An Analysis of Women's Fertility and Labor Supply: the Case of Korean Women

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December 2006

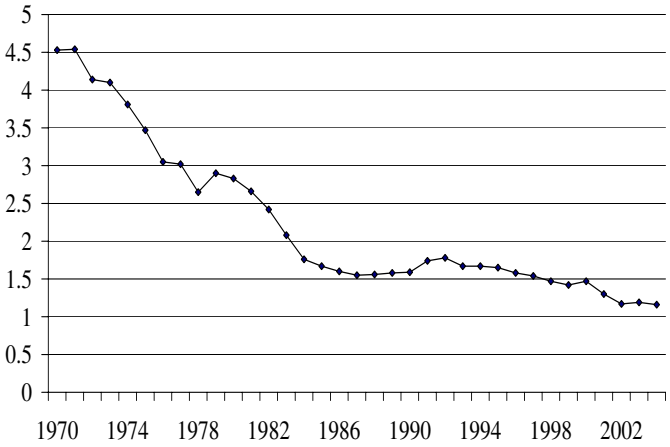
[Questions]

- What determines women's fertility and labor supply?
- What factors cause drastic changes in them over time?
- What policies can be used?
- Which policies are effective in encouraging both fertility and labor supply?

[Motivation]

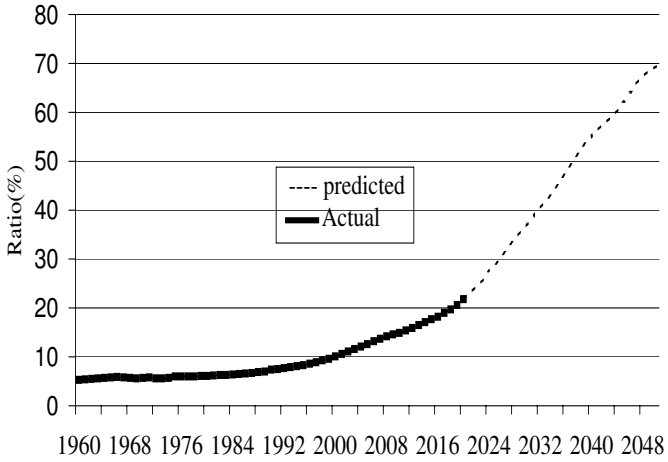
- The total fertility rate (TFR) rapidly declined from 4.53 in 1970 to 1.08 in 2005. $\rightarrow$ Accelerating the ageing of the population.

A. Total Fertility Rate



Source: Vital Statistics, 2005, Korea National Statistics Office

B. Dependency Ratio

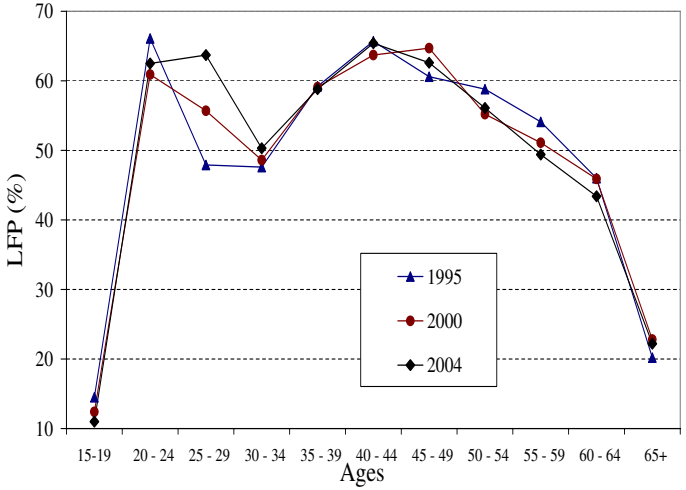


Source: KOSIS, 2005, Korea National Statistics Office

[Some Notable Features]

