

Labor Market - Supply

- Individual labor supply as function of relative wage is , using (5) ,

$$\ell_s^H(\xi) = \ell_\sigma^*(w_s, w_s; Q) = \frac{Q^\sigma \bar{\ell}}{Q^\sigma + 1}, \quad \sigma < \hat{\sigma},$$

$$\ell_s^L(\xi) = \ell_\sigma^*(w_u, w_s; 1) = \frac{\bar{\ell}}{\xi^{1-\sigma} + 1}, \quad \sigma > \hat{\sigma}$$

$$\ell_u^H(\xi) = \ell_\sigma^*(w_s, w_u; Q) = \frac{Q^\sigma \bar{\ell}}{Q^\sigma + \xi^{\sigma-1}}, \quad \sigma < \hat{\sigma},$$

$$\ell_u^L(\xi) = \ell_\sigma^*(w_u, w_u; 1) = \frac{\bar{\ell}}{2}, \quad \sigma > \hat{\sigma}.$$

- Aggregation yields the total labor supply of each type,

$$L_s^S = N\theta \left\{ \int_1^{\hat{\sigma}} \ell_s^H(\xi) d\sigma + \int_{\hat{\sigma}}^\infty \ell_s^L(\xi) d\sigma \right\}, \quad (8)$$

$$L_u^S = N(1 - \theta) \left\{ \int_1^{\hat{\sigma}} \ell_u^H(\xi) d\sigma + \int_{\hat{\sigma}}^\infty \ell_u^L(\xi) d\sigma \right\}. \quad (9)$$

Market Equilibrium

- $\hat{\sigma}$ is decreasing in ξ
- L_s^D and L_u^S is decreasing in $\xi = \frac{w_s}{w_u}$ and L_s^S and L_u^D are increasing in ξ .
- Equilibrium relative wage for a given quality level, $\xi^*(Q)$, is determined by the skilled labor market clearing condition,

$$L_s^D(\xi) = L_s^S(\xi).$$

Comparative Statics (1)

How equilibrium labor supply and relative wage change with quality.

Claim 2 (i) L_s^S , L_u^S and L_s^D are increasing and L_u^D are decreasing in Q .

(ii) *Equilibrium relative wages and level of skilled labor are increasing in quality. That is, $\partial \xi^*(Q)/\partial Q > 0$ and $\partial L_s^*(Q)/\partial Q > 0$.*

(Figures 5 and 6)

- Higher quality makes consumption attractive for skilled workers and increase proportion of all workers that consume the high quality product \Rightarrow **Both demand and supply of skilled labor is increasing in quality.**
- The same effect increases the supply of unskilled workers and reduces demand for low quality good \Rightarrow **Latter effect implies demand for unskilled workers decreases when quality improves.**

Comparative Statics (2)

How equilibrium labor supply and relative wage change with population and skilled workers.

- Skilled labor supply is increasing in population, $\partial L_s^S / \partial N > 0$, from (8) and demand is also increasing in population, $\partial L_s^D / \partial N > 0$, from (6).

Claim 3 *Both equilibrium skilled and unskilled labor will increase when population increases, $\partial L_s^* / \partial N > 0$ and $\partial L_u^* / \partial N > 0$.*

- Demand and supply of skilled labor is also increasing in proportion of skilled consumers, $\partial L_s^S / \partial \theta > 0$, and $\partial L_s^D / \partial \theta > 0$.

Claim 4 *Equilibrium skilled labor and equilibrium relative wage are increasing in the proportion of skilled consumers, $\partial L_s^* / \partial \theta > 0$ and $\partial \xi^* / \partial \theta > 0$.*

Birthrate

- Individual number of children are,

$$n_s^H(\xi) = n_\sigma^*(w_s, w_s; Q) = \frac{\bar{\ell}}{Q^\sigma + 1}, \quad \sigma < \hat{\sigma},$$

$$n_s^L(\xi) = n_\sigma^*(w_u, w_s; 1) = \frac{\bar{\ell}}{\xi^{\sigma-1} + 1}, \quad \sigma > \hat{\sigma}$$

$$n_u^H(\xi) = n_\sigma^*(w_s, w_u; Q) = \frac{\bar{\ell}}{Q^\sigma \xi^{1-\sigma} + 1}, \quad \sigma < \hat{\sigma},$$

$$n_u^L(\xi) = n_\sigma^*(w_u, w_u; 1) = \frac{\bar{\ell}}{2}, \quad \sigma > \hat{\sigma}.$$

- High quality consumers devote even more resources for consumption and **reduce number of children when quality improves.**

Birthrate

Claim 5 (i) *Skilled consumers have less children . That is , $n_s^H < n_u^H$ for $\sigma < \hat{\sigma}$ and $n_s^L < n_u^L$ for $\sigma > \hat{\sigma}$.*

(ii) *Skilled consumers have less children when quality of product improves. That is, $dn_s^H/dQ < 0$ for $\sigma < \hat{\sigma}$ and $dn_s^L/dQ < 0$ for $\sigma > \hat{\sigma}$.*

(iii) *Unskilled consumers that consume low quality product have the same number of children when quality improves. That is, $dn_u^L/dQ = 0$ for $\sigma > \hat{\sigma}$.*

- Substitution effect dominates and skilled workers that consume low quality \Rightarrow reduce number of children.
- Income effect in the other direction for unskilled consumers that consume high quality good (relative wage decreases). The total effect is not clear.

