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ORIGINAL PAPER

Fertility and Minority: A Study in Two Provinces of Iran Using Matching Estimator Technique

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Abstract The main aim of this study was to compare fertility in minor (Sunnah) and major (Shia) religious groups of Iran after matching the two groups by some confounding factors. 12,099 data of population and census survey of Iran in 2011 in two provinces of Guilan and Kurdistan were used in this study. Propensity scoring matching method was used for matching two groups. First confounder variables were found and after that the groups were matched. Principal component analysis was used to make a socioeconomic (SES) variable. At the end, two groups were compared to each other by nearest neighborhood method. Also Poisson regression was used to find the effective factors of fertility. Before using matching method, the results showed that fertility in Kurdistan was higher than Guilan, but after matching, fertility in Guilan was higher. The results of regression model showed that in Guilan, living in urban region, age and level of education had effect on fertility, but in Kurdistan, education, age and SES were effective factors.

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Introduction

Demography is one of multi dimension and complex topics. Population factors have impact on many facets of life and fertility is one of the important characteristics in a population. "Fertility refers to the number of the live births a woman has." It is directly determined by number of factors which, in turn, are affected by social, cultural, environmental, economic, and health factors [1].

Differences in fertility between religious, racial and refugee minority groups with majority in society was an impact topic in the literature of fertility as minority groups and refugees often live with lower socioeconomic conditions in comparison with others [2]. Four factors are considered as the major components of fertility:

Social characteristics which states that difference in terms of TFR in minority and majority groups is due to difference in social characteristics which has effect on fertility behavior.

Sub cultural attributes indicates that there is also high fertility rate in minority group members of higher socio economic status due to cultural characteristics.

Minority group status posits that being a part of a minority population with low socio economic status difficulties the face in society may result in higher fertility rate.

In *Economic Factors*, if women in minority and majority groups have the same income, the difference in fertility will be at minimum [3].

In India higher fertility in Muslims in comparison with Hindus was related to religious beliefs and social factors

such as low education level and life standards [4, 5]. Evaluation of comparative pattern of fertility in Hispanics showed that Fertility in Hispanics was 48 percent higher than Whites [6]. Also fertility in Afghan refugees was about two times more than native Iranians while access to reproductive health services was the same for both groups, indicating the social and cultural factors role in this case [2].

Since 1988 the Total Fertility Rate (TFR) for Iran had a sharp decline from 5.6 to 2.8 in 1996 which is 50 % decrease in just 8 years and then reached replacement level [7, 8] in 2000 and went further to 1.92 in 2012 [9]. In terms of ethnicity, Iran's population is heterogeneous and provinces have variety of socioeconomic developments, but after starting providing family planning services by private sectors and health network systems in mid-1980, TFR in Iran started to decline in all provinces. Although it is stated that the fertility transition started from more developed provinces like Tehran and Guilan [7–9].

While the role of demographic and socioeconomic factors influencing fertility in Iran is undeniable [10–12], religions influence on fertility was not discussed properly in Iran. In most studies confounding factors (Age, education, socioeconomic status,…) effect were neglected and comparison of two groups had done without considering, removing and matching them and in studies considering these variables, due to small sample size they were not able to remove and match confounding variables. In this study while choosing larger sample size of two provinces, Guilan (Shia) and Kurdistan (Sunnah), we resolve these limits by using latest propensity score method. So the main aim of this article is to determine the effect of religious believes on fertility in Iran.

Methods

Data

This was a descriptive analytical study. In this study, econometrics methods were used to find the differences of fertility in two regions. Data of Iran population and census in 2011 were used for this study. This data contained Data of more than 15 years old married women in two provinces of Kurdistan and Guilan. Iran is a country with majority of Shia religion (89 %). Population with Sunnah religion is the largest minority group in country (9 %). Guilan is a province in the north of Iran with the least total fertility rate of country with a majority of Shia. Guilan is one of the most important origins of Shiism in Iran historically. A lot of shrines went to Guilan because of its good geographical situation [13]. Kurdistan is a province in the west of Iran with a majority of Sunnah. Kurdistan has one of the highest fertility rates in Iran [14, 15]. In the present study, Guilan fertility data were used as a religious majority population and Kurdistan data as religious minority population of country. Data of Iran 2011 population of census were used in this study. These data were gathered by Iran statistical center (ISC). In Guilan, data of Astara and Talesh (where some Sunnah families lived there) were deleted from the study. Also for Kurdistan, data of Ghorveh and Bijar (where some Shia population lived there) were deleted. At the end, 12,099 data were remained for analysis (6239 in Kurdistan and 5860 in Guilan).

