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A Network Approach to the Economic Models of Fertility

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Abstract

Since its first appearance in the late 1950s, Neoclassical economic theory of fertility, especially as exemplified by Gary Becker's model of household production function that assumed a unitary utility function of the household, has become one of the most popular paradigms to examine fertility changes. This paper intends to expand the economic model by incorporating the social network approach into the original paradigm. Social networks are crucial in determining the fertility rate of a society above and beyond parameters originally included in the neoclassical economic model in two ways. First, the extent that separate utilities of spouses could be treated in one function is, in part, dependent on the network embeddedness of spouses: intra-household network. If spouses are not embedded into each other's networks, it would be natural to drop the assumption of the unitary utility function and reformulate the decision process based on bargaining. Second, in addition to the intra-household network, inter-house networks also play a role in couple's decisions with regard to fertility. Couples need information about other couples' fertility decisions for their own and also normative pressures from other couples or friends are crucial in the dynamic process of fertility change. Social networks are a major conduit both for information and normative constraints. This paper focuses on the first kind of networks (intra-household networks) with illustrative empirical results by using the two waves of Korean Longitudinal Survey of Women and Families (KLOWF).

Keywords: fertility, economic model of fertility, neoclassical economic model, social network approach, unitary utility function, information networks, and normative pressures.

JEL classification: A10; A12; A14; D10; D13

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1. INTRODUCTION

Japan and South Korea have been exemplary countries in East Asia that showed extremely low fertility rates for almost a decade. Usually the total fertility rate (TFR) of 2.1 is believed to be necessary to maintain the current population size (replacement rate) and some scholars coined the term 'lowest-low fertility rate' to refer to 1.3 of TFR. The rate of 1.3 implies a reduction of the birth cohort by 50% and a halving of the stable population size every 45 years (Kohler, Billari, and Ortega 2001, 2). Figure 1 shows that since 2007, the total fertility rates in both countries have dropped below 1.3 and never came back.

Especially the quite dramatic change of South Korea's fertility rate is pretty interesting. When South Korea's TFR reached six in 1960, the Korean government newly established the Family Planning Association of Korea in 1962 for extremely strong and persistent government-initiated family planning policy. The policy remained one of the most successful cases in family planning history in the world (Freedman and Berelson 1976; Lapham and Mauldin 1972). During only four-year period between 1966 and 1970, the fertility rate dropped half among women aged 15 to 19 and women aged among 20 to 24 showed almost a quarter reduction (Lapham and Mauldin 1972). This kind of strong family-planning policy for the fertility reduction continued till 1996 and then, only several years later, South Korea faced one of the lowest fertility rates in human history.

Now South Korean government initiated another and opposite strong policy to increase the fertility rate: it enacted a new law of 'Basic Regulations for Aging Society with Low Fertility Rate' in 2005 and has implemented a series of government programs. However, with compared to numerous and various policies, it is relatively hard to find theoretical frameworks to examine the change of the fertility rate in South Korea. Unlike South Korea in 1960s when the government could implement strong nation-wide policies across virtually any societal domains including firms, families, and communities with little resistance, South Korea is now a relatively well modernized, individualized, and de-centralized society. Successful policy operation needs a robust empirical basis guided by well-elaborated theoretical frameworks. Various economic models have proven to be effective in understanding fertility behaviors in general for the last 50 years but still elusive in some aspects and has not lived up to early expectations (Robinson 1997: 63). This study tries to add some explanatory powers by introducing social network approach to the models in a harmonious way. The purpose of this study is not to criticize economic models by any sense but rather to improve them by taking couples' social embeddedness into account in their decision making processes.

2. TWO ECONOMIC MODELS OF FERTILITY

The economic model of fertility can be traced back to Harvey Leibenstein's original work where he observed the fertility decline and formulated an economic model where families balance utilities against disutilities with regard to an n_{th} child (1957). Based on many works following a paper in 1960, Becker elaborated the economic model to the fuller extent where the family is working as a factory that produces household products such as housework, children, etc. (Becker 1960; Becker and Lewis 1973; Becker and Barro 1988; Becker 1991). He proposed a household production function where all familiar neo-classical assumptions of maximizing behavior and equilibrium solutions are applied. Especially he proposed an answer one of the hottest puzzles of fertility at that time: why did fertility fall as income increases? Common sense told that as income increases the fertility would increase too unless the child-service is an inferior good with negative income-elasticity of demand, which seemed unreasonable (Robinson 1997). He came up with the concept of 'quality' of children and formulated a model where total child-services equals the number of children times an average quality per child and successfully showed that as income increases people maximize their utilities by increasing average quality rather than the number of children (Becker and Lewis 1974). It has been a dominating theory of fertility within social sciences because of its simplicity and rigor.