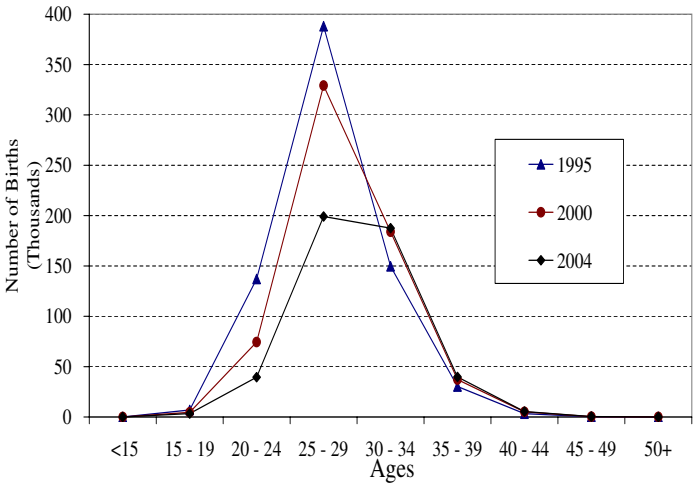
- Low LFP of women: Korea(52.8), Japan(64.5), US(65.4), Germany(66.6), Sweden(71.8) as of 2004.
- 'M' shape pattern/A negative relationship between fertility and LFP

B. Labor Force Participation of Women by Age



Source; Author's calculation from Economically Active Population Survey.

C. Number of Births by Mothers' Age



Source; Author's calculation from Vital Statistics.

[Fertility and Labor Supply]

- An increase in women's market activities is frequently suggested as the cause of the decline in fertility rates. → However, the causal inference between these two is not straightforward.

- Women's labor supply is an important part of human capital especially in an ageing economy. → Encouraging fertility without reducing women's market activities is an important policy goal.

- Little is known about the dynamic behavior of fertility and labor supply, which limits understanding on the effectiveness of policies.

[Literature Review]

- Empirical work examining the fertility impact on women's labor supply. (Heckman, 1974; Heckman and Macurdy, 1980)
  - treating fertility as an exogenous variable may bias its effect on women's labor supply.

- A theory on fertility (Becker, 1960)
  - The demand for children is no different from the demand for durable goods. (quality and quantity, and price)

- A lifecycle model of fertility and labor supply (Moffitt, 1984; Rosenzweig and Wolpin, 1980;Hotz and Miller, 1988)
  - Findings: Wage rates and childcare costs are important.

[A Lifecycle Model]

- Three stages:From I(age at marriage) to Q(end of reproductive age)/From Q+1 to R(Retirement)/From R+1 to D(Death).
- Decisions on c(consumption), q(quality of children), k(quantity of children), a(assets), h(hours of work) and l(leisure).
- Quality of a child is produced with goods and time investment in child's human capital: $q = f(g, m)$.
- A realistic environment where uncertainty, fixed time costs associated with children, and borrowing constraints exist.

[A Lifecycle Model-cont'd]

$$V(y,w,k,a,j) = \max_{c,g,m,h,b,a'} u(c,q,k,l)$$

$$+\beta \int\int V(y',w',k',a',j+1) d\Phi_y(y'|y) d\Phi_w(w'|w)$$

subject to

$$\begin{aligned} c/\phi + g + a' &= wh - \tau(wh) + (1+r)a + y \\ k' &= k + b, \\ l &= 1 - m - z - h, \\ q &= f(g,m). \end{aligned}$$

[Calibration and Estimation]

- Make assumptions about functional forms.

$$u(c,q,k,l) = \frac{c^{1-\sigma}}{1-\sigma} + A\frac{q^{\kappa}}{\kappa}\frac{k^{\zeta}}{\zeta} + B\frac{l^{1-\xi}}{1-\xi}. \quad \text{(Preferences)}$$

$$q_t = (g_t^{\eta} + m_t^{\eta})^{1/\eta}, \quad \eta < 1. \quad \text{(Production of child service)}$$

$$z_t = \sum_{j=t-5}^{t} \gamma b_j \phi^{t-j}, \quad 0 < \phi < 1. \quad \text{(Fixed time costs)}$$

$$\tau(I) = a_0(I - (I^{-a_1} + a_2)^{-1/a_1}) \quad \text{where} \quad I = wh. \text{ (Income Tax)}$$

- Conduct SMM (Simulated Method of Moments) to obtain parameters.