Econometrics Model

Fertility is affected by socioeconomics characteristics like Income, education and others. The main aim of this study was to find the effect of minority on fertility. Socioeconomic factors like income, education and … might be different in two regions. So these factors might change the differences between two regions. Propensity score is a method which can solve the problem. For comparing the results with propensity scoring method first confounding variables must be found. For this purpose a logit regression was run. The logit model is shown below:

$$relig_i = urb_i + age_i + int_i + edu_i + SES_i + work_i + u_i$$

where, relig was the dependent variable of being Sunnah or shia (0 = Sunnah, 1 = shia), urb was living in urban (1) or rural(0) regions, age was the age of the person, int was using internet(0 = using internt, 1 = not using internet) and edu was the level of education. edu contained 7 levels: 0 = illiterate, 1 = primary school, 2 = secondary school, 3 = high school, 4 = university degree, 5 = post graduate level, 6 = highest level of education. In addition, SES was the calculated socioeconomic status. "Work" was working variable, if the woman was working the value of the variable was 1, otherwise it was 0.

If each of these variables had relationship with the dependent variable, they were considered as confounders and must be matched in the model. Propensity scoring method, gives one value to the whole of confounders and it is able to match the two groups easily. After matching two groups by propensity scorning method, ATT of nearest neighborhood method was used for comparing the results.

Estimating Models

After calculating the differences, two fertility models for Guilan and Kurdistan were estimated. The model is shown below:

$$tfr_i = urb_i + age_i + age2_i + int_i + edu_i + ses_i + work + u_i$$

where tfr was fertility of each married woman, ses was the socioeconomic index, "work" was working and age2 was

Table 1 PCA analysis and descriptive statistics of data

Variable	Eigen values	Proportion	Socre/SD
Facilities available to the household			
Light automobile (car, pick-up, van. etc.)	3.0156	0.1675	3.37611
Personal computer	1.79346	0.0996	3.86813
The major fuel used by the household for cooking	1.50893	0.0838	2.52060
Main source of water supply used by the household for drinking	1.29793	0.0721	1.37948
Type of tenure of housing unit	1.08126	0.0601	2.43616
Number of rooms, hall, dining room, closed kitchen available to the household	1.04827	0.0582	2.42162
Facilities in housing unit (available/not available)			
Electricity	0.992884	0.0552	13.92184
Fixed telephone	0.927406	0.0515	3.021084
Piped gas	0.915099	0.0508	2.921262
Central heating system	0.825257	0.0458	9.055626
Central heating and cooling system	0.788087	0.0438	13.32807
Kitchen	0.732996	0.0407	7.65360
Bathroom	0.676157	0.0376	7.43381
Toilet	0.665978	0.0370	34.98718
Number of closed kitchen in housing unit	0.613851	0.0341	0.705515
Type of housing unit skeleton (metal, reinforced, concrete, other)	0.56555	0.0314	3.28826
Year of construction completion of the housing unit	0.474215	0.0263	3.126962
Type of sewage disposal in the housing unit (toilet)	0.0770659	0.0043	1.59257

the square of age. Other variables were similar to the first regression.

Calculation of Wealth Index

Principal component analysis (PCA) technique was used for calculating SES index in families. 18 components were used for this analysis. First the correlation of the variables were checked. If one variable had inverse correlation with others, it would be changed and fixed to a direct correlation with others. Components were used in this analysis contained: having car, having computer, the main fuel for the household, the main water source, ownership of the house, number of rooms, having electricity system, having telephone line, having gas pipeline, heating system, cooling system, having kitchen, having toilet, having bathroom, number of kitchens, structure of house, the age of the house, water waste of house.

Calculating Concentration Curve

Concentration curve (CI) is a curve which shows the level of inequality. In the Y-axis of concentration curve used in this study, the total fertility of each woman was placed and in the X-axis the socioeconomic status of each family was used. The X-axis was ranked from lowest socioeconomic status to highest. CIs have equity lines too. The further CI from the equity line indicates having more inequality. If a CI is above the equity line, it indicates that the number of fertilities are higher in families with lower socioeconomic statuses and vice versa.