Until the early 1990s, following the Becker's model, most economic models treated the household as one economic unit in which family members behave as if they share a common utility or at least as if they agree on every economic activity. This 'common preference' (or unitary utility of the couple) is guaranteed by consensus (Samuelson 1956) or altruism (Becker 1991). Different terms are used to describe this approach: the 'neoclassical model' (McElroy and Horney 1981; Schultz 1990), the 'common preference model' (Thomas 1990), the 'unitary model' (Alderman et al. 1995), or the 'consensus model' (Behrman 1997).

One of the major reasons this approach gained popularity was that economic consumption data were typically reported only at the level of the household. It also allowed economists to analyze household data with relative ease by putting aside the theoretical task of showing how individual preferences are collectively aggregated at the household level (the so- called 'preference aggregation problem'). Becker provided the seminal theoretical basis for this analytical convenience in studies of the family. As a possible mechanism to ensure the unitary utility of the household, Becker paid attention to 'care'. In his well-known 'rotten-kid' theorem, he proved that even if only one of the members is caring for others so that his or her preference depends on the other's utility function, every family member (including a rotten kid) will try to maximize the joint family utility or dynastic utility (Becker 1991). This provided a theoretical justification for studying family behavior as if its members share one utility although they have separate utilities in reality.

Although Becker avoids the preference aggregation problem by assuming 'caring' (or 'altruism'), the issue over who has the last word (or ultimate power) in the household is not solved (Ben-Porath 1982). A caring person (or a parent) must have the ultimate power in the household in order for the rotten kid theorem to be valid. It disregards the fact that the family is also often a place for conflict and struggle. In economics, many different approaches, denoted 'collective models' (Alderman et al. 1995; Behrman 1997; Bourguuignon and Chiappori 1992) or 'bargaining models' (Lundberg and Pollak 1993; 1994; 1996; Stark 1984), have been developed that treat the family as a collection of individuals with separate utilities and that show how the aggregated outcome emerges from different and even conflicting utilities.

Based on the Nash bargaining model, bargaining models assume a cooperative game between two persons with separate utility functions who bargain over the intra-household resource allocation (Manser and Brown 1980; McElroy and Horney 1981). All these are efforts to explain intra-household decisions without relying on the assumption of a single household utility function

Many empirical results have challenged the unitary utility argument, especially by showing that family members do not look like they pool their income (Lundberg, Pollak, and Wales 1997; Schultz 1990; Thomas 1990; especially Alderman et al. 1995 for a summary) and now many believe that the burden of proof should shift to those who argue for the unitary utility of the family (Alderman et al. 1995; Lundberg and Pollak 1996).[1]

An important lesson to be drawn from the discussion on the two competing economic paradigms is that we must conceptualize the family as the place where both love and bargaining (or care and struggle) coexist (Stark 1984). We must identify the conditions under which reciprocity and altruism emerge, rather than assume that they are *always* or *never* characteristic of families (Ferree 1990, p. 879). Following this dictum, I try to show the relevance of the level of structural embeddedness of the couple as a contingent factor in predicting fertility behavior of the family. I develop a bargaining model where in the beginning, the spouse has his or her own distinctive utility functions and the magnitude of the couple's embeddedness is incorporated as a deciding factor of transfer between spouses. Contingent on the level of structural embeddedness of the couple, two distinctive equilibria emerge. Among weakly embedded couples, the model predicts that the fertility behavior that is the result of the bargaining between partners with separate and conflicting utilities. In contrast to this pure bargaining situation, strongly embedded couples behave as if they share a unitary utility in deciding the fertility as assumed in Becker's model.

[1] For a fuller discussion of two competing economic paradigms in household behavior, please see another paper (Youm 2005).

