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FERTILITY ADAPTATION BY RURAL-URBAN MIGRANTS IN DEVELOPING COUNTRIES: THE CASE OF KOREA

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ABSTRACT

The purpose of this study is to develop and test a model to assess the influence of rural-urban migration on fertility in less developed countries. Two major reasons may account for lower fertility levels observed among such migrants than among women who remained in rural areas: a selection effect, and adaptation to constraints in the area of destination. Results of previous studies have only rarely suggested that the effect of adaptation was significant. We use the detailed personal migration and pregnancy histories recorded in the Korean World Fertility Survey of 1974 and an autoregressive model to control for unobservable variations in personal preferences for different family sizes between migrants and non-migrants. Our study provides evidence that adaptation following rural-urban migration is a significant factor which explains the lower fertility of rural-urban migrants compared with that of rural stayers.

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FERTILITY ADAPTATION BY RURAL-URBAN MIGRANTS IN DEVELOPING COUNTRIES: THE CASE OF KOREA*

Fertility Adaptation by Rural-Urban Migrants)

Bun Song Lee and Stephen C. Farber†

I. Introduction

The relationship between rural-urban migration and fertility can be studied from several perspectives, one of which is its influence on the fertility behaviour of migrants. The effect of migration could be decomposed into those due to migration *per se* and those resulting from adaptation after migration. The purpose of this study is to develop and test a fertility model to assess the adaptation effect on migrants' fertility in a developing country, Korea. In this study we use the detailed personal migration and pregnancy histories of approximately 5,000 currently married women aged 20-49 in the Korean World Fertility Survey of 1974 (KWFS). We can trace the changes in fertility differentials between rural-urban migrants and a control group of rural stayers at different periods after migration. We show that rural-urban migration is important in lowering national fertility, and suggest that the adaptation to urban constraints and fertility norms is a significant factor which explains the lower fertility of rural-urban migrants compared with that of rural stayers even after we have controlled for the selection effect of migration. Our results are consistent with the Korean experience which shows a virtual disappearance of rural-urban fertility differentials during recent periods in spite of the fact that in Korea the volume of rural-urban migration during the last two decades has been extremely large.[1] This contradicts the predictions in the literature that continued rural-urban migration is likely to slow down the reduction of the rural-urban fertility gap because of the selection effect of migration.[2]

II. Literature

Demographers and economists have studied the relation between rural-urban migration and fertility on several occasions.[3] Three alternative hypotheses have been suggested to explain lower fertility among rural-urban migrants tha among those who remain in rural areas. First, many writers have supported th selection hypothesis.[4] This hypothesis suggests that the lower fertility among rural-urban migrants can be accounted for primarily by the selectivity of the migration process; i.e. that those who migrate are a select group with different socio-economic and demographic characteristics such as education, occupational experience, age, sex and marital status from that of the rural population as a whole and that their preferred family sizes may also be different. Secondly, the disruption hypothesis proposed by Goldstein and Goldstein and Tirasawat suggests that lower fertility among recent migrants to urban areas in Thailand compared with that of urban natives of similar ages reflects lower fertility of migrants in the years immediately following settlement at the place of destination.[5] They attribute this to disruptive factors associated with the process of migration and to the lower probability of migration for women who are pregnant or have small children. Finally, the adaptation hypothesis suggests that even when selection effects are controlled, age-specific fertility rates of rural-urban migrants after migration will remain lower than those of rural stayers, even after possible disruptive effects.[6] As a result, differences in cumulative fertility between rural-urban migrants and rural stayers will increase as the length of urban residence increases. Possibly all three basic hypotheses are valid. Therefore, it is important to emphasize that the adaptation hypothesis suggests that the adaptation effect is statistically significant even when selection and the disrupting effects of migration are controlled.

There are few empirical studies in which a significant adaptation effect of rural-urban migration has been observed. Potential exceptions are two cross-sectional studies of rural-urban migration to Manila by Hendershot.[7] He shows that fertility of the older rural-urban migrants, who are likely to have lived in urban areas longer, is lower than that of persons of the same age who were born in urban areas. Conversely, the fertility of the younger migrants, who are likely to have been exposed to urban life for a shorter period, is higher than that of persons of similar ages who were born in urban areas. However, he suggests that only highly selected migrants would adapt to the urban environment by reducing the size of their families. Hendershot implies that rural-urban migration had become less selective over time. According to his model, the adaptation effect will become less significant as urbanization progresses.

We suggest that the absence of studies which support the adaptation hypothesis is due to defects of method, and cannot be regarded as proving that the effects of adaptation were not significant. First, in only two studies were data on the year of migration used, but in neither of them were pregnancy histories studied.[8] Therefore, the insufficiency of data relating to migration and the lack of pregnancy histories may have made it impossible to trace the adaptation behaviour of migrants and to assess its effect. Secondly, controls for the selection effect of migration were inadequate because the use of various socio-economic and demographic characteristics of migrants for this purpose is subject to two serious drawbacks. There is no information whether the migrants had attained their current leven of education before or after migration. The proper control is, of course, the level achieved before migration. Education received after migration compounds the effects of adaptation and selection. The second drawback is that it is also necessary to control for differences in preferences relating to family size which cannot be measured. Ribe and Schultz[9] demonstrate that unobserved personal preferences, in the sense in which economists use this term, is an important characteristic of selection which distinguishes migrants from non-migrants.

III. Model

A traditional static model which maximizes household utility would suggest that a household's demand function for children is represented by

$$(1)\quad N^* = h\,(W_h, W_w, P_x, I; F, \rho),$$

where N^* represents the desired number of children; W_h and W_w are time prices for husband and wife; P_x is the price of market purchased goods and services; I is income; F is fecundity; and ρ is a parameter reflecting household tastes.[10] Unfortunately, this model is only a theoretical representation of fertility behaviour. Desired fertility, N^*, cannot be observed directly; only actual cumulative fertility or a fertility rate at different points in the household's life cycle is available. Secondly, the taste parameter, ρ, is a crucial variable in Equation (1), but again cannot be directly observed. These two problems are particularly serious in studies of the fertility adaptation effect of rural-urban migration. The importance of differences in tastes between a rural-urban migrant, M, and a rural stayer, S, can be represented in Figure 1. N measures the household's desired number of children and Z measures purchasable goods. The household income, the price of goods, and the price of children jointly determine the set of goods and number of children from which the household will select the most preferred combinations. Suppose this set is representable by line RR for both household S and household M prior to its migration. If curves S and M represent the indifference curves of households S and M, respectively, the most preferred number of children is N_S^* for household S and N_M^* for household M, since these values lie on each household's highest indifference curve. Different tastes, represented by ρ in Equation (1), cause the difference between N_S^* and N_M^*.