Endogenous Quality

- Level of quality is increasing in the size of the skilled labor.
 - $Q = Q_T(L_s)$ is an increasing function of Q .
 - Subscript T refers to “technology”.
- The inverse relationship between the market equilibrium supply of skilled labor and quality of $L_s^*(Q)$ denoted as $Q = Q_M(L_s)$, an increasing function.
- The equilibrium level of labor L_s^* and equilibrium level of quality, $Q^* = Q_M(L_s^*) = Q_T(L_s^*)$, is the intersection of the two curves. (Figure 7)

Equilibrium Quality and Skilled Labor

- **Infant technology ($Q'_T > Q'_M$) : equilibrium is unstable.**
 - Spiral increase in quality and skilled labor supply or spiral decrease of quality and skilled labor supply.
- **Mature technology ($Q'_T < Q'_M$) : equilibrium is stable.**
- Multiple equilibria possible.

Effect of Population Decline (1)

- $Q_M(L_s)$ function will shift upward in the $L_s - Q$ space (Figure 8).

Claim 6 (i) *If the technology is in its infancy, then equilibrium quality and skilled labor supply increase when population declines. That is,*

$$Q'_T > Q'_M \quad \Rightarrow \quad \frac{\partial Q^*}{\partial N} < 0, \quad \frac{\partial L_s^*}{\partial N} < 0.$$

(ii) *If the technology is mature, then equilibrium quality and skilled labor supply decrease when the population decreases. That is,*

$$Q'_T < Q'_M \quad \Rightarrow \quad \frac{\partial Q^*}{\partial N} > 0, \quad \frac{\partial L_s^*}{\partial N} > 0.$$

- **Mature technology: Quality and supply of skilled labor decrease \Rightarrow lower quality will increase the birthrate.**

Effect of Population Decline (2)

- **Infant technology: Quality and supply of skilled labor increase \Rightarrow higher quality will decrease the birthrate.**
 - Products are more polarized
 - Skilled labor has higher relative wage and work more. Utility is derived from more consumption and there is less children.
 - The cohort effect does not hold because the economy adjusts to the lower level of population according to the available technology.

Effect of More Skilled Labor (1)

- $Q_M(L_s)$ function will shift downward in the $L_s - Q$ space (Figure 9).

Claim 7 (i) *If the technology is in its infancy, then equilibrium quality and skilled labor supply decrease when the proportion of skilled workers increase. That is,*

$$Q'_T > Q'_M \quad \Rightarrow \quad \frac{\partial Q^*}{\partial \theta} < 0, \quad \frac{\partial L_s^*}{\partial \theta} < 0.$$

(i) *If the technology is mature, then equilibrium quality and skilled labor supply increase when the proportion of skilled workers increase. That is,*

$$Q'_T < Q'_M \quad \Rightarrow \quad \frac{\partial Q^*}{\partial \theta} > 0, \quad \frac{\partial L_s^*}{\partial \theta} > 0.$$

- Equilibrium quality will **decrease** (increase) when technology is in its **infancy** (maturity) when the proportion of skilled workers **increase**.