[Estimated Parameters]

Parameter	Statistics	Data		Model
	Time and goods use of women			
A=0.0060	Labor supply(annual hours of work)	2,489	(1,041)	2,490
B=0.0545	Overall LFP	57.3%	(5.1)	57.6
$\xi = 1.0526$	LFP within 5 years since birth	34.0%	(4.7)	34.6
$\kappa = 0.6716$	Income share of expenditure on children	29.3%	(5.5)	27.8
	Fertility			
$\zeta = 0.7600$	Number of children	1.48	(0.6)	1.5
$\eta = 0.8929$	Age at first birth	25.2	(2.9)	25.7

[Policy Tools]

- Child Allowances
  - A tax-exempt universal cash transfer to households with children.

- Conditional Childcare Subsidies
  - An in-kind transfer to help with child care conditional on mothers' employment: provision of public child care or voucher.

- Tax Credits
  - A reduction in tax liabilities for working parents.

- Maternal Leaves
  - A provision of leaves for birth or childcare reasons.

[Policy Mechanism]

- Child allowances: directly related to the number of children/ income effect.

$$c_t/\phi + g_t + a_{t+1} = w_t h_t - \tau(w_t h_t) + (1+r)a_t + y_t + M(k_t - k_{t-5}).$$

- Conditional childcare subsidies: substitute time inputs/ saved time goes either to work or leisure

$$q_t = \{(G + g_t)^\eta + m_t^\eta\}^{1/\eta}$$

$\begin{cases} G > 0, \text{ if } \quad LFP = 1 \\ G = 0, \text{ if } \quad LFP = 0 \end{cases}$ and $G = \bar{g}(k_t - k_{t-5})$, $\bar{g}$ is per child amount.

[Policy Mechanism-cont'd]

- Pronatal Income Tax: reduce tax rates according to the number of children

$$\tau(I) = (a_0 - E\bar{k_t})(I - (I^{-a_1} + a_2)^{-1/a_1}) \quad \text{where} \quad I = w_t h_t$$

$\bar{k_t}$ is the number of children under six.

- Maternal Leaves: provide 20% of earnings for 2 years of leaves

$$\begin{aligned} c_t/\pi + g_t + a_{t+1} &= 0.2 \times w_t \bar{h} + (1+r)a_t + y_t \\ l_t &= 1 - m_t - z_t \\ t = j, j+1 \quad &\text{and} \quad b_j = 1 \end{aligned}$$

[Results]

Results from Policy Experiments

	baseline	child allowances	conditional subsidies	pronatal tax	maternal leaves
program costs (subsidy+Δtax)	-	6.572	3.528	9.014	6.194
utility	-21.427	-21.363	-21.370	-21.383	-21.402
chd quantity	1.50	1.87	1.73	1.73	1.82
chd quality	11.6	12.0	11.8	13.2	11.6
LFP (overall)	57.6	54.5	72.8	65.4	64.5
LFP (young)†	34.6	29.8	58.0	46.6	45.0
hours of work	2,490	2,454	2,500	2,536	2,406

† indicates the labor force participation of women within 6 years since birth.

[Conclusions]

- This paper investigates women's fertility and labor supply in a lifecycle framework.
- Through the model, the effects of policies to encourage fertility and labor supply are examined.
- There is no single criterion to evaluate the effectiveness of each program.
- Given that encouraging childbearing without reducing labor supply is an important policy goal, the provision of child care combined with tax credits conditional on work is more effective than an unconditional monetary transfer.