3. INTER-HOUSEHOLD NETWORK EMBEDDEDNESS AS A CONTINGENT FACTOR

The following five assumptions are necessary to develop a bargaining model where the couple's social embeddedness is a contingent factor to predict the divergence of fertility behaviors.

Assumption 1: (Utility function of the spouse) The household comprises a married husband and wife and they decide the number of children to be born. The utilities of the spouses are separate and dependent on (1) the divisible private goods (*x*) and (2) a public good (*B*) (i.e. the flow of child-services from the birth).

$$U_h = V_h(x) + V_h(B) \tag{1}$$

$$U_w = V_w(x) + V_w(B) \tag{2}$$

Assumption 2: (Cost for the child) In order to produce children, both wife and husband pay some costs but we assume that wife's cost is higher than husband's. Some examples include (mental and physical) cost for bearing and rearing children and the stoppage of career. We simplify the model by assigning the cost only for the wife. This won't change the major conclusions of the model. We denote this cost as *C(B)*.

Assumption 3: (Network-contingent transfer) I also assume that since the children are a public good of the household and thus, there should be some transfer of utility from the husband to the wife in order to produce it. For example, the wife wants the fair reward for bearing and rearing the child from the husband later even when she can't get back to work after a certain period of career breakdown.

However, the wife can't be always sure that there will be a fair transfer. Sometimes there could be unfair transfer or betrayal of the husband. When the husband betrays, he has to pay the cost that refers to the value of emotional strain, loss of love, companionship, and reputation etc. We assume that this cost the husband must pay is systematically dependent on the strength of couple's network embeddedness. The stronger the spouse is embedded into each other's social networks, the more expensive the cost from the betrayal is.[2] Thus, I denote β as the level of couple's embeddedness ($0 \le \beta \le 1$) then, the expected transfer amount from the husband to the wife will be a fraction of the full amount, $\beta*T$.

[2] Youm and Laumann discussed in detail the cost from the betrayal between spouses with regard to the intra-household resource allocation (Youm and Laumann 2003). Their study examined the effects of spousal embeddedness on the division of housework rather than fertility.

Assumption 4: (Transfer function) The amount of the transfer from the husband to the wife is determined by the traditional bargaining model based on each spouse's bargaining power (Lundberg and Pollak 1996; Rasul 2008; Suen and Chan 2003). We denote the transfer as T and the husband's bargaining power as α ($0 < \alpha < 1$).

$$T = (1-\alpha)U_h - \alpha[U_w - C(B)] \tag{3}$$

Now, the wife will maximize the following with respect to the number of children (B) while taking account of the transfer she receives.

$$Max(B): U_w + \beta * T - C(B) \tag{4}$$

If we substitute eq. (3) into eq. (4), then we will get the following.

$$(1-\alpha\beta)U_w + \beta(1-\alpha)U_h + (\alpha\beta - 1)C(B) \tag{5}$$

Once eq. (1) and eq. (2) are substituted into eq. (5), then the first order condition for the maximization would be;

$$(1-\alpha\beta)\frac{\delta}{\delta_B}V_w(B^*) + \beta(1-\alpha)\frac{\delta}{\delta_B}V_h(B^*) = (1-\alpha\beta)\frac{\delta}{\delta_B}C(B^*) \tag{6}$$

From the equation (6), we can show that depending on the embeddedness level, the fertility behaviors are diverging.

When the spouse is strongly embedded into each other's networks and thus, we can expect fair transfer from the husband to the wife (when $\beta = 1$), the number of children at equilibrium will be decided regardless of the bargaining power of the husband (α disappears in the equation (6)). Actually the wife will behave as if she maximizes the unitary utility function of the couples that is the sum of two spouses' utilities, the LHS of the equation (6). Thus, the predicted fertility behavior will be identical with the one Becker's model expected. In their decision process, the bargaining power of each spouse must be insignificant. They will behave as if they share one utility function without bargaining.

