strong. Hence, the fertility rate may decline even if bequest income produces a negligible (or no) rise in the wife's Pareto weight. This simple, intuitively sensible result is conveniently consistent with the general predictions of the collective household models. Thus, when the wife's bequest income increases, the demand for children tends to increase due to pure wealth effect, but this effect can be counterbalanced by the desire to obtain better quality of children. The latter effect is even stronger when the wife's relative power rises as a result. It is possible that an increase in the husband's bequest income does not affect the fertility decision in the same way as an

increase in the wife's bequest income. This ambiguity can also be generated even under the general assumption $\mu'_{B^H} \neq 0$.

4. Data Source and Description

We use Japanese micro data from the Preference Parameters Study of Osaka University's 21st Century COE Program "Behavioral Macrodynamics Based on Surveys and Experiments" and its Global COE project "Human Behavior and Socioeconomic Dynamics". The data is based on nationally representative annual surveys using visiting and placement methodology. The respondents are selected using two-stage stratified random sampling method.[14] This study utilizes the survey data from 2010 wave because the 2010 wave has the most complete information about our main variables of interest. Our sample is restricted to 2,665 married households that reached completed fertility cycle – i.e., households with female spouse older than 49 years old. This allows us to examine the equilibrium effect of our variables of interest on demand for children and avoid complications related to dynamics that cross-sectional data would not be able to address.

The dependent variable is the number of children (*Number of children*). We follow our theory and extant fertility literature to identify independent variables. The survey questionnaire asks respondents whether they received and/or expected to receive inheritance and/or gifts from their parents. However, the amount of transfer is not specified. Using available information, we construct six main explanatory variables. *Transfer Rec.* is a dummy variable that is 1 if a respondent received inheritance and/or gifts from their own and/or spouse's parents. Similarly, *Transfer Exp.* equals 1 if a household is expected to receive inheritance and/or gifts in the future from the husband's and/or the wife's parents. The other four dummy variables are transfers received from the husband's parents [*Transfer Rec. (H)*], transfers received from the wife's parents [*Transfer Rec. (W)*], transfers expected from the husband's parents [*Transfer Exp. (H)*], and transfers expected from the wife's parents [*Transfer Exp. (W)*].

[14] First, the Japan's prefectures are grouped into ten regions and then each of the regions is divided into four strata (government-designated major cities, cities with more than 100 thousands population, cities with less than 100 thousands population, towns and villages).

The upper panel in Table 1 presents disaggregated information about received and expected parental transfers. The data shows a significant variation across various dimensions. For example, 9.3% of sample households [100*234/(810+1700)] received transfers from both the husband's and the wife's parents, whereas 54.2% (1,360 out of 2,510) did not receive any transfers from either parents. The remaining households – around 36.5% – received transfers from either the husband's or the wife's parents; the number of families that received inheritance and/or gifts solely from the husband's parents and entirely from the wife's parents are 576 and 340, respectively. Approximately 33.4% of households expect to receive parental transfers; among them are some who received transfers in the past. Around 9.6% of families (241 out of 2,498) received transfers from the husband's parents and expect to receive more from the husband's parents in the future. This figure is about 6% (143 out of 2,484) for households who received transfers from the wife's parents and expect to receive more in the future.

[Table 1 here]

We also divide households based on the source of parental transfers and compute the average number of children for each group (lower panel in Table 1). Overall, the number of children is greater in households that received or expected to receive transfers from male spouse parents than in families that received or expected to receive parental transfers from female spouse parents. Further, families that received or expected to receive transfers from the husband's parents have more children than households that did not receive (or are not expected to receive) parental transfers from the husband's parents. However, the opposite holds true for transfers from the wife's parents.

According to the theoretical model (Section 3), price of children and income of spouses (other than transfers) are important determinants of family size in addition to parental transfers. Unfortunately, direct measures for price of children and permanent income of spouses are not available. The survey data has information about spouses' employment status for the last two years and earnings for the previous (2009) year. However, current employment status is not informative about wife's opportunity cost of having kids at the time of fertility decision, which might have been many years ago for our completed-fertility sample. Being employed at current or last year does not necessarily mean that a spouse was regularly employed. Similarly, last-year's income is not a good indicator of long-term earnings. Therefore, we use education to