When household M migrates to an urban area children become more expensive and household income may increase. Suppose the migrant household faces constraint line UU after migration. The desired number of children changes to $N_M^{*'}$. Without control for ρ, it may be mistakenly concluded that $N_S^* - N_M^{*'}$ is the fertility adaptation effect of rural-urban migration rather than $N_M^* - N_M^{*'}$. Furthermore, unless we observe completed fertility, we cannot observe N^*. Due to uncertainties surrounding conception, contraception and child survival even the observation of completed fertility is only an approximation to desired fertility. We present a model that attempts to deal with these problems.

(Figure 1)

The most straightforward method of testing for migrant adaptation in the presence of a possible selection effect is to find a control group whose fertility behaviour is similar to that of migrants before migration. If the pre-migration fertility patterns are similar and migration causes them to differ after migration, this would suggest that adaptation is occurring.[11] This problem may be studied by an autoregressive model, the formal derivation of which is given in the technical appendix. The equation is:

$$2) \quad N_t = \beta_o^* + \beta_1^* N_{t-1} + \beta_2^* A_t + \beta_3^* A_t^2 + \sum_{\ell=1}^{L+M} \gamma_{\ell t} X_{\ell t} + \alpha_{t,t-r}^* M + e_t$$

N_t represents the actual number of children-ever-born in period t; A_t is age at time t; and $X_{\ell t}$ is the ℓth exogenous variable in (1), such as income and price. M is a migration dummy variable which takes the value of 1 if the woman migrated r periods ago, and 0 if she remained in the rural area up to time t. Equation (2) relates to one year of observation, say 1974, in which rural stayers are combined with rural-urban migrants who migrated r periods ago and (2) is estimated for this sample for that year. The adaptation effect is measured by α^*. Equation (2) states that when age and other exogenous variables are the same for a rural stayer and a migrant of r periods ago at time t who have born the same number of children by period t-1, the migrant

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will have $\alpha^*_{t,t-r}$ fewer <u>additional</u> children between period t-1 and t than the rural stayer if $\alpha^* < 0$. If $\alpha^* = 0$, migration does not change fertility behaviour. When <u>r</u>=1, i.e., migration took place during the previous period, $\alpha^*_{t,t-1}$ is the effect of migration during the period immediately following migration. If $\alpha^*_{t,t-1} < 0$ and $\alpha^*_{t,t-r} = 0$ for $r > 1$, the migration effect is temporary, and reflects the pure disruption hypothesis proposed by Goldstein and Goldstein and Tirasawat.[12] If $\alpha^*_{t,t-r} < 0$ for all $r \geq 1$, the adaptation hypothesis is appropriate.

We use Equation (2) to test the following strong hypothesis concerning the adaptation effect of rural-urban migration on migrant fertility:

Hypothesis 1: A rural-urban migrant has fewer additional births after migration within <u>each</u> five-year period after migration than a comparable rural stayer when previous fertility levels are controlled.

It should be noted that a weaker form of this adaptation hypothesis is that the migrant would have fewer additional births in at least one or more of the five-year periods after migration and no more births in any post-migration period than a comparable rural stayer.

IV. <u>Estimation</u>

This study is based on data contained in the <u>Korean World Fertility Survey</u> of 1974.[13] The sub-sample used in this study consists of 4,540 currently married women aged 20-49, married only once, who have had at least one live birth. Women who never had a live-birth are excluded because a substantial proportion of such women in many societies in which incomes are low, such as Korea, are childless because of sub-fecundity, rather than by choice.

The sample may be classified into: rural non-migrants; rural migrants; rural-urban migrants; urban-urban migrants; urban natives; and urban-rural migrants. Since we are studying the influence of rural-urban migration on the fertility of migrants, we are interested in two categories; rural stayers (a group which includes rural non-migrants and those who migrate between two different rural destinations) and rural-urban migrants. The rural stayers included in our analysis are individuals whose birthplace, previous residence, and current residence were all in rural areas; while the rural-urban migrants are those whose current residence was urban but who were born and previously lived in the rural area. Therefore, our analysis ignores multi-stage rural-urban migrants.[14] "Rural" is defined as town (eup) or village (myun); whereas "urban" is defined as city (shi), an administrative unit with more than 50,000 inhabitants. Rural non-migrants are defined as rural stayers who never changed their residence. Rural migrants are defined as women who changed their residence from one rural area to another. In Table 1 we present some descriptive statistics for Korean once-married women included in the Korean World Fertility Survey classified by age and migration status.

(Table 1)

Adaptation to urban life can include improved education and increased labour force experience, as well as revised fertlity goals. Since we are interested only in adaptation of fertility, not adaptation of socio-economic characteristics, we must measure socio-economic characteristics before migration to control for selection. In Korea, until recently, few women continued their education after marriage. Therefore, we can be reasonably sure that by restricting the analysis to women who migrated after their marriage, their current education levels were not influenced by migration.

