ORIGINAL ARTICLE

# Multi-Level Analysis of Inter-Provincial Differences in Fertility in Iran: The Case of Six Provinces with High and Low Fertility Rates

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## Abstract

**Background:** Identifying the effect of the social environment in which couples live and the demographic decisions are made, along with individual characteristics, are important in explaining human fertility. In the present study, an attempt was made to explain women's fertility in the six provinces using the multi-level analysis.

**Methods:** The present study is a quantitative research with emphasis on the secondary analysis of the existing data. The statistical population consists of married women aged 15-49 living in the selected provinces. The sample included 95421 individuals. The selected provinces were Gilan, Mazandaran, Tehran, Sistan & Baluchistan, South Khorasan and Hormozgan. The census micro-data of population and housing in 2016 as well as some socio-economic indexes of selected provinces were analyzed using HLM software. Place of residence, educational level and employment status were individual variables, while income per capita as well as unemployment and literacy rates were the contextual variables. Also, the number of children ever born was considered as the fertility index or dependent variable.

**Results:** The impact of individual variables on women's fertility is stronger than community effects. There were statistically significant inter-provincial differences in women's fertility. All the women's individual characteristics had a statistically significant impact on their fertility. Unemployment and literacy rates, as contextual effects, had a statistically significant impact on inter-provincial fertility.

**Conclusion:** The inter-provincial differences in the fertility originate from their socio-economic circumstances. If the provinces' socio-economic circumstances become similar, the convergence in fertility behavior across provinces may increase.

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**Keywords:** Women, Differential fertility, Individual characteristics, Contextual effects, Iran

## Introduction

Common understanding in the demographic studies indicates the importance of knowing about the environment where decisions related to demographic behavior, such as childbearing are made. Hence, some experts have supported the inclusion of community level variables such as social environment in which couples live in fertility research in interaction with individual characteristics.[1] There is agreement among social researchers regarding the importance of intermediate social contexts in the adoption of social behaviors, such

as childbearing, as they join macro-social structures and micro-individual actions. In the historical context, the geographical variation of fertility behavior has been defined as contextual effects. It means that geographical characteristics has been understood as a unit of analysis beyond individual characteristics.[2] There are two major theoretical categories for explanation of the causes of fertility changes. The first one is generally known as demographic transition theory which emphasizes the structural or socioeconomic conditions. Meanwhile, an alternative perspective is ideational theory which emphasizes the cultural variables. Regarding the above theory and empirical evidence, a socioeconomic theory of fertility is best framed in terms of both structural and individual factors.[3] A study[2] using multilevel analysis in Sweden pointed out that 2.5% of fertility difference among women was related to the real social effects. They conclude that who you are is more important than where you live. A research,[3] using multilevel analysis among Indonesia, Peninsular Malaysia, the Philippines, and Thailand, indicated that the contextual variables accounted for a modest but statistically significant share of individual variation in fertility. Also, they found that about one-half of the total inter-areal variation in fertility can be explained through the women's status of contextual variables, particularly modern sector employment. A study[4] showed that fertility responded negatively to downturns in the business cycle. Recessions often lead to postponement of childbearing. It means that there is negative relationship between fertility and economic downturns. Gross domestic production (GDP) decline, in the macro-level, often correlates with a subsequent fall in the fertility level. Compared with GDP change, rising unemployment as an economic crisis index, is a better indicator of the impact of economic crisis and has a more tangible impact on fertility. Based on some studies,[5] educational achievements are one of the most important variables that influence fertility at both micro and macro levels. Women's education is usually associated with lower fertility at both contextual and individual levels. The empirical association between changes in educational level and changes in fertility level at the population level is more complicated than the individual level. As a result, although rising education level generally leads to decreasing fertility rate, the importance of educational level varies. The impact of educational change probably depends on the starting levels of education and fertility as well as other community variables. Regarding the studies,[6, 7] women education can be expected to reduce fertility for a number of reasons, such as rising opportunity costs of childbearing and reduced dependence on son for social status and old-age security. A study,[8] in western Germany using multilevel analysis found that access to informal care arrangements increased the probability of childbearing, but it did not find any statistically significant impact of public day care provision on fertility. In Iran, the average childbearing was about 7 birth per woman in early 1980s and then it reduced after 1985. Total fertility rate changes were so slow in recent years. One of the features of fertility changes in Iran is that fertility decline has taken place simultaneously in all geographical regions. It means that the trend of fertility changes has converged throughout the country and specifically among provinces. However, fertility levels are still different among provinces.[9-14] The differences in fertility among provinces have established this concerns for the reasons why some provinces have a higher fertility than other provinces. Attributing high or low fertility to factors other than economic and social conditions at both individual and geographical area can lead to incorrect policies related to population. According to the above statements, the present study was an attempt to answer the following questions: What is the impact of characteristics and socioeconomic status of women in their fertility behavior compared to contextual effects? What variables can explain individual and inter-provincial differences of fertility? To find the answers to the above questions, the six provinces of the country, which are located at the two ends of the fertility spectrum, were examined. The total fertility rate for Gilan, Mazandaran and Tehran declined from 2.7, 2.5 and 3.1 to 1.38, 1.51 and 1.56 during 1990 to 2016, respectively. The above rate for Sistan & Baluchistan, South Khorasan and Hormozgan reached from 6.2, 4.3 and 4.7 to 3.96, 2.58 and 2.64 during that time, respectively.[15, 16]