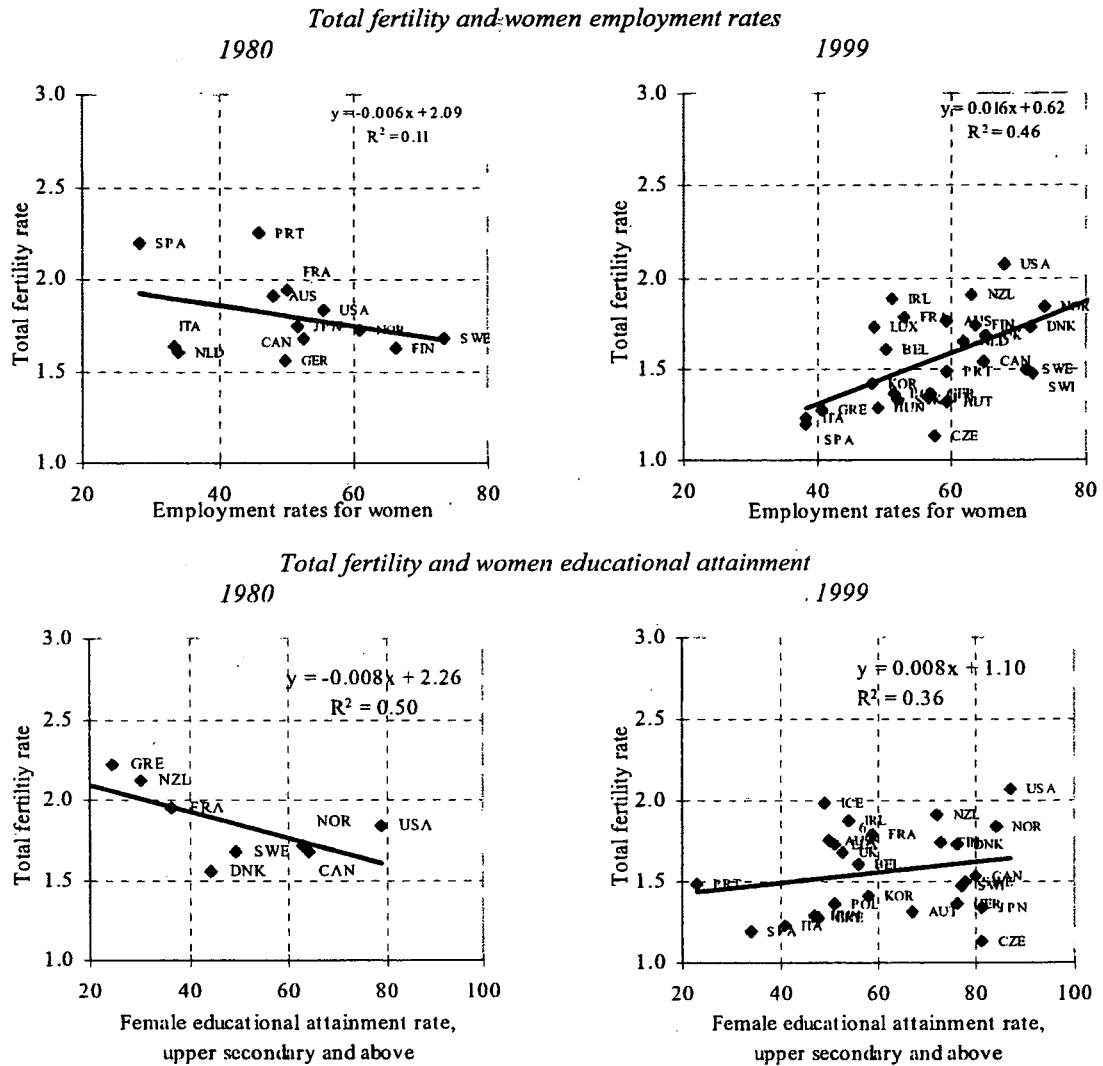
Effect of More Skilled Labor (2)

- When proportion of skilled consumers increase \Rightarrow Each skilled labor supplies less to maintain same quality \Rightarrow Quality reduced to reduce demand
- Lower quality (and lower wage) likely to imply higher birthrate.
- When technology is sufficiently productive, the increasing skilled workers will increase the birthrate.
- When technology is mature, then higher labor implies higher quality \Rightarrow This may reduce the birthrate.
- Increasing the proportion of skilled labor can be effective in reversing decline in birthrate whenever the cohort effect does not hold.
- This was the case when technology was in infancy .
- On the other hand, when the technology is mature, cohort effect is likely to hold and the same policy will prevent the feedback mechanism that otherwise will function.

Concluding Remarks

- Cohort effect may not work
- Population decline will continue
- This is likely to occur when economy is able to adjust technologically
- Increasing skilled labor is effective for reversing low fertility
- Extension to dynamic framework necessary

Figure 7. Fertility, women employment and education



Note. The trend line refers to the same number of countries in the two periods.
 Source: OECD data