Assumption 5: (Nash product solution) When the spouse is weakly embedded into each other's social networks and thus, the wife can't expect a fair reward from the husband, now the couple is in the bargaining situation. The wife will maximize her own utility based on the equation (6) while the husband will do the same based on corresponding utility structure and constraints. We do not have a universal economic model to predict the result of the bargaining. A series of different economic bargaining models of intra-household resource allocation were developed and they showed the differences in the assumptions of essential parameters such as utility functions, transfer rules, and equilibrium concepts. However all models agree on one thing: the final equilibrium must be a result of maximizing weighted average of each spouse's utility. For example, the Nash solution, one of the most popular bargaining solution concept, expects that the bargaining equilibrium must be a geometric mean of each spouse's utility maximization weighted by ach own threat point.[3]

Thus, when the spouses are not quite embedded into each other's social networks and thus, the low cost of betrayal lead to only small fraction of the full transfer (when β is close to zero), now the equilibrium is decided by bargaining power as predicted in many bargaining models. Now each spouse's threat point that is usually measured by wage or educational level must be crucial to decide the couple's fertility behavior. In a nutshell, when the couples are strongly embedded, we can expect that they will behave just like they share one utility function of the household as Becker assumed. When the couples are only weakly embedded, however, spouse will be in bargaining situation where the final fertility behavior is a product of maximizing an average of each spouse's utility weighted by each own threat points and bargaining powers. In addition to this type of intra-household networks of spouses, the social networks across household are also crucial to determine the speed of fertility change. Let me briefly discuss it now.

4. INTRA-HOUSEHOLD NETWORKS FOR INFORMATION AND NORMS

Although I believe that the socio-economic parameters such as increasing earning power of women and the cost of rearing children had a crucial role in the fertility drop, the concrete dynamics of fertility changes must be also dependent on the social network patterns across households. Unless each household decides the fertility of its own in an independent way without interacting with other household, the way the households interact with each other must be crucial in fertility change path. Now many demographers do not believe that socioeconomic change in itself cannot explain fertility drop in Europe and found out that time path of fertility change is different from one predicted by models that take socio-economic parameters into account only. Increasing number of studies has actively paid attention to the diffusion processes of knowledge, information, attitudes, and norms to explain the fertility change fully (Bongaarts and Watkins 1996; Buhler and Philipov 2005; Coale and Watkins 1986; Easterlin 1978; Kohler 2000).

It is well-known that depending on network patterns, the diffusion process can take quite different paths. For example, Burt illustrated two distinctive hypothetical diffusion processes

[3] The solution of the bargaining will be to maximize the product of each spouse's utility in a form , $(U_w - D_w)(U_h - D_h)$, where U_i and D_i is the utility and threat point of each spouse, respectively (Nash 1953; Binmore, Rubinstein, and Wolinsky 1986). The solution is a type of geometric mean weighted by each spouse's threat point.

of new pill: the one without network contagion and the other one with network contagion where the odds of doctors adopt a new drug is systematically dependent on the proportion of colleagues who already adopt it (Burt 1987). Clearly the latter one fits to the S-pattern that has been known to be actual diffusion process of many products, ideas, diseases, and social phenomena.

Intra-household networks provide two related but distinctive mechanisms through which fertility change can be accelerated or deterred: information and norms. First, households need to know the fertility intensions of other households since their own optimum fertility behavior itself is dependent on the behaviors of others (Kohler 2000). As illustrated in Kohler's paper, multiple-equilibria situation constitutes a coordination problem: the limitation of fertility is not a rational decision, given (expectations about) a prevailing high fertility level in the population (Kohler 2000, 241). Let's take an opposite example. If substantial proportion of household decides to invest a lot of money and efforts for the education of their children and thus focus on quality over quantity (just like in South Korea), other households also want to change their focus from quantity to quality.

Another mechanism that could be responsible for fertility change is social normative pressure through inter-household networks. Networks convey attitudes, beliefs, and norms in addition to information: they must be responsible for changing preferences, beliefs, and attitudes.

Numerous social network studies showed that strong and intensive ties are believed to produce greater mutual commitment and social influences and pressures while weak ties provide more information than control (Burt 1992; Kincaid 2000; Sandefur and Laumann 1998). The speed and robustness of diffusion are also contingent on the level of homogeneity of social networks. If social networks are strongly assortative and thus, people interact mainly with other people with similar backgrounds, the diffusion will be slow but also robust in the sense that it won't die out easily. Otherwise, if social ties are formed in a very dissortative way and thus, people get acquainted with many others with different backgrounds, the diffusion will be fast but non-robust. In order to understand the full picture of fertility change, we need to turn our attention to the way that households interact with each other, especially with regard to different regions and social-classes in a country.