Table 2 The results of finding confounding variables

Variable	Coefficient	Standard Error	*P* value
Living in urban regions	−0.2514962	0.0441212	0.000
Age	0.0520589	0.0018483	0.000
Using Internet at home	−0.0682482	0.1005804	0.551
Level of education = 1	1.403321	0.0652169	0.000
Level of education = 2	2.458779	0.0779529	0.000
Level of education = 3	2.966406	0.0798577	0.000
Level of education = 4	3.15873	0.1078845	0.000
Level of education = 5	4.92421	1.094622	0.000
Level of education = 6	2.461642	0.3874832	0.000
SES	−4.916136	0.2673256	0.000
Work = 1	−0.0155101	0.0797287	0.846
Constant	−2.45489	0.2342391	0.000

Results

Calculating SES Index

In the Table 1, the Eigen value, proportion of each variable and scoring factors by standard deviation (SD) in principal

Table 3 The results of comparing total fertility in two groups of study

Comparing method	Guilan	Kurdistan	Differences	Standard error	t-statistics
Unmatched	2.6470588	3.261365	−0.614306	0.048879928	−12.57
ATT	2.6470588	2.307848	0.339210	0.080635754	4.21

component analysis (PCA) are shown. The results of scoring factors by SD showed the effects of each variable to the SES index. The SES index calculated in present study had inverse indexes and smaller results were indicated as better SES. So the results were fixed and changed from lower to higher indexes.

Finding Confounder Variables and Matching

In the Table 2, the results of logit regression is shown. As shown in the table, all of the variables had significant relationships with religion expect Internet and Work. All of the effective variables were confounders and must be matched in the comparison. The results of this model showed that age and the level of education and SES index in Guilan were significantly higher than Kurdistan, but living in urban regions was significantly higher in Kurdistan. Using internet and working were not significantly different in two provinces. After finding confounders the two groups were matched by the calculated propensity scores of each data.

Results of Comparing Two Groups

In the Table 3, the results of comparing two groups with nearest neighborhood method is shown. Two groups were matched by propensity scoring method, next they were compared together. In the table, the results of comparing two groups by unmatched method are shown too. As shown in the table, the t-statistics in unmatched method was −12.57 which confirms having difference in fertility of each mother between two regions. Also the t-statistics of ATT was 4.21 and the matching method confirms having differences too. But what is surprising in comparing two groups was that without using a matching estimator, total fertility of Kurdistan was higher,(3.2613 in Kurdistan and 2.647 for Guilan) but with matching estimator, total fertility was higher in Guilan (2.3078 in Kurdistan and 2.647 for Guilan). In the Fig. 1, the concentration curves of fertility rate in Kurdistan and Guilan are shown. As indicated in the figure, Kurdistan's curve was above Guilan's curve, so the differences of fertility in mothers in Kurdistan was higher than Guilan and the amount of fertility in Kurdistan was more dependent with SES status in compare with Guilan.

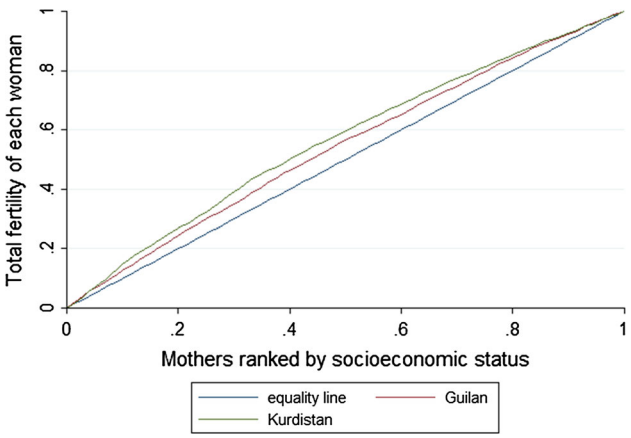

Fig. 1 Concentration curve of total fertility for each mother ranked by SES

Results of Poisson Regression

In the Table 4, the results of Poisson regressions were shown. In the left of the table, the results of Guilan and in the right the results of Kurdistan were placed. In Guilan, living in urban region had negative relationship with TFR. Age had positive relationship with TFR but the rate was diminishing. The mother's level of education had negative relationship with TFR too but by increasing in the level of education, the effect of education on decreasing TFR was higher. SES and working did not have any relationships with TFR. In Kurdistan, living in urban regions and work did not have any relationships with TFR. Like Guilan, with a diminishing rate, age had positive relationship with the TFR. The relationship for education was negative. In addition, SES had positive relationship with TFR. The pseudo R^2 goodness of fit in Guilan regression was 0.2669 and 0.3276 for Kurdistan respectively. Log likelihood statistics in Guilan regression was −9412.363 and −10,994.871 for Kurdistan respectively. The Kurdistan model was better predictor than Guilan.