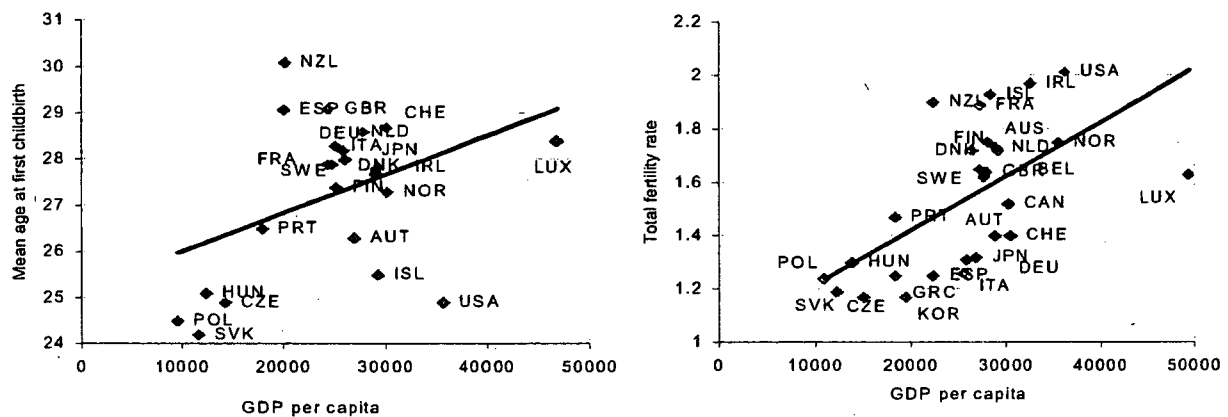
Family patterns

38. The strength and nature of family relationships may also influence fertility rates, as the proportion of women with children tends to be higher among married women than for women cohabitating with a partner in the context of a consensual union and for those living alone (see below). Again, cross-country correlations between total fertility rates and several proxies of the dominance of traditional forms of family relationships suggest a different pattern. Two indicators of family patterns are shown in Figure 8: divorce rates (an indicator of the frequency of disruptions in marriages) and the proportion of out-of-wedlock births (*i.e.* birth occurring outside marriages, as a proportion of all births). In both cases, Figure 8 suggests that OECD countries where divorce and out-of-wedlock births are more frequent have, at the end of the 1990s, lower fertility rates than other countries. Further support for this cross-country pattern is provided by the large increase in the proportion of out-of-wedlock births in Sweden, France, the United Kingdom and the United States (countries with relatively high total fertility rates), as compared to broad

market, its entry wages decline; as aspirations for material prosperity are shaped by conditions in childhood, a wider gap between expectations and outcomes will tend to delay marriage and reduce childbirths. As a result of these patterns, total fertility rates may display large changes over time, as changes in the size of various cohorts lead to opposite movements in their relative income.

- Second, disentangling directions of causation is complex, as relations are both ways. Barlow (1998), for example, reports evidence that output growth is lowered by higher levels of *current* birth rates (which lead more women to withdraw from the labour force) but increased by higher levels of *past* birth rates (which raise the size of the labour force). The aggregate relation between income levels and fertility rates is therefore ambiguous, and will also depend on how income is distributed across households.¹⁶ Changes in fertility rates may also generate shifts in the risks of poverty among households of different size.¹⁷

Figure 10. Cross-country relation between GDP per capita, mean age at first childbirth and total fertility rates



Note: Gross domestic product is expressed in purchasing power parities. Data of the left-hand panel refer to 2002; data for the right-hand panel refer to 2000.

Source: Various issues of *Society at a Glance – OECD Social Indicators*.

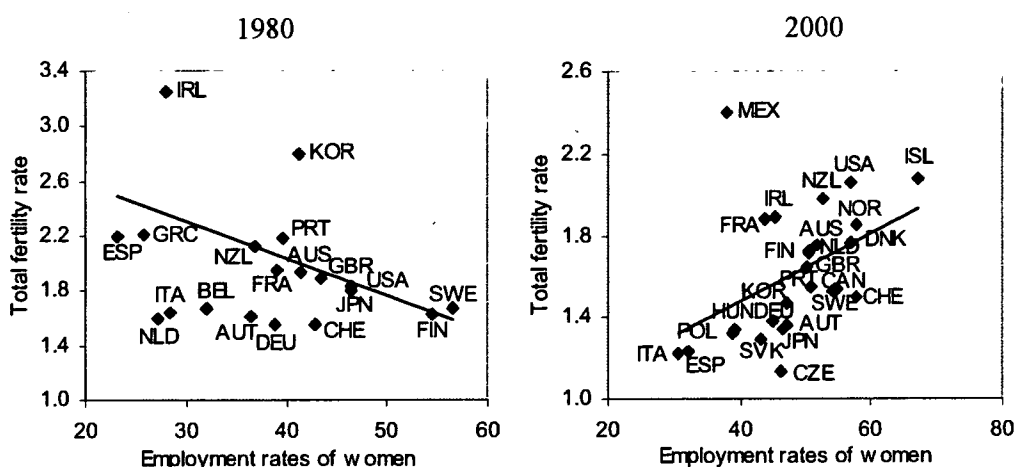
41. The influence of income on childbearing behaviour is also evident at the level of individuals and households. The theory of the allocation of time, along with the assumption that children are time-intensive with respect to mother's time, implies that women's income and earnings are key influences on childbearing and that total fertility rates and female labour force participation will be inversely related. As childrearing competes with paid work of mothers, higher earnings increases the opportunity cost of not working.

16. The relation between changes in fertility rates and in income distribution will depend on both *dependency* and *acquisition* effects (IUSSP, 1998). The first refers to the worsening of income inequality that occurs if the fertility decline is concentrated among richer households (i.e. new births are increasingly concentrated in poorer households). The second measures the impact of a lower ability of poorer households to achieve the same level of well-being when (because of higher fertility) their household size increases. The size of acquisition effects will reflect, *inter alia*, changes in the costs of each additional child and the labour supply response of parents to changes in family needs; for example, when births lead to an increase in the labour supplied by parents, the acquisition effect falls and income inequality narrows.