5. AN EMPIRICAL ILLUSTRATION

In order to carry out empirical studies based on the frameworks I proposed above, we need to consider the following issues on data availability and measurement. First, with regard to data-availability, intra-household network data is much more available than inter-household one. Most network studies have focused on individual-level (or ego-level) ties yet and it is relatively rare to find network data at the level of household. Second, the measure of social embeddedness of spouses is not quite straightforward. Since there are only a few networks studies to focus on embeddedness of spouses, we do not have a set of universal measurements. One study successfully utilized two dimensions of couples' networks to measure the strength of embeddedness and used it to explain the division of housework: the number of mutual friends and shared time (Youm and Laumann 2003). We need more studies to be confident about proper empirical measures of embeddedness of couples.

Data

In this paper, I would like to present an empirical illustration that an intra-household network is working as a key contingent factor in predicting the patterns of the fertility behavior. The Korean Longitudinal Survey of Women and Families (KLOWF) provides one of the best available empirical data of Korean society to examine the hypothesis although it is far from perfect. The data first collected a representative sample of 9,068 households where at least one woman aged from 19 to 64 lived in South Korea from September 2007 to February 2008. The second wave was collected from October 2008 to June 2009 for the 7,704 households who participated in the first wave (15% attrition rate).

The third wave data collection is done in June 2011 and they are expecting a public release by the end August 2011. There exist several limitations to examine the current hypothesis. (1) Although the data contained some measures of couples' social networks, they were not elaborated. Thus, available social network measures are very limited. (2) It did not collect match-paired data. Only women were interviewed and this means that all the variables describing the partners, including their wages and social networking patterns, must be estimated from the women's report about them. (3) Although it is a panel data, the current data set contained only two-wave and furthermore, the waves were only one year apart. It does not provide enough number waves across enough time-lag to fully observe and analyze fertility behavior. As a result, the following empirical analysis can only be taken as illustrative of an empirical examination of the model's implication.

Measures

Since there were only 313 people who actually gave a birth within one year period, I decided to consider also people who had a plan to give a birth in five years. The number of the respondents who actually gave a birth *or* had a plan to give a baby in five years is 575 in the sample. I adopted a logistic regression to predict this group of people.

A set of independent variables that were included for control purpose includes age, age squared, respondent's educational level, use of housemaid, cohabiting with parents-in-law, cohabiting with parents, logarithm of total asset, household income as a categorical variable, marriage satisfaction level.

In order to measure the amount of embeddedness of the couple, I used the questionnaire that asked if the couple met the parents or siblings of the wife at least once a month. I believe this is a good measure to measure the amount of husband's embeddeness into wife's intimate social networks. If the husband's investment is high in the wife's social networks, she can expect a fair reward from giving a birth.

I used the logarithm of wage ratio of the couples as a proxy for bargaining power of the wife. It is calculated as [log(wage of the wife + 1) – log(wage of the husband + 1]. Since many wives were not working at the time of interview, I ran a regression to predict the wage of non-working woman based on their educational level, age, and career history and replace the wage by it. I also added one to avoid log(0). The higher logarithm of the wage ratio, the more bargaining power of the wife.

Hypothesis

H1: Since the couple's embeddedness is the key contingent factor on which the couple's fertility behavior follows *either* Becker's unitary utility model *or* bargaining models with conflicting utilities, there exist the interaction effect between the embeddedness and bargaining power. In other words, depending on the strength of the embeddedness, the effect of the bargaining power differs. In the empirical analysis below, this implies the existence of statistical significance of the interaction term between the couple's visit to wife's family at least once a month and the logarithm of wage ratio of the wife (with compared to the husband).

H2: When the embeddedness is strong, the couples would behave just like they share one utility function and thus, bargaining power measured by the wage ratio loses its significance in predicting the fertility. Thus, when the couples visit the wife's family at least once a month, the effect of the wage ratio is statistically insignificant.