Restricting our sample of rural-urban migrants to those who migrated after marriage requires a careful selection of a control group of rural stayers. We can classify the migrants by calendar year of migration and use as a control for each migration cohort group those rural stayers who had been married for at least as long as the migrants. In Table 2 we explain how the sub-sample for each migration cohort regression was constructed. A migration cohort will be defined as a set of women who last changed their residence during a given five-year interval. The five migration cohorts used are 1970-74, 1965-69, 1960-64, 1955-59 and 1950-54. Since women who migrated after marriage must have been married at least as long as their duration of current residence, the range of duration of marriage is limited in any one cohort. For example, women who last migrated in 1965-69 must have been married for at least 5-9 years in 1974. In other words, those women who migrated in 1969 would have been married for at least five years in 1974 and those who migrated in 1965 would have been married for at least nine years in 1974. In order to control for this restriction, it is necessary to restrict the rural control group to those with a similar duration of marriage. In this example, we restrict both rural-urban migrants and rural stayers by the 10 year minimum duration of marriage. Therefore, women who migrated in 1965-69 but had been married for less than ten years are excluded from this sub-sample. The statistics in Row 1, Column 2 of Table 2 show that 211 women who migrated from rural to urban areas between 1970 and 1974 had been married for at least five years. For this migration cohort either the 419 rural non-migrant women (Column 3, Table 2) or the 906 rural migrant women (Column 4, Table 2) who had been married for at least five years can be used as a control group. Similarly, the 357 rural non-migrants or 716 rural migrants who were married for at least ten years can be used as a control group for the 158 rural-urban migrants who migrated during the period of 1965-69 and were married at least 10 years. For the remaining migration cohorts, the samples of rural-urban migrants and rural stayers are similarly restricted.

(Table 2)

We shall estimate a separate regression for each migration cohort, including its appropriate control group for each year of observation, 1974, 1969, 1964, 1959, and 1954. For example, if we estimate (2) for the 1965-69 migration cohort at t = 1974, α^* measure the difference between the number of additional children born during 1970-74 to rural-urban migrants and members of the respective control group. This will be the measure of adaptation during the period five to ten years after migration for this migration cohort. For the migration cohort of 1960-64 observed at t = 1974, α^* is the adaptation effect ten to fifteen years after migration.

The main test of the fertility adaptation hypothesis is based on 25 regression estimates of Equation (2) for the five migration cohorts combined with the five years of observations. Fertility is measured by the total number of live births per woman. The fertility data for the years before 1974 were obtained from the individual woman's lifetime fertility history. The following equation was estimated:[15]

$$N_t = \beta_0 + \beta_1 N_{t-1} + \beta_2 M + \beta_3 A_t + \beta_4 A_t^2 + \beta_5 D_t + \beta_6 D_t^2 + \beta_7 S_w + \beta_8 S_w^2 + \beta_9 S_h + \beta_{10} S_h^2 + \beta_{11} Q + \beta_{12} W_w + \beta_{13} W_h + \varepsilon_t \quad (3)$$

where N_t is children-ever-born at time t, M is the migration dummy variable, A_t is age at time t, D_t is duration of marriage at time t, S_w is wife's years of schooling in 1974, S_h is husband's years of schooling in 1974, Q is the child mortality rate in 1974, W_w is wife's earnings in 1974, W_h is husband's earnings in 1974.

Since duration of marriage, D, should determine both how near the woman is to achieving her fertility goals and the exposure to the risk of fertility, it should be a fertility-determining variable. Because of biological effects age, A, will be a constraining variable. For observations at a given calendar time, age will also determine the birth cohort,so the age variable will have confounded in it a biological and birth cohort effect. From Equation (1) we see that the utility maximization model requires full incomes and prices of children as constraint determinants. Education levels of the husband, S_h, and wife, S_w, will influence both of these. Education of the wife may increase child prices by increasing her opportunity cost of raising children, and the education of both husband and wife may increase this price because of the greater demand for child quality. There are also wealth effects of education. Since there may be a large variance in quality of education, ability, or returns on education, the wage levels of the husband, W_h, and the wife, W_w, in 1974 are included. The child mortality experience of the wife, Q, measured by the number of child deaths divided by the number of live births, should create readjustments in the desired number of children.

Before presenting the OLS estimates of (3) for periods after migration it is necessary to test whether the autoregressive model adequately controls for differences between the preferences of migrants and rural stayers. In Table 3 we show estimates of the coefficient of the migraton dummy, M, in the OLS estimation of (3) for each of four migration cohorts before migration. Separate regressions were run for each of the two control groups of rural stayers, rural non-migrants and rural migrants. Each column of Table 3 represents regressions for a given migration cohort observed S five-year periods before migration, (S=-1,...-4). For example, the coefficient in Row 1, Column 1, is the estimate of β_2 in (3) for the migration cohort of 1970-74 observed four periods, i.e. 20 years before 1974; therefore, t = 1954 and t-1 = 1949. Consequently, members of the migration cohort of 1970-74 had an average 0.2607 fewer live births between 1950 and 1954 than women in a rural non-migrant household with the same number of children-ever-born in 1950. We see from

Table 3 that when the rural control group consists of non-migrants, the difference between the numbers of additional children born is significant only for the case of the migration cohort of 1970-74 and the period immediately preceding migration, S=-1. Given the ten regressions for this control group and a significance level of 0.10, this could have occurred by chance. It is shown in Table 3 that when rural migrants are used as a control group more of the differences between fertility rates before migration are significant. These results suggest that the autoregressive procedure reasonably controls for preference selectivity when the rural non-migrants are used as a control group. In the following, we present only the results of OLS estimates of (3) with rural non-migrants as a control group.

(Table 3)

In Table 4 we show OLS estimates of the coefficient of the migration dummy variable, M in Equation (3) for different migration cohorts in periods after migration for the rural non-migrant control group. For example, the coefficient in Row 1, Column 1 is the estimate of β_2 in the fertility equation for the migration cohort of 1970-74 in 1974; therefore, t=1974 and t-1=1969. This cell shows that a woman who had migrated between 1970 and 1974 bore an average 0.2217 fewer children during the five years after migration than a rural non-migrant woman with identical fertility in 1970, N_{t-1} and identical socio-economic constraints.[16] Similarly, coefficients in Row 2, Column 1 and Row 2, Column 2 are estimates of the coefficients of a migration dummy variable in the fertility equations for 1969 and 1974, respectively, for the migration cohort of 1965-69. The statistics in Table 4 support the adaptation hypothesis and indicate that the fertility rates of rural-urban migrants after migration were significantly lower than those of comparable rural non-migrants. Table 4 shows that in only five of 15 cells is the difference between five year fertility rates of rural-urban migrants and rural non-migrants not significant at the 0.10 level. Table 4 also shows that in the three oldest migration cohorts this migration effect was not significant in the period of migration itself, although it appeared later. There is an apparent calendar time effect in Table 4. There appears to be little migration effect on fertility before 1960-64. There is no migration effect for the migration cohort of 1960-64 during that period. For the migration cohort of 1950-54, there is no effect before 1960-64, which would be two periods after migration. Although we observe a migration effect for the migration cohort of 1955-59 in 1960-64, one five-year period after migration, there was no effect during the period of migration itself. These calendar effects could be partially explained by the fact that active family planning programmes sponsored by the Korean government had begun in 1962.