17. In the United Kingdom, for example, although the risk of child poverty increases with family size, recent reductions in the proportion of children in low-income households seem to have been concentrated in larger families (UK Parliament, *Second report on Child Poverty for the United Kingdom*, 2004).

women is more common. This change in the patterns of cross-country association between the two variables is not affected by which measure of birth rates is used (i.e. cohort or period fertility rates). Across OECD countries, there is also little association between the *changes* in female employment and the *changes* in fertility rates: in other words, countries where employment rates of women have increased the most from 1980 to 2000 do not consistently record larger declines in fertility rates.

Figure 13. Cross-country relation between female employment rates and total fertility rates, 1980 and 2000

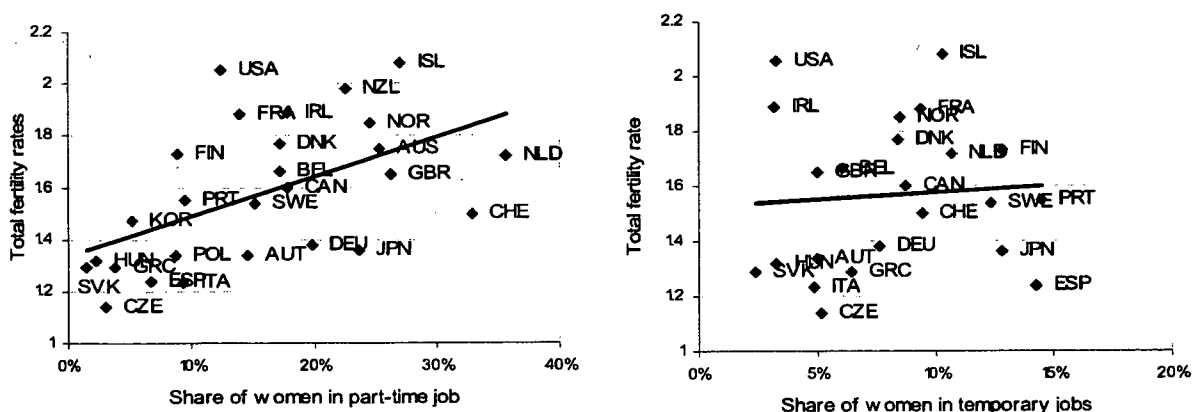


Note: Employment rates refer to women aged 15-64.

Source: Computations on data from *Society at a Glance – OECD Social Indicators* and OECD (2005a), Labour market indicators.

45. Total fertility rates in 2000 were also higher in OECD countries where a higher share of women held part-time jobs (Figure 14, left-hand panel). Conversely, there is much diversity in country experiences in terms of the share of women holding temporary jobs: total fertility rates are low in some of the countries where a large proportion of women work in temporary jobs (Spain and Japan), but also in some of the countries where temporary jobs among women are less common (e.g. several Southern and Eastern European countries, right-hand panel).

Figure 14. Cross-country relation between women in part-time and temporary jobs and total fertility rates, 2000



Source: Computations on data from *Society at a Glance – OECD Social Indicators* and OECD (2005), Labour market indicators.