capture these effects. Education, in addition to its direct effect on preferences towards children, can serve as a proxy for long-term income and opportunity cost of having children owing to its positive correlation with earnings and probability of employment for female spouse. The education variables – *Education (H)* and *Education (W)* – are indices ranging between 1 (elementary/junior high school) and 11 (doctoral degree), where *H* and *W* denote husband and wife, respectively. We also construct a measure of wealth for the entire household; separate data for spouses are not available. The survey asks respondents to report their (present) appraised value of houses and properties, financial assets, housing loans, and debts other than housing loans for their households. The respondents are not asked to report the exact amount of assets and debts. Instead, they are presented with different ranges of values to choose from. Using this information, first we construct indices of property assets and financial assets – each ranging from 1 to 8 with larger value indicative of greater amount of assets – and aggregate them.[15] Second, indices of property loans and (other) financial debts are created and summed; each index varies from 1 to 5 with greater value signifying higher debts.[16] The asset and debt indices have dissimilar ranges because the corresponding survey questions are different. Third, our wealth measure – *Wealth index* – is computed as the ratio of aggregated asset index to aggregated debt index. Unfortunately, we cannot identify the amount of wealth that is originated from parental transfers. In our analysis, we examine the robustness of transfers' effects with and without wealth variable. Following the fertility literature, we include in our regressions the duration of marriage in years (*Marriage duration*) and a measure of religious beliefs (*Religiosity*). The data for the degree of religiosity is available only for a responding spouse. So we assume that this approximately represents the degree of religiosity of both spouses. The religiosity index varies from 1 to 5. The religiosity measure is transformed so that the higher values indicate a stronger degree of religiosity. The summary statistics of the variables are shown in Table 2. The number of observations varies across variables owing to missing values.

[15] The ranges for each index are as follow: 1 (less than ¥5,000,000), 2 (between ¥5,000,000 and ¥10,000,000), 3 (between ¥10,000,000 and ¥15,000,000), 4 (between ¥15,000,000 and ¥20,000,000), 5 (between ¥20,000,000 and ¥30,000,000), 6 (between ¥30,000,000 and ¥50,000,000), 7 (between ¥50,000,000 and ¥100,000,000), and 8 (more than ¥100,000,000).

[16] Each index takes the following values: 1 (zero debt), 2 (less than ¥5,000,000), 3 (between ¥5,000,000 and ¥7,500,000), 4 (between ¥7,500,000 and ¥10,000,000), and 5 (more than ¥10,000,000).

[Table 2 hear]

5. Results

Our dependent variable is a count of children in a given household. Poisson and negative binomial estimators are two commonly used approaches for modeling count data. We apply Poisson regression since our data does not exhibit a serious overdispersion problem; negative binomial estimator also produces similar results (available upon request). The data is cross-sectional at the household level. Robust standard errors are computed to account for potential heteroscedasticity.

In Table 3, Model 1 includes total parental transfers received and total parental transfers expected, Model 2 incorporates only received transfers decomposed by gender, Model 3 contains only expected transfers decomposed by gender, and Model 4 encompasses received transfers and expected transfers – each decomposed by gender. Model 5 re-estimates Model 4 by entering wealth index.

[Table 3 here]

The effect of received parental transfers, though not statistically significant, is negative whereas the impact of expected parental transfers is positive. Decomposed analysis, however, reveals a rather nuanced picture. On average, a household that receives transfers from the wife's parents is expected to have fewer children compared to a household that does not receive transfers from the wife's parents (Models 2, 4, and 5). Transfer receipts from the husband's parents have a positive, albeit non-robust, effect on the number of children. We perform the Wald test and confirm that the effect of the husband's parental transfers received statistically differs from the impact of the wife's parental transfers received. This central finding of our study coincides with our theoretical prediction that transfers from the wife's parents boost her intra-household bargaining power. Having command on financial resources increases the wife's say in deciding the number of children she may desire to have. In our model, a female-spouse's desire to have fewer children arises from her preference for quality, rather than quantity, of children. This argument is consistent with the findings by a several studies suggesting that women care more about the health and nutrition outcomes of their children than men (e.g., Duflo, 2003; Thomas, 1990). With regard to anticipated

parental transfers, transfers expected from the wife's parents have no statistically significant effect on the number of children. Hence, only received transfers from the wife's parents – not expected transfers – influence her relative bargaining power. The effect of expected transfers from the husband's parents is positive and statistically significant.