(Table 4)

By expressing Equation (3) in terms of first differences, we can eliminate the fixed effect from the intercept term. Therefore, if the effect in the model in which first differences are used is smaller than in the simple OLS estimates of Equation (3), selection may not be properly controlled in (3) and the adaptation effects in Table 4 would be exaggerated. For variables like age and duration of marriage, $A_t = A_{t-1} + 5$ and $D_t = D_{t-1} + 5$, where _t_-1 is five years before _t_. Consequently, the first differences on the quadratic terms in A_t and D_t, $A_t^2 - A_{t-1}^2$ and $D_t^2 - D_{t-1}^2$ will be linear in A_t and D_t, respectively. Some socio-economic variables, such as education would not change much after marriage. There were no estimates available for changes in wages over time. Consequently, education and wage variables are eliminated from the first differences form, whereas age and duration of marriage remain. The first differences form of Equation (3) is:

$$(4) \quad N_t - N_{t-1} = \beta_0' + \beta_1 (N_{t-1} - N_{t-2}) + \beta_2' M + \beta_3' A_t + \beta_4' D_t + \varepsilon_t$$

The estimates of the migration dummy coefficient are shown in Table 5. The estimates in Table 5 are generally larger, i.e. the adaptation effect is stronger than in the OLS estimates in Table 4. The autoregressive model is thus an adequate control for preference selectivity.

(Table 5)

It is known that a Seemingly Unrelated Regression (SUR) estimation of Equation (3) is preferred to OLS estimation when there are fixed individual preference effects included in the disturbance terms.[17] In this case responses of the dependent variable in (3) to exogenous variables differ between individuals, but, for a given individual, are constant over time. Therefore, the SUR estimation is more efficient than the OLS estimation because it takes account of the correlation of the disturbance terms for different periods. If much of the estimated fertility adaptation effects of rural-urban migration shown in Table 4 result from preference differences which we claimed to control but which, in fact, were not controlled, SUR estimation should reduce the significance of these effects.

SUR estimates of the coefficient for the migration dummy variable, M, were obtained for each migration cohort. The initial equation in each cohort system related to the period immediately preceding migration. For example, the migration cohort of 1970-74 would require two equations in its system: one for the period of migration and one for the period preceeding migration. Table 6 shows these estimates for the rural non-migrant control group. A comparison of the coefficients in Tables 4 and 6 shows that estimates of the migration effect are robust with respect to the estimating procedures. Estimated coefficients are equally significant under the OLS and SUR estimations.

(Table 6)

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In earlier discussion, we mentioned that support of the adaptation hypothesis does not require increasing differentials in fertility rates after migration between rural-urban migrants and rural stayers as the duration of urban residence increases, i.e. increasing α's with duration of residence. An F-test on the differences in coefficients of the migration dummy variable between equations for a migration cohort can be used to determine whether migration effects change with length of residence in the urban area. Pairwise comparisons of coefficients in Table 6 estimated by SUR were made for each migration cohort and period after migration. A significant inequality, at the 0.10 level, between coefficients for two adjacent periods in Table 6 is represented by the $\neq$ symbol. Equality is represented by no symbol. Except for the oldest migration cohort, once a significant migration effect has occurred, that effect remains constant as the length of urban residence increases. For example, in the migration cohort of 1955-59 the effect of migration is significant one five-year period after migration. There is no significant difference between migration effects in subsequent periods. For the migration cohort of 1950-54, the effect four five-year periods after migration is significantly smaller than during the third period. These results suggest that once a migration adaptation effect has occurred within a five-year period, it remains constant for subsequent five-year periods, i.e. Hypothesis 1 is supported.

The nature of rural-urban constraint changes for a household may depend on its socio-economic characteristics. Education is one socio-economic variable that may affect the size of rural-urban constraint changes and responses to those changes. Expected differences between rural and urban earnings (including the probability of employment) may increase with education for both men and women. The effect of the wife's education is the net result of a substitution and income effect, while the income effect component may be more important in the case of the husband's education effect. The wife's education may have a greater negative effect on differences between rural and urban fertility than the husband's education. Education may increase the change in perceived constraints in addition to the effects of rural-urban wage differentials. Job search costs ay be lower for more educated households. Given a distribution of urban opportunities, more educated persons would be more likely than less educated persons to have found urban opportunities with high rewards before moving to the town. Education may also improve the ability to comprehend information about urban life and the ability to control fertility. Both effects should result in more educated persons being able to adjust more accurately to the real changes in constraints. Finally, education may increase the substitutability between goods and children. Urban life may appear richer to the more educated person and the goods necessary for urban life become better substitutes for children. Also, more educated persons may be more willing to substitute child quality for quantity, and higher urban child prices may force them to make this substitution.

With the exception of the household's income effect, these arguments suggest that incrased education of members of the household will speed the reduction in fertility rates as a result of anticipated or actual rural-urban migration. Therefore, we are interested in testing Hypothesis 2:

Hypothesis 2: The differential in fertility rates between the rural-urban migrant during the period after migration and a comparable rural non-migrant is greater for individuals with higher education than for individuals with lower education.

In order to test this hypothesis, an (education level x migration dummy) variable was added to the single-equation in the OLS model. In Table 7 we show the estimated coefficients for this interaction term when the control group consists of rural non-migrants. Both wife's and husband's schooling were introduced into the same equation. For both the wife's and husband's education interaction terms, 14 out of 20 coefficients were negative, as expected. However, only three were significant and of the correct sign for the wife's interaction term and only four were significant and of the correct sign for the husband's interaction term. Although the number of correct signs and the number of significant differences are greater than expected by chance, the support for the hypothesis that education results in more rapid adjustment to rural-urban constraint changes is weak.[18]

(Table 7)

V. Summary and Conclusion.

This study of fertility behaviour among Korean women rural-urban migrants has recognized that the difference between migrant fertility and fertility of rural stayers could be due to selection of migrants, disruption of migration *per se*, and adaptation to urban constraints and norms. We have concentrated attention on whether there is an adaptation resulting from rural-urban migration after controlling for selection. Fertility preference selectivity has been controlled by comparing fertility of rural-urban migrants with that of rural stayers who had similar fertility preferences and lived in similar socio-economic conditions.