Discussion

In this study, it has been found that before matching the women by some confounder factors, fertility rate was higher in Kurdistan which the most of people were Sunnah

Table 4 The results of estimating the models for Guilan and Kurdistan using Poisson method

Variables	Guilan			Kurdistan		
	Coefficient	S.E	*P* value	Coefficient	S.E	*P* value
Urb = 1	−0.0992847	0.0195964	0.000	−0.0231363	0.0145305	0.111
age	0.1101386	0.0036931	0.000	0.1295019	0.0029928	0.000
Age2	−0.0007701	0.0000352	0.000	−0.0009532	0.0000276	0.000
Int	0.0125375	0.0527442	0.812	−0.0312022	0.0619933	0.615
Edu = 1	−0.2274717	0.0242441	0.000	−0.1886912	0.0208386	0.000
Edu = 2	−0.2848399	0.0294115	0.000	−0.323423	0.032522	0.000
Edu = 3	−0.4457437	0.0307556	0.000	−0.5705211	0.0345162	0.000
Edu = 4	−0.7057431	0.049176	0.000	−0.9229231	0.0600164	0.000
Edu = 5	−0.7104095	0.3198199	0.026	−0.6455706	0.7081106	0.362
Edu = 6	−0.3693051	0.1310531	0.005	−0.1627675	0.1698889	0.338
Work = 1	−0.0108178	0.0335456	0.747	0.044239	0.0311217	0.155
SES	0.074328	0.1143524	0.516	−0.3039286	0.0854221	0.000
Constant	−2.048749	0.1425059	0.000	−2.209685	0.1472484	0.000
	Pseudo $R^2 = 0.2669$			Pseudo $R^2 = 0.3271$		
	Log likelihood = −9377.8877			Log likelihood = −10,943.135		

and minority. After matching, the results showed that fertility was higher in Guilan as the majorities with religion of Shia. It has been shown that, religious minority was not the reason of higher fertility rates. Some socioeconomic factors like income, wealth, living in urban regions and … had more effects on total fertility. In this study it was indicated that if Kurdistan had equal socioeconomic factors as well as Guilan, it had lower fertility rates. In Kurdistan, SES and lower education were the important reasons for the high fertility, not religion. Age had positive effect on fertility in both regions but its rate was diminishing. Comparison of results of Poisson regression in Guilan and Kurdistan showed that age had less effect on fertility in Guilan. Increasing in education would decrease probability of fertility in both regions. The differences of coefficients in Kurdistan were higher than Guilan. In Kurdistan, the coefficients had range between −0.188 and −0.922, but in Guilan, the coefficients were between −0.227 and −0.710, which showed more inequality in level of education in Kurdistan compare with Guilan. The calculated SES indicator had no relationship with fertility in Guilan, but it had negative effect on fertility in Kurdistan. The concentration curves confirmed these results too. If women were ranked by socioeconomic status, the differences in fertility in Kurdistan were higher than Guilan. In addition, attendance in work did not have any relationship with fertility in both provinces.

Bhagat et al. in a study done in India, compared Hindu and Muslim fertilities. They divided people by socioeconomic status and compared two groups together. In this study, they found that minorities (Muslims) had more total fertility but the gap between Hindus and Muslims was decreasing during study period. Also they found that by increasing socioeconomic status of Muslims, total fertility decreased rapidly [5]. In a study done in United States, the author pooled data from 2005 to 2009 American Community survey. In this study done by Lichter et al., they compared fertility rate between Hispanics and whites. They found that fertility was higher among Hispanics but 25 % of this difference was covered by lower socioeconomic indicators like age, education and etc. [6]. Hammond and Guzzo using data of women 18–24 and 40–44 of a survey between 2000 and 2010, found the differences of fertility in races of United States. They stratified groups by socioeconomic status and found that there were differences in fertility among race-ethnicity groups [16]. Morgan et al. in a study done in 2002, compared fertility in Muslim and non-Muslim groups in four countries of India, Malaysia, Thailand, and the Philippines. They found that Muslims had more children, liked to have more children and had low use of contraception [17]. Heaton in a study done in 2010 compared the differences of fertility in developing nations. They used health survey data of 30 countries. In the study, the differences in development, social characteristics and some other factors were considered. They found that fertility in Muslims were higher than Christians but there was no differences between Catholics and Protestants [18]. Hashemian et al. in a study done in Khorasan, Iran, compared fertility in Shia and Sunnah population. They found that the marriage age of Sunnah women was lower than Shia ones and it was a reason for higher fertility rates of Sunnah. Also they found that education was the reason of later marriage of Shia women [19]. Sadeghipour et al. in a study done in Rey, Iran, studied fertility in Iranian and non-Iranian populations. Without using any matching, they found that general fertility rate was 60 in Iranians and 110