The impacts of control variables are generally in accordance with the findings in literature. The duration of marriage, as expected, has a positive effect on the number of children. The degree of religiosity is also important; households with a stronger degree of religiosity are likely to have a greater number of children. The estimated coefficient for the index of wealth is negative and statistically significant; other things constant, wealthier households have fewer children presumably by opting for higher quality. The remaining explanatory variables are either not statistically significant or not robust.

[Table 4 here]

Next, we examine the magnitude of the effects – see Table 4. Families that *expect* to receive transfers from the husband's parents, have 5% more children. However, households that *received* transfers from the wife's parents, on average, have 5% fewer children. The mean values of received transfers from the wife's parents and expected transfers from the husband's parents are both around 0.24 with standard deviations of 0.43. Table 5 reports predicted counts of children for families that did not receive parental transfers, received transfers from one of the spouses' parents, and received transfers from both spouses' parents. The differences in predicted counts are statistically significant; the exception is the difference between households that did not receive any parental transfers and those that received transfers from both spouses' parents. Families that received transfers only from the husband's parents are predicted to have the greatest number of children at 2.16, whereas households that received transfers only from the wife's parents are expected to have the fewest number of children at 2. Note that the average number of children in our sample is 2.09 with standard deviation of 0.83 (Table 2).

[Table 5 here]

A one-unit increase in the wealth index reduces the expected number of children by about 1%; this translates into almost 4% reduction in the number of children in response to one standard deviation (3.9)

increase in the wealth index. In Figure 1, we plot the predicted number of children at different values of the wealth index separately for households that receive parental transfers from the wife's parents and households that do not receive such transfers. The predicted count of children is statistically significant, based on 95% confidence interval, for all possible values of the wealth index. As the wealth index increases, the predicted count reduces; hence, wealthier households are predicted to have fewer children. At every level of wealth, households that received transfers from the wife's parents have fewer children. We also calculate the marginal effect of wealth for all possible values of the wealth index – see Figure 2. The marginal effect of wealth is negative and statistically significant. The magnitude of the effect, however, becomes less negative as the wealth index increases. At every level of wealth, the marginal effect is smaller in absolute term (less negative) for households that received transfers from the wife's parents.

[Figures 1 and 2 here]

6. Discussion

The results imply that only received transfers influence the relative bargaining power of a female spouse thereby reducing the number of children. Families that received transfers from the wife's parents, on average, have 5% fewer children. Expected parental transfers are not statistically significant when they originate from the wife's side. These results are at variance with positive effects of the husband's parental transfers – expected and received – on the number of kids.

The estimated coefficients of parental transfers are biased by reverse causation if the number of children determines whether a family receives transfers. Such consideration may arise from the likely concern that parents can be more empathetic towards children who have larger families as they may require more financial resources to fulfil their needs. Unfortunately, we do not have good instruments to address this issue. However, past studies do not provide any solid evidence to support this conjecture (e.g., McGarry, 1999; Wilhelm, 1996). Nevertheless, there is a reason to believe that our qualitative result for the wife's parental transfers is not affected. In fact, our estimate might be conservative. It is reasonable to assume that households with more children are more likely to receive parental transfers, other things hold constant.

Even if this actually is true, our estimates of transfers would be positively biased. Notice that the estimated effect of received parental transfers for female spouse is negative, which implies that the true effect would also be negative. In terms of magnitude, the true effect would be larger in absolute value. However, a positive simultaneity bias leads to overestimation of the estimates of husband's parental transfers.

7. Conclusion

Our theoretical model of fertility choice predicts dissimilar effects of the wife's and the husband's parental transfers on family size. The empirical outcomes – based on Japanese data of married households with completed fertility cycle – strongly support this hypothesis. The received transfers from the wife's parents have a negative effect on the number of children. In contrast, both expected and received transfers from the male-spouse's parents are positively associated with family size. The dichotomous nature of our transfer variables does not allow us to examine the magnitude of the impact of the amounts of transfers; this important issue merits further investigation. However, our findings indicate that government policies that influence parental transfers have consequences for fertility and the direction of the outcome depends on the relative share of transfers from the spouses' parents.