We tested two control groups of rural stayers: those who never changed their rural community of residence and those who migrated between rural communities. Fertility of rural-urban migrants before migration was generally not significantly different from that of rural non-migrants when socio-economic variables were controlled. However, fertility of rural-urban migrants before migration differed significantly from that of rural migrants. Consequently, rural non-migrants were used as the most appropriate control group.

We found that fertility rates of rural-urban migrants fell below those of comparable rural non-migrants after migration to an urban area. This reduction occurred sooner after migration among more recent migrants than among earlier migrants. The decline persisted as the duration of urban residence increased. There was no strong evidence that more educated women adapted more rapidly to urban life than less educated women.

We used several methods to test for the adaptation effects. First, an OLS autoregressive model was constructed and estimated. Secondly, an OLS first-difference model was estimated. Thirdly, a SUR estimate of the autoregressive model was made. All these methods yielded results in accordance with expectation. All models suggested that adequate controls for selection had been made and that adaptation is a significant phenomenon.

FOOTNOTES

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[1]The rural total fertility per woman was about two births higher than urban total fertility in Korea during the 1960's, but the difference was less than 0.5 births in 1980.

[2]For example, see D. N. Holmes, Jr., "Migration and Fertility: Introduction," in *The Dynamics of Migration: Internal Migration and Fertility*, Occasional Monograph Series No. 5, Vol. 1. Interdisciplinary Communications Program, The Smithsonian Institution, 1976.

[3]For literature reviews see A. Zarate and A. U. Zarate, "On the Reconciliation of Research Findings of Migrant-Non-Migrant Fertility Differentials in Urban Areas," *International Migration Review*, 9 (2) (1975), pp. 115-156; S. Goldstein and P. Tirasawat, *The Fertility of Migrants to Places in Thailand*, East-West Population Institute (Honolulu, 1977); O. Wolowyna, "Rural-Urban Migration and Fertility: A Simulation Model," Ph.D. Dissertation, Brown University, 1980; and H. Ribe and T. P. Schultz, "Migrant and Native Fertility at Destination in Colombia in 1973: Are Migrants Selected According to Their Reproductive Preferences?" Unpublished manuscript, Yale University, 1980.

[4]Ribe and Schultz, loc. cit., in footnote 3.

[5]S. Goldstein, "Interrelations Between Migration and Fertility in Thailand," Demography, 10 (2) (1973), pp. 225-240, and S. Goldstein and P. Tirasawat, loc. cit., in footnote 3.

[6]The following factors reflect changes in opportunities and constraints influencing fertility behaviour of rural-urban migrants: rural-urban differences in relative prices; particularly costs of childrearing, differences between men's and women's wages; the level of child mortality; and occupational structures.

[7]G. Hendershot, "Cityward Migration and Urban Fertility in the Philippines," Philippines Sociological Review, 19 (3) (1971), pp. 183-193, and "Social Class, Migration, and Fertility in the Philippines," in The Dynamics of Migration: Internal Migration and Fertility, Occasional Monograph Series, Vol. 1, No. 5, Interdisciplinary Communications Program, Smithsonian Institution, 1976.

[8]Goldstein and Tirasawat, loc. cit., in footnote 3; and Ribe and Schultz, loc. cit., in footnote 3.

[9]loc. cit., in footnote 3

[10]For an explanation of this model see D. De Tray, "Child Quality and the Demand for Children," Journal of Political Economy, 81 (2), Part 2 (1973), pp. s70-s90.

[11]Selectivity is not completely ruled out. A migrant may prefer the observed pattern to the pattern of the control group.

[12]loc. cit., in footnote 5 and loc. cit., in footnote 3.

[13]The 1974 KWFS is composed of two surveys undertaken jointly: households and individuals. The individual sample used in this study was, like most national fertility surveys, complex, multi-stage, stratified and clustered. The sample design for the survey aimed for a self-weighting, nationally representative probability sample. It was basically a two-stage design for the household survey with a further sampling stage for the individual survey. Census enumeration districts were used as the primary sampling units, with households in the selected primary sampling units constituting the ultimate sampling units. Sample sizes of 21,248 and 6,849 households for the household and individual surveys were drawn, respectively, the latter being a sub-sample of the former. An overall sampling fraction was approximately 1/340 for the household survey. In fact, 5,724 ever-married women aged 15-49 were identified in the 6,849 households sampled for the individual survey.

[14]The sub-sample of rural-urban multi-stage migrants whose birth places were rural, but who lived in urban areas before their last move, was excluded from our study, because only data on the years of residence in the current location were provided in the KWFS, which would underestimate the true duration of urban life for multi-stage, rural-urban migrants.

[15]The least squares regression estimation of the autoregressive model originally developed by Ashenfelter could yield inconsistent estimators of the coefficients for the migration status dummy variable, M in equation (3). (O. Ashenfelter, "Estimating the Effect of Training Programs on Earnings," Review of Economics and Statistics, 60 (1) (1978), pp. 47-57.) This occurs because it is reasonable to assume that both N_{t-1} and M are influenced by the selectivity of migrants reflected in the disturbance term. This problem can be solved by an iterative maximum likelihood procedure. (Z. Griliches, "A Note on Serial Correlation Bias in Estimates of Distributed Lags,"

Econometrica, 29 (1), (1961), pp. 65-74.) In our major report we applied this approach but the estimates we obtained were almost identical to those yielded by OLS. (B. S. Lee, S. Farber, A. M. M. Jamal, and V. E. Rulison, The Influence of Rural-Urban Migration on the Fertility of Migrants in Developing Countries: Analysis of Korean Data, Final Report for the Office of Urban Development, Agency for International Development, Contract No. AID/OTR-C-1769, March 1981.)