## Materials and Methods

We conducted this research using secondary data analysis and hierarchical linear regression model. Statistical population consisted of married women aged 15-49 in Gilan, Mazandaran, Tehran as well as Sistan & Baluchistan, South Khorasan and Hormozgan. The sample included 95421 cases. The data were extracted from the census micro-data of population and housing in 2016. First of all, the quality of data was assessed and an attempt was made to harmonize the data by discarding the outlier and missing data. Multilevel analysis is known as hierarchical linear model, hierarchical regression and random coefficients model as well. Multilevel models include multiple levels. Multilevel modeling modifies bias in parameter estimation. Disregarding multiple-level structure leads to bias in parameter estimation and bias in standard error. In addition, multilevel modeling introduces the true standard error, confidence interval and significant test.[17, 18] The two-levels analysis was used in the present study. The first-level units (individuals) were nested in the second-level units (provinces). The number of children ever born was the dependent variable and age, place of residence, educational level and employment status were the micro-level or individual variables. Also, income per capita, total unemployment rate and total literacy rate for provinces were the macro or provincial-level variables. All the micro-level variables were taken from the census micro-data of population

and housing in 2016.[19] Age, the total literacy rate as well as the total unemployment rate were measured as an interval variable. The place of residence and the employment status were the nominal variables with urban-rural and employed-housewife categories, respectively. Educational level is also the categorical variable with five groups. The above variable consisted of illiterate, primary education, secondary education, high school and higher education. The total literacy and total unemployment rates for provinces were taken from selected results of Iranian census in 2016,[20] and finally, we reached income per capita through dividing the province's gross domestic product[19] by the total population. It should be noted that since the multi-level model assumes women are nested in the macro-level, it is better to use the general characteristics of provincial level instead of women characteristics. Also, the variation of women characteristics is relatively similar among provinces. Regarding the above reasons, in the present study, the contextual variables were derived from the general provinces characteristics.

For conducting the statistical tests, we used the HLM 6.03 software. In general, three models were examined. First of all, the One-Way ANOVA with Random Effect was examined. The above model was used to study the inter-provincial differences in fertility. In the above mentioned model, the individual and provincial-level variables did not enter into the regression model. For studying the individual-level variables' impact on the dependent variable, we applied random-coefficients regression model. The micro-level variables were entered into the above model. To research the provincial-level variables' impact on women's fertility, we benefitted from the means-as-outcomes regression that includes the macro-level variables.

## Results

Table 1 summarizes the individual characteristics of the sample. The mean age of the studied women was 34.1 and about 31% of the sample were aged 15-29, 41% were aged 30-39 and 28% were aged 40-49. About 22% of the women were living in rural areas while others lived in urban areas. Also, about 7% of the sample were illiterate and the others were literate. About 16% of the Iranian married women had primary education, 15% secondary education, 36% high school education and the other women had a university degree. About 12% of the studied women were employed and the others were housewife.