H3: When the embeddedness is weak, now the logarithm of wage ratio becomes significant since the couple is bargaining now to maximize each own utility. Given the fact that on average the wife would prefer less number of children than the husband due to genderspecific cost[4], the higher the logarithm of the wage ratio of the wife (with compared to the husband), the lower the odds that the couple had a childbirth or plan to have a childbirth.

Results and Discussion

Table 1 summarized the all the coefficients from the logistical regression and figure 2 summarized the interaction effect. The predicted probability is calculated given other variables are fixed as average. The first column of the table 1 revealed that there exists strong interaction effect between the logarithm of wage ratio of the wife and the husband's embeddedness: the coefficient is 0.388 and the t-value for the hypothesis that the coefficient is statistically insignificant is 3.26. As we proposed in the H1, the logistic regression confirmed that the effect of the wage ratio is contingent on the strength of the embeddedness.

This hypothesis is also confirmed on the second and the third column. The logistic regression only among weakly embedded couples showed statistically significant effect of the wage ratio while the one among strongly embedded couples did not identify the statistical significance. Among the couples who are strongly embedded would behave just like they share unitary utility and thus, there is no statistical significance of the wage ratio: the coefficient is 0.0566 with 0.82 t-value. This result is consistent with the H2.

Also the figure 2 confirmed the H3. When we calculated the predicted probability of having a childbirth or plan to childbirth, the direction of the logarithm of the wage ratio is consistent with the H3. Among the couple with strong embeddedness, there is no effect of wage ratio but when the couple is weakly embedded, the logarithm of the wage ratio becomes significant. Furthermore, among the couple who were weakly embedded, the higher the logarithm of the wife's wage ratio, the lower the odds that the couple had a childbirth of plan to have one.

Some major limitations of the empirical examination must be discussed. First, as I mentioned, I would like to take the result as an empirical illustration rather than robust evidence since the date is incomplete in two senses. Any two-wave data in one year apart is not enough for examining fertility behaviors. Also since the data was not built for network analysis, many possible measures of embeddedness could not be utilized. For example, if

[4] It would be natural to assume that the wife prefers less children if the wife pay cost more than the husband from the childbirth as we assumed. Although there is no available data for Korea, according to the Malaysian Family Life Survey (MFLS), Malaysian men prefer more children than Malaysian women (Rasul 2008).

the spouses maintain each own bank account or not usually provides a good measure of the trust within the household (Heimdal and Houseknecht 2003; Treas 1993). We might want to wait until the data with rich measures of social networks of the couples are available for more robust and detailed answers. Also the current model of network embeddedness was not elaborated and developed to the full extent. A fuller model could incorporate the couple's embeddedness into even bargaining processes so that we can predict the effects of the social embeddedness on the bargaining equilibrium. But I believe the current empirical results would suffice as an illustrative example for my model.

This paper also has strong policy implications to improve fertility rates in a society. One possible policy direction is to increase the husband's embeddedness with the wife's social life. We can consider longer paternity leave at work or even obligatory observation of paternity leave. This will increase the actual (and expected) transfer amount from the husband to the wife. Or the reduction of working hours on average could be helpful. Although this kind of suggestions is consistent with work-family balance approach (Brewster and Rindfuss 2000; MacIness 2006; Shreffler, Pirretti, and Drago 2010), the model argued that this kind of policies will help to improve the fertility rates above and beyond work-life balance through different mechanisms. Also the current theoretical model implies that this effect will be maintained regardless of the levels of employment and college education among women: under the strong embeddedness, the wage ratio has no effect. This could be specifically important for the countries like Korea that observed extremely high proportion of employment and college education among women.

None of the above discussions is intended to criticize economic approaches to fertility behavior. I believe, in fact, economic models are essential to understand the processes of fertility decision. I also believe if we can carefully incorporate some social network components to the economic models, the explanatory power increases.