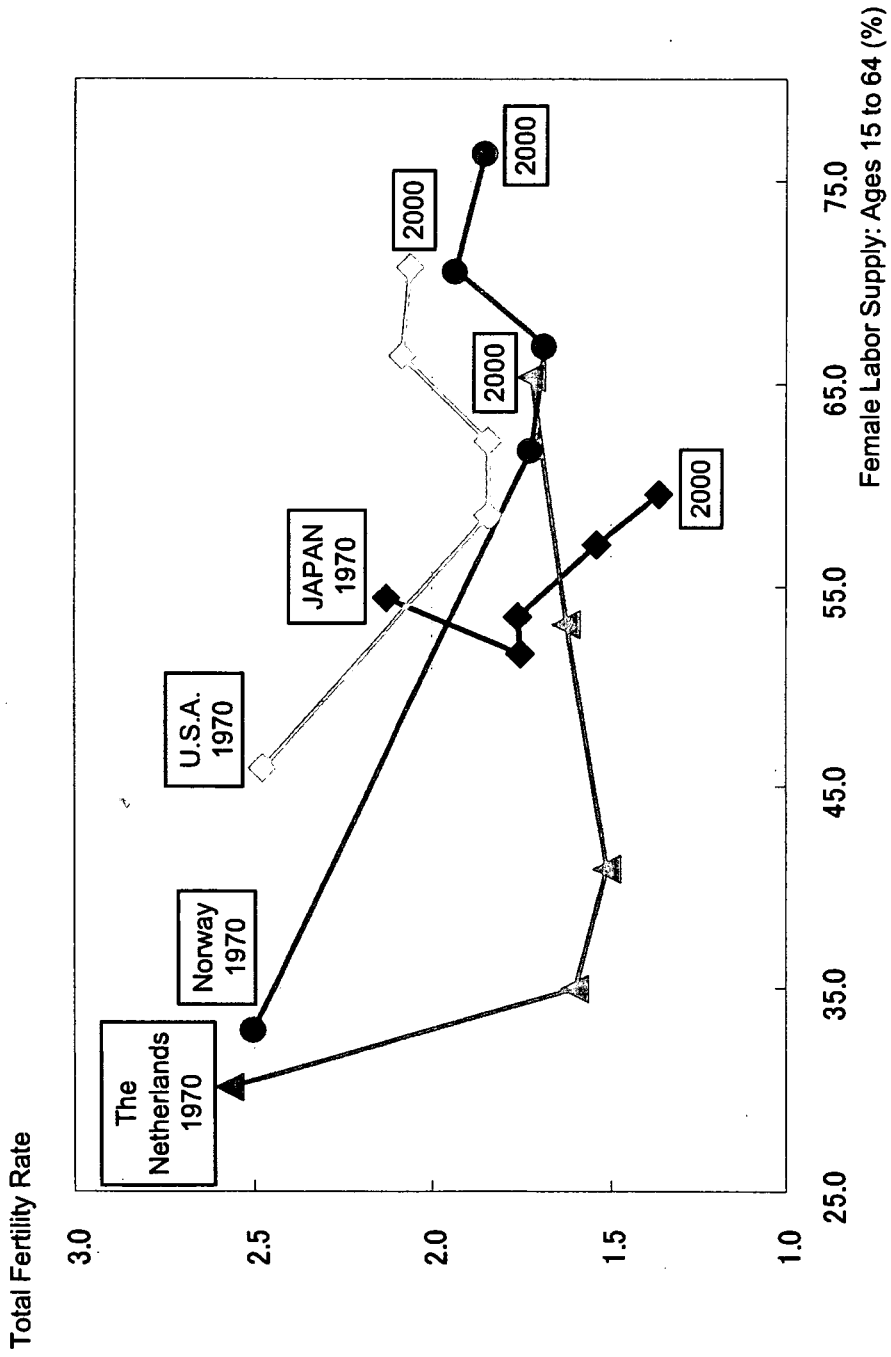
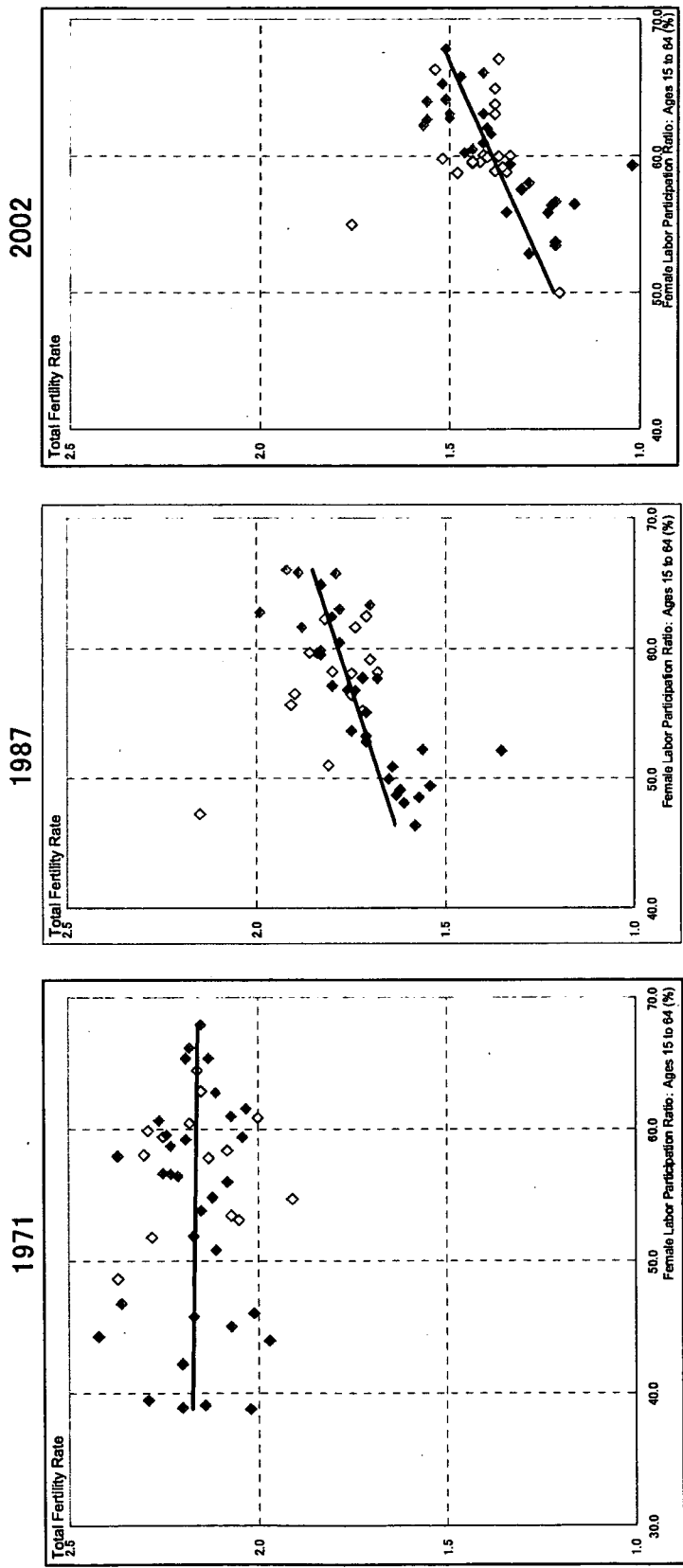