[16]The full OLS regression of the 1974 fertility equation for the rural-urban migation cohort of 1970-74 with the rural non-migrant control group is:

$$N_{1974} = \underset{(-0.22)}{-0.3384} + \underset{(37.45)}{1.0075}\, N_{1970} - \underset{(-2.77)}{0.2217}\, M + \underset{(2.69)}{0.2614}\, A - \underset{(-3.22)}{0.0044}\, A^2$$

$$\underset{(-5.68)}{-0.2084}\, D + \underset{(4.65)}{0.0047}\, D^2 - \underset{(-1.89)}{0.0550}\, S_w + \underset{(0.86)}{0.0202}\, S_w^2 + \underset{(0.22)}{0.0007}\, S_h$$

$$\underset{(-1.07)}{-0.0018}\, S_h^2 + \underset{(1.06)}{0.0012}\, W_h + \underset{(0.03)}{0.0001}\, W_w + \underset{(2.05)}{0.4221}\, Q$$

$R^2 = 0.87$, $F = 310.4$

When migration between counties (gun) was used to differentiate between rural migrants and non-migrants, the coefficients of M were almost the same as those in Table 4 where the determinant of rural migration status is whether a woman changed her village (myun) or town (eup) of residence. Equation (3) was estimated with and without the socio-economic constraint variables, schooling and wages. These variables are expected to be positively related to migration and negatively to fertility. Their inclusion reduced the negative effect of rural-urban migration on fertility. Equation (3) was also estimated using two lagged fertility variables, N_{t-1} and N_{t-2}, as an adaptive expectations model would suggest. The values of the rural-urban migration effects were not changed much by this inclusion.

[17]G. Judge, W. E. Griffiths, R. Hill, and T. C. Lee, The Theory and Practice of Econometrics, (New York: Wiley, 1980).

[18]Multicollinearity may be a problem in interpreting the separate effects of each spouse's education. When the sum of the spouses' education was used instead of each spouse's education, the interactive terms in five out of twenty cases are significantly negative. There may be some concern with analyzing the effect of migrants' education on fertility adaptation in absolute terms. Since fertility is lower for women with more education in both rural and urban areas, the decline in fertility associated with the rural-urban migration for women with more education may be smaller in absolute, but not relative, terms than that decline recorded for less educated women. All rural-urban migrants and rural stayers were divided into three groups: women with less than four years education, four to six years, and more than six years education. Regression equations similar to (3) were estimated separately for each schooling group. Migrants with less than four years education had 25.3 percent fewer additional children than rural stayers of the same level of education. Migrants with four to six years education had 16.3 percent fewer additional children and migrants with more than six years education had 26.2 percent fewer additional children than comparable rural stayers. Adaptation, measured in relative terms, was not related to education.

TECHNICAL APPENDIX

Following Schultz and Joseph[19], suppose that the number of additional children desired during the next period, ΔN^*_{t+1}, depends on the difference between the desired total in t+1, N^*_{t+1}, and the actual number in t, N_t:

$$(4)\quad \Delta N^*_{t+1} = g\cdot(N^*_{t+1} - N_t),$$

where g is a function of variables S_i, that affect desired child-spacing:

$$(5)\quad g = a_o + (\sum_{i=1} a_i S_{it})/(N^*_{t+1} - N_t).$$

S_i would include variables such as education, anticipated migration, age, etc.

The actual number of additional children for the next year, ΔN_{t+1}, equals the desired number plus an error term,

$$(6)\quad \Delta N_{t+1} = \Delta N^*_{t+1} + u_{t+1}$$

Substituting (4) and (5) into (6) yields:

$$(7)\quad \Delta N_{t+1} = a_o N^*_{t+1} + \sum_{i=1}^{M} a_i S_{it} - a_o N_t + u_{t+1},$$

Following Ashenfelter[20], after suppressing individual subscripts i, a household autoregressive fertility function for the fertility level at time t

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[19] T. P. Schultz, "An Economic Interpretation of the Decline in Fertility in Rapidly Developing Countries: Consequences of Development and Family Planning," in R. A. Easterlin edited, Population and Economic Change in Developing Countries, Chicago: The University of Chicago Press, 1980, and H Joseph, "Estimation of Fertility Using a Stock-Adjustment Model," Review of Economics and Statistics, 62 (4), (1980), pp. 545-554.

[20] Ashenfelter, loc. cit., in footnote 15.

for the sub-sample of rural stayers and rural-urban migrants who migrated in the t-r period can be defined as

$$(8)\quad N_t^* = \beta_{ot,t-r} + \beta_{1t,t-r}N_{t-1} + \beta_{2t,t-r}A_t + \beta_{3t,t-r}A_t^2 + \sum_{\ell=1}^{L}\gamma_{\ell t,t-r}X_{\ell t} + \alpha_{t,t-r}M + \varepsilon_t$$

where the symbols are explained in the text.

Substituting (8) into (7) lagged one period yields:

$$(9)\quad \Delta N_t = a_o\beta_o + a_o\beta_1 N_{t-1} + a_o\beta_2 A_t + a_o\sum_{\ell=1}^{L}\gamma_{\ell t}X_{\ell t} + \sum_{i=1}^{M} a_i S_{it} - a_o N_{t-1} + a_o\alpha_{t,\,t-r}M + a_o\varepsilon_t + u_t$$

In order to simplify the notation, time and migration cohort subscripts, t and t-r, are suppressed from all the parameters in (9) except

Using $\Delta N_t = N_t - N_{t-1}$, equation (9) is equivalent to:

$$(10)\quad N_t = a_o\beta_o + (1-a_o+a_o\beta_1)N_{t-1} + a_o\beta_2 A_t + a_o\beta_3 A_t^2 + a_o\sum_{\ell=1}^{L}\gamma_{\ell t}X_{\ell t} + \sum_{i=1}^{M} a_i S_{it} + a_o\alpha_{t,t-r}M + a_o\varepsilon_t + u_t$$

which can be further simplified:

$$(11)\quad N_t = \beta_o^* + \beta_1^* N_{t-1} + \beta_2^* A_t + \beta_3^* A_t^2 + \sum_{\ell=1}^{L+M}\gamma_{\ell t}X_{\ell t} + \alpha_{t,t-r}^* M + e_t$$

This is the estimating Equation (3) cited in the text.