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Table 1 Parental transfers and the average number of children

		Transfer Rec. (H)		*Transfer Exp. (W)*	
		Yes	No	Yes	No
Transfer Exp. (H)					
	Yes	241	357	164	422
	No	571	1329	249	1666
	Total	812	1686	413	2088
Transfer Rec. (W)					
	Yes	234	340	143	439
	No	576	1360	272	1630
	Total	810	1700	415	2069

	Transfer Rec. (H)		*Transfer Rec. (W)*	
	Yes	No	Yes	No
Average number of children	2.15	2.06	2.02	2.10

	Transfer Exp. (H)		*Transfer Exp. (W)*	
	Yes	No	Yes	No
Average number of children	2.12	2.07	2.06	2.08

Table 2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of children	2606	2.09	0.83	0	5
Transfer Rec.	2645	0.47	0.50	0	1
Transfer Exp.	2573	0.34	0.47	0	1
Transfer Rec. (W)	2565	0.24	0.43	0	1
Transfer Rec. (H)	2590	0.34	0.47	0	1
Transfer Exp. (W)	2535	0.17	0.37	0	1
Transfer Exp. (H)	2539	0.24	0.43	0	1
Marriage duration	2589	33.77	9.22	1	56
Wealth index	2301	4.70	3.90	0.13	16
Education (W)	2605	3.60	1.66	1	10
Education (H)	2610	4.25	2.30	1	11
Religiosity	2665	1.95	1.13	1	5

Notes: *H* stands for husband and *W* denotes wife.

Table 3 Poisson regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Transfer Rec.	-0.013				
	(0.016)				
Transfer Exp.	0.044**				
	(0.019)				
Transfer Rec. (W)		-0.053***		-0.047**	-0.047**
		(0.019)		(0.020)	(0.021)
Transfer Rec. (H)		0.022		0.021	0.031*
		(0.017)		(0.017)	(0.018)
Transfer Exp. (W)			0.005	0.010	0.001
			(0.023)	(0.024)	(0.026)
Transfer Exp. (H)			0.052**	0.049**	0.053**
			(0.020)	(0.021)	(0.022)
Marriage duration	0.006***	0.005***	0.005***	0.006***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Wealth index					-0.011***
					(0.002)
Education (W)	0.006	0.009	0.009	0.008	0.014**
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Education (H)	-0.004	-0.002	-0.004	-0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Religiosity	0.019***	0.020***	0.021***	0.020***	0.015*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Constant	0.491***	0.515***	0.487***	0.487***	0.432***
	(0.053)	(0.051)	(0.053)	(0.054)	(0.057)
N	2381	2337	2323	2256	1990

Notes: Significance levels: *** is <.01, ** is <.05, and * is <.10. Huber/White robust standard errors are in parentheses.

Table 4 Poisson regressions: Incidence rate ratios

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Transfer Rec.	0.987				
Transfer Exp.	1.045**				
Transfer Rec. (W)		0.949***		0.954**	0.954**
Transfer Rec. (H)		1.022		1.022	1.032*
Transfer Exp. (W)			1.006	1.010	1.001
Transfer Exp. (H)			1.053**	1.050**	1.055**
Marriage duration	1.006***	1.005***	1.006***	1.006***	1.008***
Wealth index					0.989***
Education (W)	1.006	1.009	1.009	1.008	1.014**
Education (H)	0.996	0.998	0.996	0.997	1.001
Religiosity	1.019**	1.020***	1.021***	1.020***	1.015*
Constant	1.634***	1.674***	1.628***	1.628***	1.541***
N	2381	2337	2323	2256	1990

Notes: Significance levels: *** is <.01, ** is <.05, and * is <.10.

Table 5 Received parental transfers and predicted count of children

	Predicted count	p-value		Differences in predicted count	p-value
No transfers	2.091	0.000	No Transfers - Husband's parents only	-0.067	0.080
Husband's parents only	2.158	0.000	No Transfers - Wife's parents only	0.096	0.024
Wife's parents only	1.995	0.000	No Transfers - Both spouses' parents	0.032	0.554
Both spouses' parents	2.059	0.000	Husband's parents only - Wife's parents only	0.162	0.007
			Husband's parents only - Both spouses' parents	0.099	0.025
			Wife's Parents only - Both spouses' parents	-0.064	0.079

Notes: Predicted counts are based on the Poisson regression – see Model 5 in Table 3 for specification.