for non-Iranian population in 1000 women. TFR was 1.73 in Iranian and 3.27 for non-Iranian population [2]. This study had some limitations; firstly we did not have data of income as Income is a major determinant of fertility and might have affected fertility. Secondly no data about the marriage age were available and this variable was eliminated from the study.

Conclusion

In the present study, after matching confounder variables, it had been shown that fertility in a major society was higher than a minor one. This finding is very important for policy makers who are concern about the low fertility of a province like Guilan. Socioeconomic factors, and level of education are more important than being minority and majority. For future studies, comparing fertility in other minorities like Zoroastrian and Christians is suggested.

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Author contribution EHR gathered the data and analyzed the study and the models, MT reviewed the literature and wrote introduction, AG wrote the discussion.

References

1. Haupt A, Kane TT, Haub C. PRB's population handbook. Washington DC: Population Reference Bureau; 2011.
2. Sadeghipour HR. Comparison of fertility indices in Iranian and non-Iranian populations in Ray, southern Tehran in 1997. Tehran Univ Med Sci J. 2000;58(1):97–103.
3. Poston DL Jr, Chang C-F, Dan H. Fertility differences between the majority and minority nationality groups in China. Popul Res Policy Rev. 2006;25(1):67–101.
4. Mishra VK. Muslim/non-muslim differentials in fertility and family planning in India. 2004.
5. Bhagat R, Praharaj P. Hindu–Muslim fertility differentials. Econ Polit Wkly. 2005;40(5):411–8.
6. Lichter DT, Johnson KM, Turner RN, Churilla A. Hispanic assimilation and fertility in new US destinations. Int Migr Rev. 2012;46(4):767–91.
7. Abbasi-Shavazi MJ, Hosseini H. Ethnic fertility differentials in Iran: trends and correlates. Iran J Sociol. 2009;8(4):3–36.
8. Abbasi-Shavazi MJ, McDonald P, Hosseini-Chavoshi M. National and provincial level fertility trends in Iran, 1972–2006. Rotterdam, Netherlands: Springer; 2009.
9. Abbasi-Shavazi MJ, McDonald P, Hosseini-Chavoshi M. The fertility transition in Iran: revolution and reproduction. Rotterdam, Netherlands: Springer; 2009.
10. Akaberi A, Mahmoudi M, Zeraati H, Majlesi F. Study of the relationship of socioeconomic and demographic factors with fertility. J Sabzevar Sch Med Sci. 2008.
11. Keshavarz H, Bahramian M, Mohajerani AL, Hosseinpour K. Factors effective in changing productive behaviors of nomadic and non-nomadic tribes in the Semirom province. Iran Health Syst Res. 2012;8(3):456–65.
12. Ghaedrahmati S, Houssieni F. Relationship between Health and Education Indexes with Fertility Rate in Iran's Provinces. Soc Welf Q. 2012;12(45):369–90.
13. Foomani A, Tadaion Ataollah. Guilan History. Rasht: Foruoji Bookshop; 1974. P. 324.
14. Meiselas S, van Bruinessen M. Kurdistan: in the shadow of history. New York: Random House; 1997.
15. Iran Statistical Center. Report of the 2011 census of housing and population of Iran. Tehran, Iran: Iran Statistical Center; 2011.
16. Alvira-Hammond M, Guzzo KB. Fertility differentials across race-ethnicity and generational status: incorporating non-hispanic immigrants. Women. 2007;40:44.
17. Morgan SP, Stash S, Smith HL, Mason KO. Muslim and non-Muslim differences in female autonomy and fertility: evidence from four Asian countries. Popul Dev Rev. 2002;28(3):515–37.
18. Heaton TB. Does religion influence fertility in developing countries. Popul Res Policy Rev. 2011;30(3):449–65.
19. Hashemian MItra, Mahingol M, editors. Experience reports and comparative performance indicators affecting the reproductive health on population 49–15 years old in Sunni and Shieh and influencing factors in Khorasan. Proceedings of the National Conference and the International Conference on experiences and good practices of primary health care; 2013.