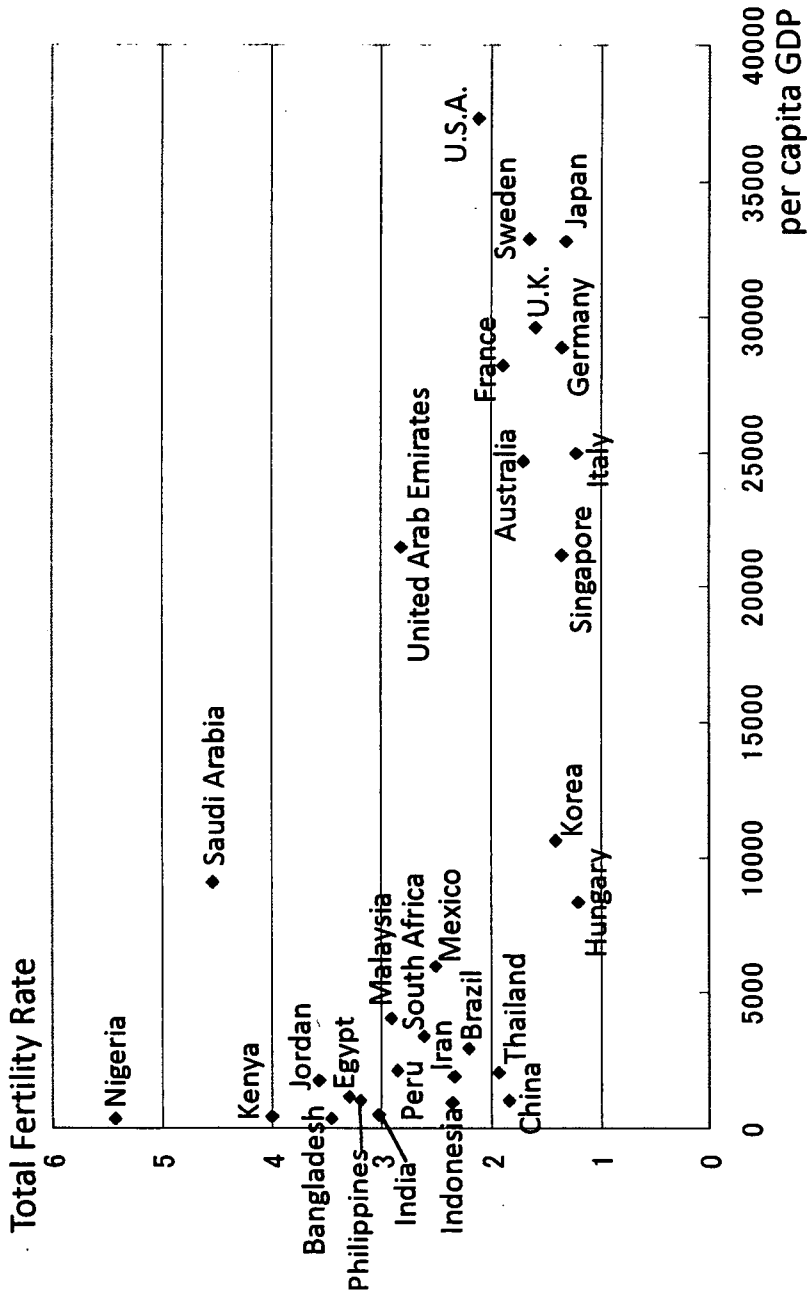
Figure 1: TFR and female labor supply 1970,80,85,90,2000
 (Council for Gender Equality, Special Committee on the Declining Birthrate and Gender-Equal Participation, 2006a)



NOTE) Pink points are TYPE1(low declining rate in TFR and high level of TFR and female labor supply). Blue points are TYPE7(high declining rate in TFR and low level in TFR and female labor supply).