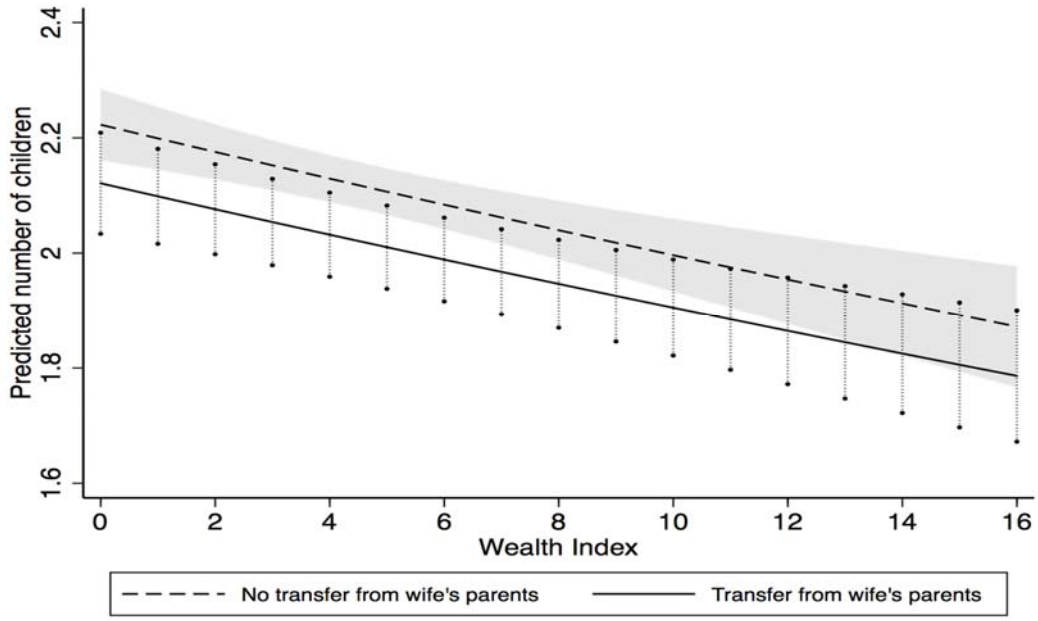

Figure 1 Predicted number of children (with 95% confidence intervals).

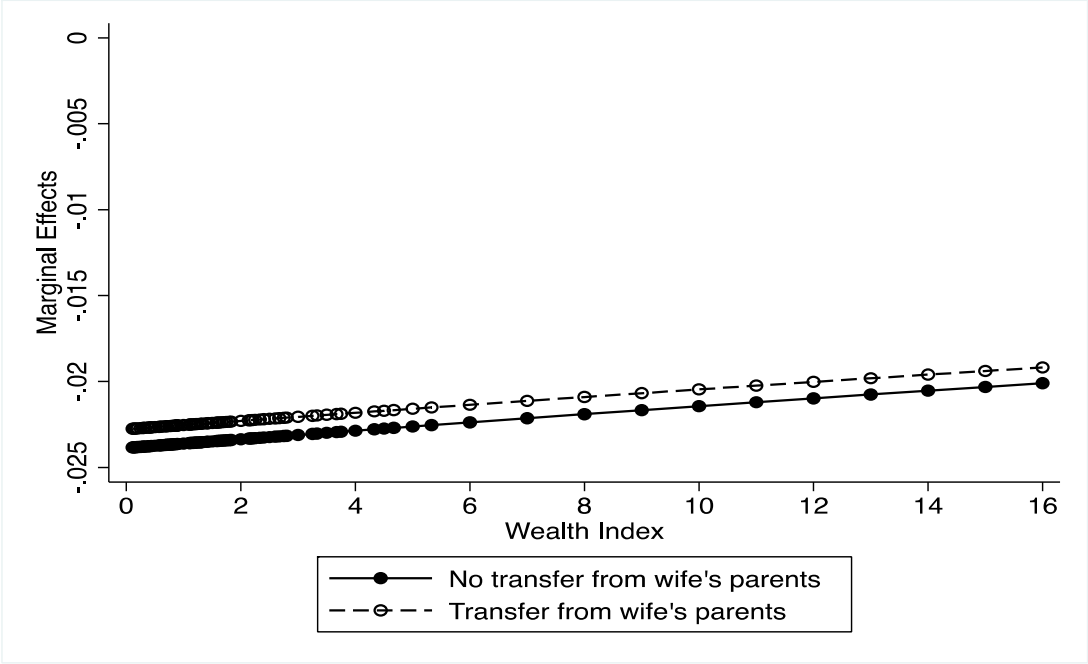

Figure 2 Marginal effects of wealth on the number of children.