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Tables and Figures

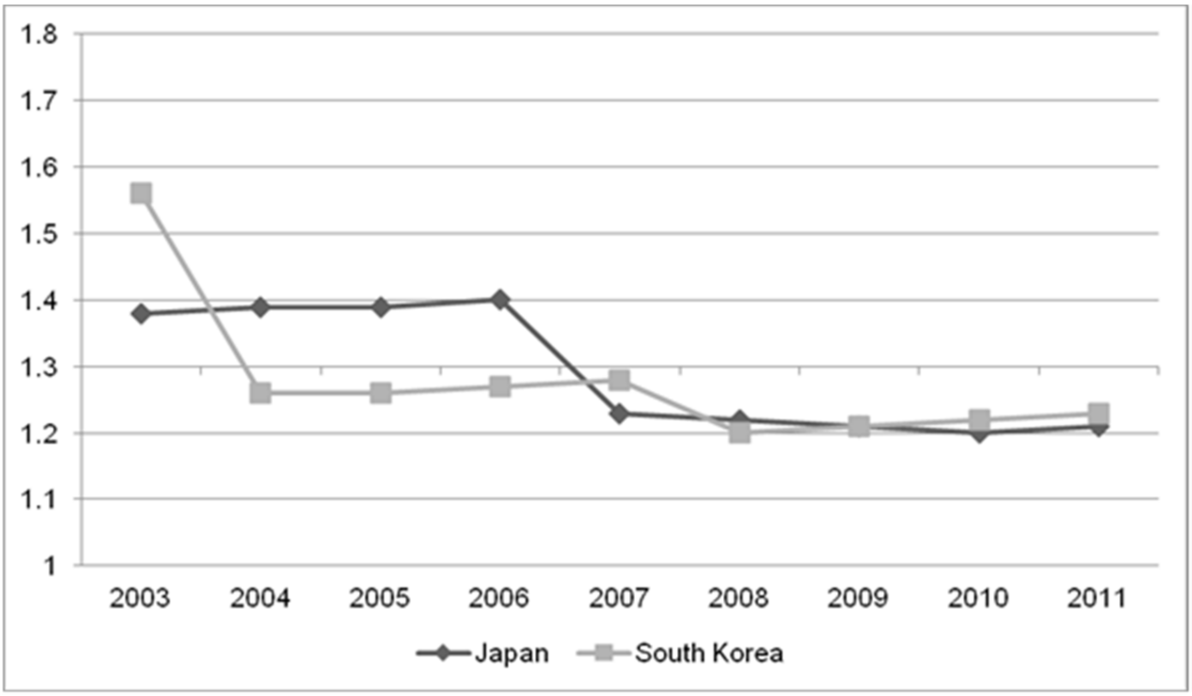

Figure 1. The total fertility rates of Japan and South Korea. (CIA World Factbook 2010).