Sources) Ministry of Internal Affairs and Communications "Employment Status Survey," National Institute of Population and Social Security Research "Indicators of Fertility by Prefecture in 1970-1985," and Health, Labor and Welfare Ministry "Population Survey Report."

Figure 2: TFR and female labor participation ratio by prefecture in 1971, 1987, 2002
 (Council for Gender Equality, Special Committee on the Declining Birthrate and Gender-Equal Participation, 2006b)



Source) United Nations Population Fund "State of World Population 2004" and IMF "World Economic Outlook Databases 2003."

Figure 3: TFR and Per Capita GDP
 (Council for Gender Equality, Special Committee on the Declining Birthrate and Gender-Equal Participation, 2006a)

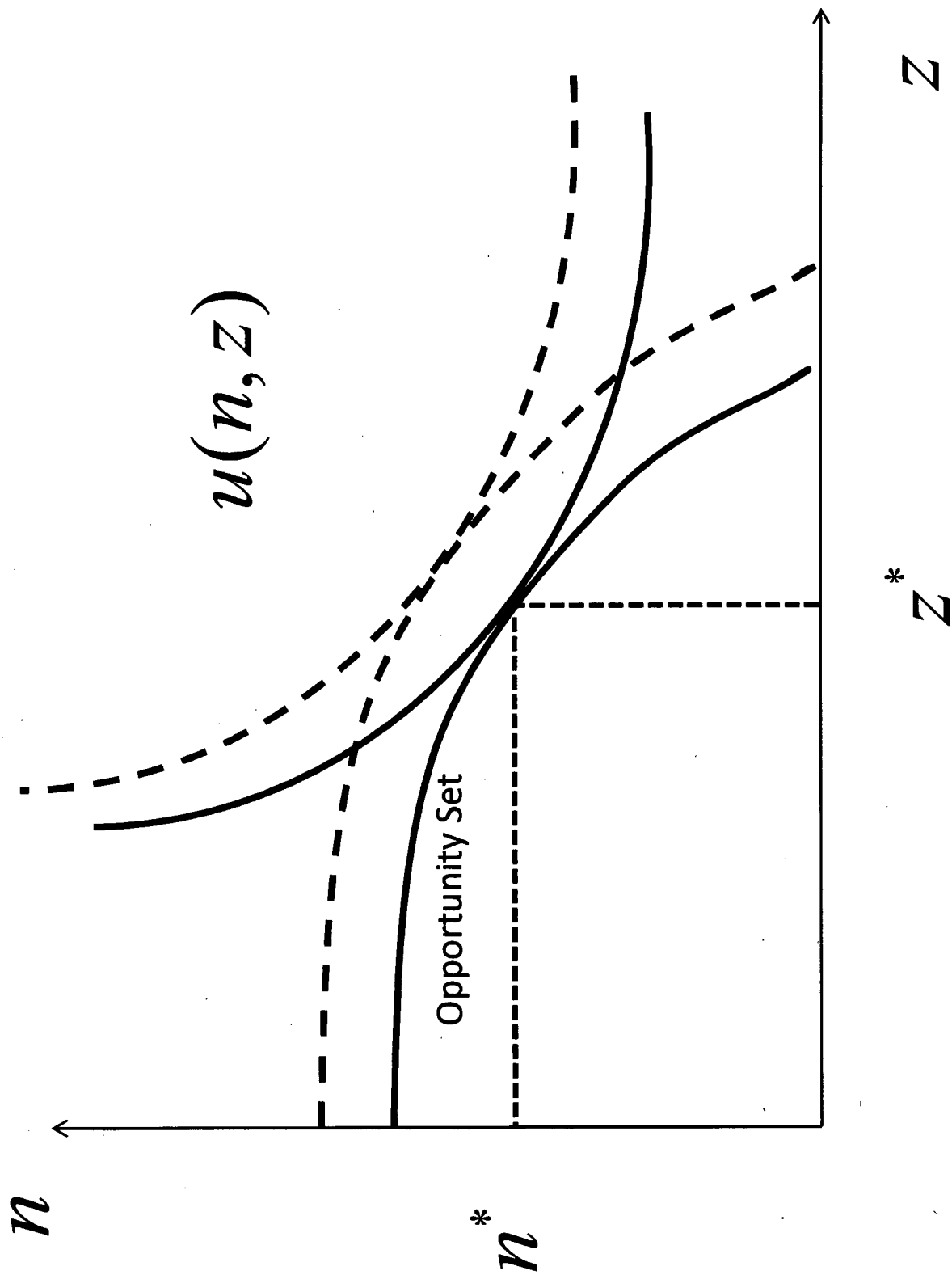


Figure 4: Optimization Problem