The results shown in Table 2 belong to one-way ANOVA with random effect test. It indicates that the mean childbearing of Iranian married women was 1.91 children per woman. Random effect included two variances. The individual-level variance was greater than the provincial-level variance. Thus, the women's fertility changes were more influenced by the individual level variables. Nevertheless, the chi-square test results showed that the impact of

**Table 1:** Socio-demographic characteristics of the sample

| Variable | | Frequency | Percentage |
|---|---|---|---|
| Age Groups (yr) | 15-29 | 29308 | 30.7 |
| | 30-39 | 38966 | 40.8 |
| | 40-49 | 27147 | 28.4 |
| | Total | 95421 | 100 |
| Mean = 34.1 Std. Deviation = 8.1 | | | |
| Place of Residence | Rural | 2399 | 22.4 |
| | Urban | 74022 | 77.6 |
| | Total | 95421 | 100 |
| Education Level | Illiterate | 6841 | 7.2 |
| | Primary | 14961 | 15.7 |
| | Secondary | 14453 | 15.1 |
| | High school | 34853 | 36.5 |
| | University degree | 24313 | 25.5 |
| | Total | 95421 | 100 |
| Employment Status | Employed | 11115 | 11.6 |
| | Housewife | 84306 | 88.4 |
| | Total | 95421 | 100 |

**Table 2:** The results of one-way ANOVA with random effect

| Fixed Effect | Coefficient | Standard Error | | |
|---|---|---|---|---|
| Mean Childbearing ($\gamma_{00}$) | 1.91 | 0.186428 | | |
| **Random Effect** | **Variance Component** | **Degree of free** | **Chi-square** | **P value** |
| $u_{0j}$ | 0.25021 | 5 | 9951.46500 | 0.000 |
| $r_{ij}$ | 1.79200 | | | |

provincial-level variance was significant; it means that macro or provincial-level characteristics had a significant impact on fertility. In other words, it points out that inter-provincial difference in fertility is statistically significant. Interclass correlation value- that is achieved through dividing the individual level variance component by the sum of provincial and individual levels variance component - was 12.2%. It means that about 12% of the Iranian women's fertility variance could be explained by provincial characteristics.

Table 3 show the result of the impact of individual variables using random coefficients regression model. The findings suggested that all the independent variables of individual level had a significant impact on the women's fertility. With age, fertility increased. Housewives and villager women experienced higher fertility than their counterparts. The women with primary, secondary and higher education had a higher fertility compared to those with university education. Comparing the micro-level variance component of the present model (1.03959) with this variance component in the one-way ANOVA with random effect model (1.792) showed that 41.9% of the Iranian women's fertility was explained through their individual characteristics that were used in the present study.

The results of means-as-outcomes regression are reported in Table 4. Findings showed that the total literacy rate had a negative and statistically significant impact on the women's fertility. Increasing the total literacy rate of provinces declined the women's fertility. Income per capita had a negative and statistically non-significant impact on fertility. Total unemployment rate had a negative and statistically significant impact on the women's fertility; it means that, increasing the total unemployment rate decreases the women's fertility. The provincial variance component decreased from 0. 25021 (In: one-way ANOVA with random effect) to 0. 01892 (In: means-as-outcomes regression). Hence, it was indicated that about 92.4% of the inter-provincial fertility variation would be explained using the entered variables.