Descriptive Statistics for Once-Married
Women by Age and Migration Status
in the 1974 KWFS Sample

Variables and Migration Status [a]	Age Group					
	20-24	25-29	30-34	35-39	40-44	45-49
Mean Years of Women's Schooling						
R/R	4.29	4.21	3.39	2.40	2.07	1.19
R/U	5.58	5.72	5.08	4.73	4.38	3.23
U/U	7.79	8.83	8.42	7.07	6.93	6.46
Mean Years of Husband's Schooling						
R/R	6.33	6.54	6.50	6.17	5.80	5.45
R/U	7.85	8.77	8.71	9.03	8.67	7.88
U/U	10.07	10.44	10.61	10.45	10.39	9.48
Mean Duration of Marriage (in years)						
R/R	3.28	6.30	11.74	17.67	24.06	30.38
R/U	2.82	5.34	10.16	16.36	22.32	29.24
U/U	3.21	4.90	9.08	14.70	21.43	27.81
Mean Number of Desired Children						
R/R	2.98	3.16	3.48	3.80	3.92	4.10
R/U	2.71	2.74	2.98	3.17	3.36	3.33
U/U	2.61	2.68	2.77	2.94	3.10	3.54
Mean Number of Children Ever-born						
R/R	1.55	2.52	4.01	5.21	6.19	7.0
R/U	1.38	2.11	3.28	3.99	4.56	5.76
U/U	1.53	1.99	2.80	3.50	4.25	5.02

R/R = Rural stayers (rural migrants and rural non-migrants)

R/U = Rural-urban migrants including both those who migrated before and after marriage.

U/U = Urban stayers (urban migrants and urban non-migrants)

Table 2

The Composition of Sub-samples For Each Migration Cohort

igration Cohort–igration Period	Marital Restriction–Minimum Years of Marriage (1)	Number of Rural-Urban Migrant Women Who Migrated In This Period and Were Married the Minimum Number of Years (2)	Number of Rural Non-Migrant Women Who Were Married the Minimum Number of Years (3)	Number of Rural Migrant Women Who Were Married the Minimum Number of Years (4)	Size of Sub-sample for Each Migration Cohort When Rural Non-migrants are the Control Group (5)	Size of the Subsample for Each Migration Cohort When Rura Migrants are the Control Group (6)
.970-74	5	211	419	906	630	1117
.965-69	10	158	357	716	515	874
.960-64	15	79	291	550	370	629
.955-59	20	32	194	332	226	364
950-54	25	28	107	187	135	215
otal Sample ize		508	419	906	NA	NA

Table 3

OLS Estimated Rural-Urban Migration Effects of Fertility Before Migration Using Rural Non-Migrant and Rural Migrant Control Groups, by Period Before Migration and Migration Cohort*

	Five-Year Periods Before Migration							
	Rural Non-Migrant Control Group				Rural Migrant Control Group			
Migration Cohort	-4 (1)	-3 (2)	-2 (3)	-1 (4)	-4 (5)	-3 (6)	-2 (7)	-1 (8)
1970-74	-0.2607 (-1.25)	0.0752 (0.49)	-0.0410 (-0.36)	-0.2482[a] (-2.76)	-0.0585[a] (-1.69)	0.0044 (0.09)	-0.0335 (-0.58)	-0.2179[a] (-3.25)
1965-69		-0.1616 (-0.60)	-0.1302 (-0.88)	-0.0250 (-0.24)		-0.0662[a] (-1.40)	-0.1050[a] (-1.76)	-0.0971[a] (-1.30)
1960-64			-0.0628 (-0.28)	0.1028 (0.76)			-0.1529[a] (-2.17)	-0.0064 (-0.07)
1955-59				-0.0081 (-0.03)				-0.1017 (-0.80)

*t-statistics are in parentheses.

[a]one-tail significance at the 0.10 level.

Table 4

OLS Estimated Rural-Urban Migration Effects
After Migration Using Rural Non-Migrant
Control Group, by Period
After Migration and Migration Cohort*

	Five-Year Periods After Migration					
Migration Cohort	0 (1)	1 (2)	2 (3)	3 (4)	4 (5)	Sample Size (6)
1970-74	-0.2217[a] (-2.77)	—	—	—	—	630
1965-69	-0.2507[a] (-2.98)	-0.2758[a] (-2.99)	—	—	—	515
1960-64	-0.0450 (-0.42)	-0.4739[a] (-4.06)	-0.3574[a] (-3.02)	—	—	370
1955-59	0.0657 (0.42)	-0.2803[a] (-1.84)	-0.4462[a] (-2.54)	-0.2325[a] (-1.50)	—	226
1950-54	0.0125 (0.05)	-0.0412 (-0.19)	-0.1615 (-0.77)	-0.7365[a] (-3.15)	-0.3309[a] (-1.59)	135

*t-statistics are in parentheses.

[a]one-tail significance at the 0.10 level.

Table 5

First Differences Estimates of Rural-Urban Migration Effect Using Rural Non-Migrant Control Group by Period After Migration and Migration Cohort*

	Five-Year Periods After Migration					
Migrant Cohort	-1 (1)	0 (2)	1 (3)	2 (4)	3 (5)	4 (6)
1970-74	-0.2645[a] (-3.73)	-0.3252[a] (-4.33)	---	---	---	---
1965-69	-0.0831 (-1.10)	-0.2872[a] (-3.68)	-0.3387[a] (-3.89)	---	---	---
1960-64	0.0233 (-0.24)	-0.1243 (-1.26)	-0.5505[a] (-5.12)	-0.3749[a] (-3.37)	---	---
1955-59	-0.0707 (-0.53)	-0.0016 (-0.01)	-0.2487[a] (-1.85)	-0.4284[a] (-2.72)	-0.2393[a] (-1.75)	---
1950-54	-0.0929 (-0.52)	-0.0717 (-0.36)	-0.1264 (-0.68)	-0.3277[a] (-1.82)	-0.7254[a] (-3.68)	-0.1705 (-0.97)

*t-statistics are in parentheses.

