income-tax increase would be compensated by the reduction in the pension contribution rate. If the pension system is Bismarckian like the German one, however, the aggregate labour distortion caused by pension contributions is likely to be small, and cutting contribution rates could even *reduce* aggregate labour supply (see Section 2). By contrast, the second recepy would actually reduce the labour distortion, because the income-tax rate would not need to increase, and pension contributions would be paid only when the agent is not engaged in raising children. When engaged in raising children, the agent would pay no contributions into scheme (i), and earn pension entitlements through scheme (ii), which does not distort the quantity/quality mix.

The full implementation of our reform proposal would generate a further efficiency gain as it would allow couples and individuals to specialize according to their personal comparative advantages in either income or child raising activities. This does not show in the Cigno-Werding simulations because the underlying econometric model predicts, in effect, the behaviour of the representative agent. Other things being equal, productivity may thus be expected to grow faster under our proposal, than if the government were to cut pensions and raise child benefits (or maintain existing policies), but there is no way of saying how faster because the model is silent on the matter, and the few available estimates of the growth effect of pension policy reported in Section 3 (Ehrlich and Zhong, 1998; Zhang and Zhang, 2004) refer to conventional pension systems, not to the unconventional one proposed here.

A final word about the political feasibility of pension reform. The reform proposed in the present paper would generate a Pareto improvement over the status quo. Couples and individuals with children would in fact benefit from the introduction of scheme (ii). Those who either cannot or choose not to have children would not lose, because scheme (i) would still allow them to qualify for a pension by working and paying contributions as at present. They would actually gain if the fertility and labour productivity increases generated by (ii) made it unnecessary for the government to raise contributions or cut benefits from their present level. By contrast, reducing the implicit return to participating in the existing pension scheme would reduce its political acceptability, and reducing the system to a mere safety net (as for example in the UK) would limit the government's ability to redistribute from the rich to the poor. Properly explained,[28] the policy reform proposed here should thus be easier to sell to the electorate than the alternatives currently under discussion.

[28] What needs to be explained, in particular, is that scheme (ii) is as much a compromise between incentive and insurance considerations as scheme (i), and that there is nothing in our proposal to stop a person opting for the latter if her assessment of her own comparative advantages, and of the relative risk of investing in children vs. investing in her own career, makes her so inclined.

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別紙５

研究成果の刊行に関する一覧表

書籍

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<cn>5

<ct>On the Persistence of Low Birth Rates in Japan

<ca>Reiko Aoki and Yoko Konishi

<h1>5.1 Introduction

We start with some observations from time-series and cross-country data on fertility and female labor participation. The usual relationship between female labor participation and fertility is negative (Becker 1965) as the time series of female labor participation rate (FLPR) and total fertility rate (TFR) of selected OECD countries exhibit (figure 5.1). Recently the positive relationship between FLPR and TFR cross-country data in 2005 (average of years 1985–1996 as well as year 2000; see Sleebos 2003; d'Addio and d'Ercole 2005; Da Rocha and Fuster 20060) has received much attention. In Japan as well, the cross-sectional data among prefectures show positive relationships in 1987 and 2002 (figure 5.2).

FIGURE 5.1 HERE

FIGURE 5.2 HERE

Other countries with high per capita GDP also have low birthrates (figure 5.3). The usual interpretation is based on a positive relationship between higher per capita GDP and higher wages. Higher opportunity cost when wages are high means lower fertility when per capita GDP is high. Higher per capita GDP is also associated with higher standard of living, reflecting investment in high quality of consumed goods. We believe that the trade-off between consumption and number of children should be taken into account when understanding childbearing decisions.

FIGURE 5.3 HERE

We fill first present a model of consumer choice where children and consumption patterns involve trade-offs bewteen goods and time. We demonstrate how a change in the quality of consumption and a change in wages have different effects on the number of children born. Since the wage level and consumption quality are related, the relationship between fertility and labor participation can be positive or negative. We support these inferences with cross-sectional Japanese

data for every five years from 1980 to 2005. We use indicators of consumption quality as well as consumption behavior.

For our model we take Japanese cross-sectional data from eightdifferent points in time (every five years from 1970–2005), and find that a positive correlation between TFR and FLPR among prefectures (regions) has been observed since 1980. However, after resolving econometric problems from unobservable heterogeneity, simultaneity or endogeneity and measurement error by fixed effect IV estimation, we find that FLPR has a significantly negative effect on TFR. The results are consistent with the theoretical predictions as well as traditional economic models of the relation between TFR and FLPR. Furthermore consumption variables are statistically significant and have a negative impact on TFR.