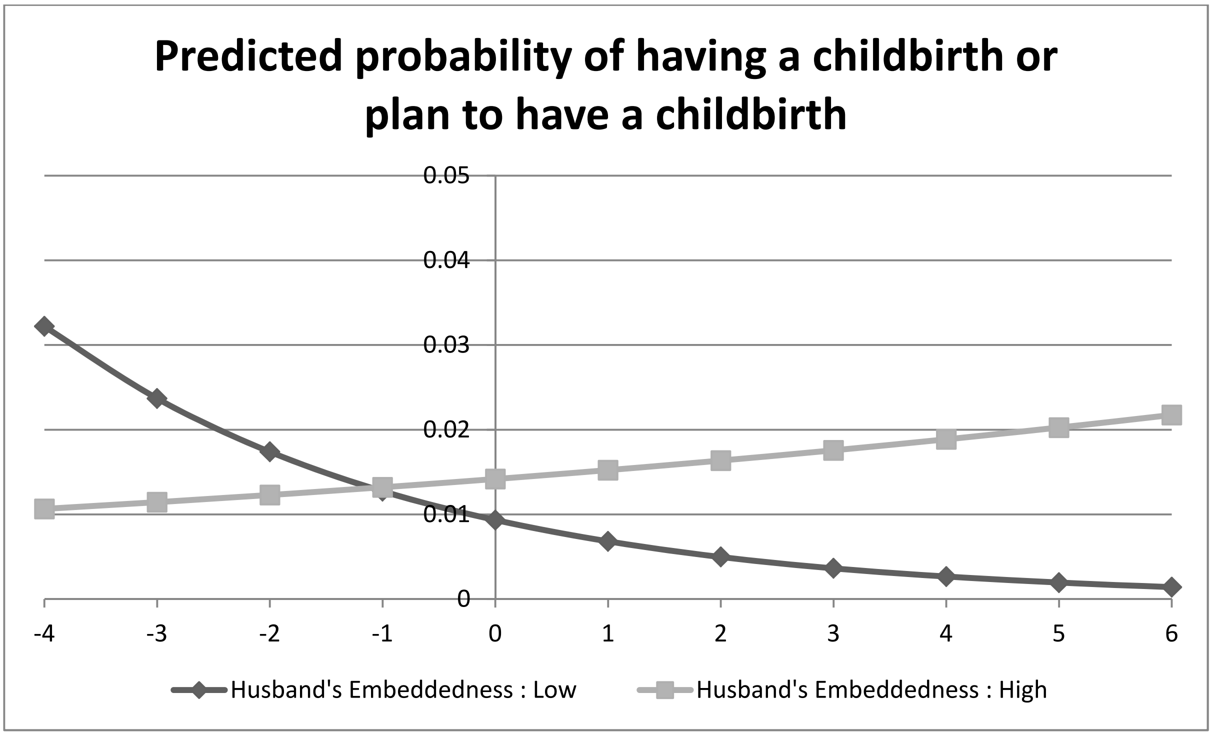

Figure 2. The interaction between embeddedness and bargaining power

	(1)	(2)	(3)
	Total sample	Weak embeddedness	Strong embeddedness
R's age	0.740***	0.788*	0.694**
	(3.74)	(2.56)	(2.65)
R's age^2	-0.0150***	-0.0156***	-0.0144***
	(-4.87)	(-3.30)	(-3.51)
R's educ : vocational high	-0.143	-0.946	14.63
	(-0.23)	(-1.33)	(0.01)
R's educ : general high	-0.200	-0.728	14.39
	(-0.31)	(-0.99)	(0.01)
R's educ : college	0.0498	-0.290	14.59
	(0.08)	(-0.40)	(0.01)
R's educ : above univ	-0.128	-0.825	14.58
	(-0.20)	(-1.11)	(0.01)
Number of births >=3	-4.375***	-4.309***	-4.590***
	(-10.85)	(-6.71)	(-8.55)
Number of births = 2	-3.970***	-3.847***	-4.123***
	(-16.64)	(-9.11)	(-13.78)
Number of birth = 1	-1.400***	-1.221**	-1.540***
	(-6.37)	(-3.21)	(-5.52)
Number of birth = 0	.	.	.
	.	.	.
household maid	0.210	0.318	0.234
	(0.85)	(0.66)	(0.79)
cohabitee : R's parent	0.506	-0.140	0.629
	(1.25)	(-0.16)	(1.36)
cohabitee : Partner's parent	0.214	-0.346	0.609+
	(0.82)	(-0.76)	(1.78)
log(Husband’s Household Labor(min)	0.106*	0.128+	0.101+
	(2.54)	(1.76)	(1.92)
Marriage Satisfaction	0.159*	0.0450	0.217*
	(2.36)	(0.38)	(2.56)
Conversation with Partner	0.120	0.364+	0.00110
	(1.07)	(1.84)	(0.01)
Shared Activity with Partner	0.00430	-0.0890+	0.0369
	(0.17)	(-1.69)	(1.25)
Husband’s embeddedness	0.424**	.	.
	(2.66)	.	.
Log (Wage Ratio)	-0.316**	-0.250*	0.0566
	(-3.04)	(-2.36)	(0.82)
Household income > 4720 (0-27%)	-0.272	0.696	-0.853**

	(-1.12)	(1.62)	(-2.76)
Household income < 4720 (27-52%)	-0.246	0.326	-0.651*
	(-1.08)	(0.84)	(-2.24)
Household income < 3560 (52-83%)	0.112	0.792*	-0.348
	(0.58)	(2.52)	(-1.38)
Household income < 2400 (83~100%)	.	.	.
	.	.	.
log(Household's total asset)	0.0537+	-0.00754	0.101*
	(1.73)	(-0.16)	(2.41)
Log (Wage Ratio) * Husband's embeddedness	0.388**		
	(3.26)		
Constant	-9.095**	-9.504+	-22.39
	(-2.91)	(-1.95)	(-0.02)
Observations	4370	2025	2345

t statistics in parentheses
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1. Logistic Regression on New Birth and Birth Planning