**Table 3:** The results of random coefficients regression Model

| **Fixed Effect** | | **Coefficient** | **Standard Error** | **T-ratio** | **P value** |
|---|---|---|---|---|---|
| Age | | 0.092 | 0.012 | 7.608 | 0.000 |
| Place of Residence | Rural | 0.114 | 0.030 | 3.811 | 0.018 |
| | Urban (Reference) | - | - | - | - |
| Employment Status | Housewife | 0.106 | 0.032 | 3.249 | 0.027 |
| | Employed (Reference) | - | - | - | - |
| Education Level | Illiterate | 1.358 | 0.186 | 7.271 | 0.000 |
| | Primary | 0.946 | 0.148 | 6.360 | 0.000 |
| | Secondary | 0.708 | 0.103 | 6.867 | 0.000 |
| | High school | 0.456 | 0.056 | 8.12 | 0.000 |
| | University degree (Reference) | - | - | - | - |
| **Random Effect** | | **Variance Component** | **Degree of free** | **Chi-square** | **P value** |
| Age | | 0.0008 | 5 | 3824.665 | 0.000 |
| Place of Residence | Rural | 0.004 | 5 | 46.126 | 0.000 |
| | Urban (Reference) | - | - | - | - |
| Employment Status | Housewife | 0.005 | 5 | 97.151 | 0.001 |
| | Employed (Reference) | - | - | - | - |
| Education Level | Illiterate | 0.206 | 5 | 563.946 | 0.000 |
| | Primary | 0.131 | 5 | 477.276 | 0.000 |
| | Secondary | 0.062 | 5 | 207.029 | 0.000 |
| | High school | 0.018 | 5 | 90.554 | 0.000 |
| | University degree (Reference) | - | - | - | - |

Variance Component of Level-1 = 1.03959

**Table 4:** The results of means-as-outcomes regression

| **Fixed Effect** | **Coefficient** | **Standard Deviation** | **T-ratio** | **P-value** |
|---|---|---|---|---|
| Intercept 2, G01 | 16.223 | 1.120 | 14.480 | 0.000 |
| Income per capita, G02 | -0.002 | 0.001 | -1.738 | 0.212 |
| Literacy rate, G03 | -0.108 | 0.009 | -11.421 | 0.00 |
| Unemployment rate, G04 | -0.384 | 0.065 | -5.889 | 0.002 |
| Random Effect | Variance Component | Degree Free | Chi-square | P-value |
| $u_{\phi}$ | 0.01892 | 2 | 334.75253 | 0.000 |
| $r_{ij}$ | 1.79200 | - | - | - |

## Discussion

Iran experienced a significant change in fertility rates over the last three decades and researchers and policymakers have considered that issue in recent years. Fertility decline and its continuity is one of the most important demographic issues in Iran that is seen as a problem by some of authorities. The study was an attempt to explain the women's fertility changes by individual and provincial-level variables. Fertility has reduced in all provinces, but their fertility level is different. In order to this do, we analyzed six provinces with high and low fertility levels. Analysis of data was performed by HLM 6.03 software. Findings of the present study showed that women's fertility in selected provinces was close to 1.9 children per woman. Inter-provincial differences in fertility were statistically significant and the micro-level variables had a larger share in explaining fertility. Hence, like a previous study,[2] "who you are" is more important than "where you live" in explaining the fertility. All the micro-level variables had a statistically significant impact on fertility. Increase in age will rise the women's fertility. Rural and housewife women had higher fertility than their urban and employed counterparts. Women with university degree had lower fertility than other women. The above findings are consistent with previous studies results.[22-29] In general, about 42% of fertility changes were explained using individual characteristics. In the macro-level, the total literacy rate had a statistically significant effect on fertility. The relationship between income per capita and fertility was negative and statistically non-significant. The above relationship is consistent with some previous studies findings.[30] Also, the findings pointed out that with increase in the unemployment rate, women's fertility decreases. Similar results were obtained in other context.[4] About 92% of inter-provincial fertility was explained through the entered variables in the model. Therefore, it can be said that inter-provincial differences in fertility come from the socio-economic circumstances. Hence, it can be expected that if socio-economic circumstances of the provinces become similar, the convergence in fertility behavior across provinces will increase.

## Conclusion

Since the socio-economic changes are relatively slow, it is expected that the current fertility and its provincial differences will be maintained in the near future. Regarding the women's socio-economic status, it is not expected that fertility increases again. In general, the possibility of complete convergence in fertility behavior across provinces will be weak in the near future.

**Conflict of Interest:** None declared.

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