In the second half of this chapter, we endogenize the wages and consumption quality in a general equilibrium model with heterogeneous labor and vertically differentiated products. Through comparative statics we analyze the cause and implications of low birthrate in the long run. We show that the

feedback mechanism of the economy may not reverse the declining birthrate, contradicting an implication of the Easterlin hypothesis cohort effect. This is because the labor market structure and product market adjusts to changes in birthrate and thus the cohort effect never materializes.

The approach of this chapter is therefore in the spirit of growth and trade, and in that regard we take into account the reaction of the economy in the long run (Acemoglu 1998; Flam and Helpman 1987; Thoenig and Verdier 2003). Acemoglu (1998) showed that while in the short run, labor input is reduced in response to scarcity of skilled labor and high wages, the skilled labor supply that increases in response triggers technological change; so that makes skilled labor even more productive, raising the wages of skilled labor in the long run. Our analysis suggests that a similar long-term adjustment of the economy can prevent a natural feedback mechanism from working. That is, a smaller population will increase the marginal product of labor in the short run, but consumption patterns will change in the long run, reducing such an advantage.

<h1>5.2 Re-examination of Female Labor Participation–birthrate Relationship

Consider a situation where utility of a household depends on the number of children, n, and consumption of a good x. Both the child rearing and the consumption of the good require expenditures of time. The number of children is determined by amount of good x_c and the time devoted, ℓ_c, to child rearing:

$$n = f(x_c, \ell_c), \qquad f_x > 0, f_\ell > 0.$$

The subscripts on functions denote partial derivatives. The utility of the consumer is in fact determined by amount z, which is the consumption experience that depends on amount of the good x and time devoted ℓ:

$$z = g(x, \ell), \qquad g_x > 0, g_\ell > 0.$$

The utility function is

$$u(n, z), \qquad u_n > 0, u_z > 0.$$

The budget constraint depends on the price of the good and wages, and the labor endowment $\bar{\ell}$:

$$px + px_c + w\ell + w\ell_c = w\bar{\ell}.$$

Figure 5.4 illustrates the optimization problem. The opportunity set is defined as

$$\{(z, n) \mid n = f(x_c, \ell_c),\quad z = g(x, \ell),\quad p(x + x_c) + w(\ell + \ell_c) = w\bar{\ell}\}$$

The frontier is downward sloping (see the appendix). It reflects the budget constraint as well as technologies *g* and *f*. We can show that:

<h4>Claim 1 *When the wage increases, the opportunity set expands (dotted line in figure 5.5). Under regularity conditions, the hours worked increases and the number of children increases or consumption increases; both increase when the wage increases. That is, denoting equilibrium quantities as* ℓ_c^*, x_c^*, ℓ^*, *and* x^*, *if* $u(n, z)$, $f(x, l)$, *and* $g(x, c)$ *are concave, then*

$$\frac{\partial \ell_c^*}{\partial w} < 0, \quad \frac{\partial \ell^*}{\partial w} < 0, \quad \textit{and} \quad \frac{df(x_c^*, \ell_c^*)}{dw} > 0 \quad \textit{or} \quad \frac{dg(x^*, \ell^*)}{dw} > 0, \quad \textit{or both.}$$

The proofis in the appendix. The result is quite intuitiveWhen the wage increases, there is substitution away from labor to goods, which increases hours worked. The higher wage enlarges the budget set and so increases x_c. This may offset the decline in ℓ_c, which increases the number of children despite the lower

ℓ_c, meaning more hours are worked. A positive relationship between labor participation and child birth is therefore observed.

We further index consumption (consumption experience) by quality Q. The utility function is

$$u(Qz, n),$$

where z measures quantity of consumption. The first-order condition for utility maximization are

$$\frac{f_x}{f_\ell} = \frac{g_x}{g_\ell} = \frac{p}{w}, \tag{5.1}$$

$$\frac{u_n}{u_z} = Q\frac{g_x}{f_x}. \tag{5.2}$$

Equation (5.1) implies that less labor-intensive consumption and child rearing methods will be used when wages increase. The time series of female wages has been rising in Japan, leading to a shif away from labor intensive methods and thus greater female labor participation. Equation (5.2) implies that higher quality consumption leads to more consumption and fewer children.