[a]one-tail significance at the 0.10 level.

Table 6

SUR Estimated Rural-Urban Migration Effects After Migration Using Rural Non-Migrant Control Group, by Period After Migration and Migration Cohort*

Migrant Cohort	Five-Year Periods After Migration -1 (1)	0 (2)	1 (3)	2 (4)	3 (5)	4 (6)
1970-74	-0.2210[a] (-2.89)	-0.2233[a] (-2.80)	—	—	—	—
1965-69	-0.0528 (-0.65)	-0.2421[a] (-2.88)	-0.2804[a] (-3.07)	—	—	—
1960-64	0.0585 (0.56)	-0.0445 (-0.41)	-0.4225[a] (-4.05)	-0.3770[a] (-3.22)	—	—
1955-59	0.0497 (0.47)	0.0668 (0.43)	-0.2790[a] (-1.84)	-0.4451[a] (-2.55)	-0.2428[a] (-1.58)	—
1950-54	-0.0758 (-0.42)	-0.1130 (-0.64)	-0.0435 (-0.20)	-0.1741 (-0.20)	-0.7436[a] (-2.82)	-0.3629[a] (-3.20)

*t-statistics are in parentheses.

[a]one-tail significance at the 0.10 level.

Table 7

OLS Coefficients for the Rural-Urban Migration Dummy x Education Interaction Term Using the Rural Non-Migrant Control Group by Period After Migration and Migrant Cohort*

Five Year Period After Migration

Migration Cohort	M x Wife's Education						M x Husband's Education					
	-1 (1)	0 (2)	1 (3)	2 (4)	3 (5)	4 (6)	-1 (7)	0 (8)	1 (9)	2 (10)	3 (11)	4 (12)
1970-74	-0.0163	-0.0485[a]	--	--	--	--	0.0108	-0.0150	--	--	--	--
	(-0.85)	(-2.42)					(0.73)	(-0.96)				
1965-69	-0.0091	-0.0007	-0.0302[a]	--	--	--	-0.0241[a]	-0.0131	-0.0332[a]	--	--	--
	(-0.46)	(-0.04)	(-1.34)				(-1.37)	(-0.73)	(-1.66)			
1960-64	0.0007	-0.0500[a]	-0.0107	0.0177	--	--	0.0024	-0.0340[a]	-0.0071	-0.0032	--	--
	(0.03)	(-2.21)	(-0.44)	(0.71)			(0.12)	(-1.67)	(-0.32)	(-0.14)		
1955-59	0.0239	0.0148	0.0353	-0.0075	-0.0552[a]	--	-0.0217	0.0189	-0.0013	0.0232	-0.0326	--
	(0.70)	(0.42)	(1.03)	(-0.19)	(-1.58)		(-0.71)	(0.59)	(-0.04)	(0.64)	(-1.04)	
1950-54	-0.0088	-0.0544	0.0822[a]	-0.0600	-0.0001	-0.0300	0.0194	0.0220	-0.0047	-0.0863[a]	-0.0161	-0.0388
	(-0.18)	(-0.84)	(1.38)	(-1.05)	(-0.01)	(-0.53)	(0.47)	(0.04)	(-0.09)	(-1.80)	(-0.43)	(-0.82)

*t-statistics are in parentheses.

[a]one-tail significance at the 0.10 level.

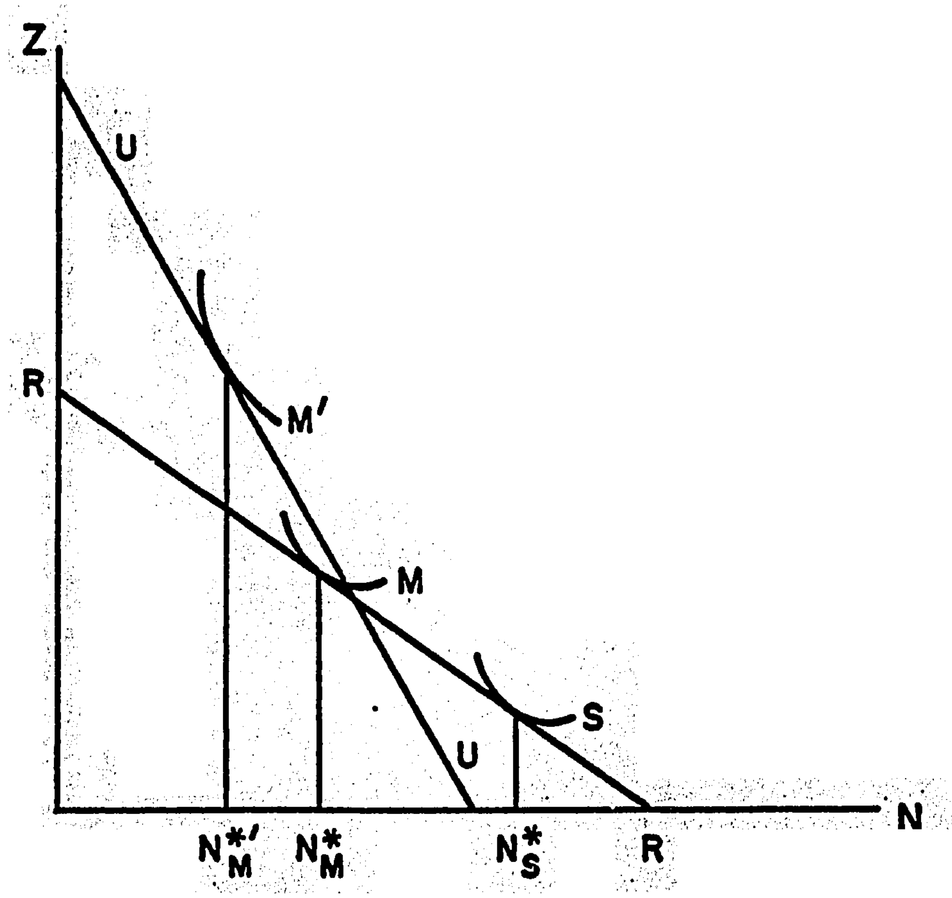

FIGURE 1.