Higher wage but not significantly higher quality obtains a positive relationship. However, with the same higher relative wage and higher quality

consumption, a negative relationship results between labor participation and fertility. Availability of consumption goods, such as entertainment and restaurants, is much greater in larger cities. This means a higher Q, and so fewer children and more consumption in the cities.

<h2>5.2.1 Empirical Evidence with Japanese Regional Data

In this section we examine the empirical evidence for the theoretical implications of the previous sections. In section 5.2.2 we present the data with descriptive statistics and so confirm the positive relationship between total fertility rate (TFR) and female labor participation rate (FLPR) among regions (prefectures) in Japan, as seen in other OECD countries. We present the estimation results in section 5.2.3. The equations we estimate allow for regional TFR to be affected by regional variables that reflect the quality of consumption goods. Specifically, we consider household leisure and entertainment expenditures, automobile ownership, and number of department stores as explanatory variables, in addition to the traditional marriage and other family variables. Child bearing and female labor market participation are determined simultaneously, which implies a simultaneous

or endogeneous relationship between TFR and consumption behavior variables. Furthermore, because the quality of consumption goods is the latent variable, we employ some proxy variables. To address the simultaneity, endogeneity, and measurement error problems, we apply the fixed effects instrumental variables (FE-IV) method to our panel data. The unobserved heterogeneity among regions is also taken into account by this approach.

<h2>5.2.2 Data and Descriptive Statistics

We use data from 47 prefectures for the years 1970, 1975, 1980, 1985, 1990, 1995, 2000, and 2005 (Okinawa prefecture is not included in 1970). Figure 5.4 plots correlation coefficients between regional TFR and FLRP for every five years from 1970 to 2005. The coefficient is negative for 1970 but is positive thereafter. For the last few years the correlation is not only positive but close to 0.5, a very clear positive relationship between TFR and FLRP. The positive relationship has also been observed in a cross section of other OECD countries in recent years. We will be controlling for the consumption variables implied by the proceeding theoretical model to understand that relationship.

FIGURE 5.4 HERE

FIGURE 5.5 HERE

The variables used for the regression in the next section are summarized in table 5.1. We introduce some new variables as determinants of TFR in addition to the traditional marriage and household variables. Specifically, we consider household leisure, entertainment expenditures, and automobile ownership as the consumer behavior variables that capture optimal choice, namely consumer behavior. To capture the quality of consumption, we use the number of department stores that specialize in high-end or high-quality products. Leisure and automobile ownership can be considered high-quality goods and the department store as a proxy variable for high quality of consumption goods. They both should have negative impacts on TFR.

TABLE 5.1 HERE

Table 5.2 summarizes the changes through time by depicting mean, standard deviation, and minimum and maximum values yearly for each variable. The steady decline of TFR is striking, and notice that TFR in 2005 has decreased

to almost half of what it was in 1970. The number of married couples has been declining as well. FLPR declines slightly in that period, but the standard deviation has changed from 6.313 (in 1975) to 2.467 (in 2005), implying that prefectures have become more homogeneous as far as FLPR is concerned. There is a similar phenomenon in the marriage standard deviation. Then again, we also observe that some variables have had rising means (proportion of one-person households, proportion of leisure and entertainment expenditure, automobile ownership rate, and number of department stores), and in particular the means of automobile ownership and the number of department store have risen substantially. And their standard deviations have increased, implying they could be better explanatory variables for heterogeneity of prefectures. In section 5.2.3 we regress TFR on FLPR and other variables, and apply the fixed effect instrumental variable model to our panel data to address the econometric problems and unobservable heterogeneity among prefectures.

TABLE 5.2 HERE

<h2>5.2.3 Estimation Results

Table 5.3 is from cross-sectional regression of TFR on all variables in table 5.2.

The regression equation is

$$TFR_i = c + \beta_1 FLPR_i + \beta_2 Marriage_i + \beta_3 Oneperson_i + \beta_4 Leisure_i + \beta_5 Automobile_i + \beta_6 Dpt.Store_i + \varepsilon_i, \quad (3)$$

where $i = 1, \ldots, 47$, c is the constant term, β_j, $j = 1, \ldots, 6$ are unknown parameters, and ε is the error term.

TABLE 5.3 HERE

Table 5.3 only shows the estimated coefficient ($\hat{\beta}_1$) of FLRP, and ** indicates that the null hypothesis $\beta_1 = 0$ can be rejected at 5 percent significance level. Although we observed a positive correlation between FRP and FLRP by the Pearson's correlation coefficient (see figure 5.4), after adding to the consumption variables, the FLPR coefficient is no longer significant at the 5 percent level. However, the coefficient is significantly positive when cross sections are pooled for 1975 to 2005 with $\beta_{FLRP} = 0.066$.

We suspected that the variables we employed did not completely explain the heterogeneity of TFR. We thought that there should be a correlation with the

error term that causes a bias in the OLS estimators, as is often the case. To address this problem, we assume the heterogeneity among the prefectures to be time invariant and applied the fixed effect model to our panel data. This was to guarantee a consistent estimation even with unobservable heterogeneity. We show the estimation results in table 5.4; column 1 of table 5.4 is the pooled OLS regression result of equation (5.3), where $t = 1975, \ldots, 2005$ and c is the constant term. We show the same result in table 5.3, where the FLPR coefficient is significantly positive with 0.066. Column 2 is result of equation (5.4), where α is the constant term and $t = 1970, \ldots, 2005$. This is a fixed effects model that takes into account of heterogeneity (α) and FLRP, and marriages are the only dependent variables, as in the previous studies. The FLPR coefficient is not significant at the 5 percent level; even the sign is negative.

$$TFR_{i,t} = \alpha_i + \beta_1 FLPR_{i,t} + \beta_2 Marriages_{i,t} + \varepsilon_{i,t} \qquad (5.4)$$

Column 3 shows a regression results of equation 5, where $t = 1975, \ldots, 2005$ and we obtain the negative coefficient of FLPR and it is significant.

$$TFR_{i,t} = \alpha_i + \beta_1 FLPR_{i,t} + \beta_2 Marriage_{i,t} + \beta_3 Oneperson_{i,t} + \beta_4 Leisure_{i,t} + \beta_5 Automobile_{i,t} + \beta_6 Dpt.Store_{i,t}$$

(5.5)

A comparison of columns 2 through 4 allows us to understand the effects of consumption variables more clearly. As we pointed out previously, we must address the simultaneity and endogeneity between TFR, FLPR, and consumer behavior variables as well as the latency of proxy variables for the quality of consumption goods. To this end, we employ the fixed effects instrumental variables model (FE-IV model), so as to guarantee a consistent estimator even with unobservable heterogeneity, a simultaneity problem, or measurement error problem. We employed the lagged variables of FLPR, marriages, and the other consumption expenditures (e.g., expenses for food, lighting and heating, furniture, and transportation expenses) as instrumental variables, and marriages is the exogenous variable. Column 4 shows the fixed effect IV estimation result of equation (5.5). We conclude that this result is our final result in the analysis.

TABLE 5.4 HERE

We focus the analysis on the impact of FLPR on TFR; the coefficient of FLPR is significantly negative after controlling the effect of consumption and dealing with the econometric problems. We note that the magnitude of the FLPR coefficient is larger in absolute value than that in column 3, and this suggests that the OLS estimator has a downward bias. The coefficient of marriages is significantly positive in the region that has the large number of married couples rather than other regions that achieve at higher TFR. There is a same phenomenon in the proportion of one-person households. We observe the significantly negative effects of automobile ownership, leisure time, and entertainment facilities on TFR. Department store is not significant in this estimation. Isolating the effect of high-quality goods on TFR is left for future research.

<h1>5.3 General Equilibrium with High-Quality Product and Heterogeneous Labor

In this section we analyze a general equilibrium model in which consumers have a utility function that reflects the previous analysis, although somewhat simplified. Consumers differ by two attributes, their preference and quality of labor.

Consumers choose either to consumer high-quality product or standard (low-quality) product. Child-bearing choices differ according to which product they choose, as well as if they are skilled or not. Skilled workers produce high-quality products, and the labor supply level determines the level of quality.

<h2>5.3.1 Approach

<h3>Consumers We simplify the consumer's problem so that the choice is between consumption x and child bearing n. A woman's preference is represented by the following utility function, which also depends on the quality of the good consumed Q:

$$U_\rho(n,x)=\left(Qx^\rho+n^\rho\right)^{1/\rho}, \qquad 0<\rho<1. \tag{5.6}$$

Consumers preference, ρ, is distributed uniformly over [0, 1]. The consumption good is either the standard (low quality) $Q = 1$ or high quality $Q > 1$. The consumer's labor endowment is $\bar{\ell}$, and wage is w, which is also the opportunity cost of children. Denoting price of the good by p, consumer chooses her consumption and number of children to maximize (5.6) with respect to the budget constraint