Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.6, No.21, 2015

The Empirical Investigation of Fertility Transition in Pakistan: Assessing the Role of Education, Family Planning and Women Empowerment (Using ARDL Approach)

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Abstract
The purpose of this paper is to assess the role of education, family planning and women empowerment to determine their effects on total fertility rate in case of Pakistan because total fertility rate is higher as compare with other developing countries and the declining trend is slow despite of taking many steps by the government. This study based on the empirical examination to observe the relationship among concern variables. The data of concern variables have been taken from statistical year book of Pakistan and federal bureau of statistics of Pakistan, time span from 1975 to 2013. **Autoregressive and distributive lag model (ARDL)** is applied to extract the relationship among variables (total fertility rate, child mortality rate, female labor force participation, real growth rate, female secondary ratio and contraceptive prevalence). Results of the study confirm the long run and short run association among variables. Error correction model identify that the speed of adjustment is moderate to attain the equilibrium condition.
Keywords: total fertility rate, female education, life expectancy at birth, per capita income

Introduction

To probe the spreading out of poverty within region and country, population is considering an important element to examine the stages of poverty. Growth of population can be judge by fertility rates. Uncontrolled population creates confusion in a society and people feel economically disturbance. All these socioeconomic traces can be analyzed by knowing the causes of increases or decreases in fertility rate which ultimately tells about growth in population. To simply define the term fertility we explain that natural ability to produce off spring and for measuring purpose, 'fertility' is the number of children born per female. A lot of studies conclude that education and fertility strongly related to each other, which means that if women years of education, fertility decreases due to higher opportunity cost of having more children. So well being of household is expected to be increases with increases female education.

Demographic transition refers to condition of transition of high birth and death rates to low birth and death rates. Reduction in fertility which represents this demographic transition shows number of benefits to individuals. Schultz (2008) explains these benefits such as better health of mother which tends better nourishment of children. Productive labor supply increases in the future. This connection which is based on low fertility is explained by the theory of "virtuous circle". By making policies to reduce fertility and reap benefits from this transition is important for developing countries where fertility is high such as Pakistan. The causal relationship between fertility and female education, development economist emphasizes to make policies to enhance the investment in female education institutions which ultimately benefits to the whole society.

There is a huge empirical and non empirical literature available regarding demographic research. This purpose o this paper is to add existing literature. The intention of this paper particularly examines the relationship in case of Pakistan. There are two techniques to measure fertility named children ever born (CEB) and total fertility rate (TFR). This paper uses total fertility rate to analyze different socioeconomic and development indicators on total fertility rate in case of Pakistan.

Review of literature

The present (obtainable) literature argued strongly associationship among education, fertility and child health. Researcher suggested that ability and discount rate which are strongly associated with fertility and education may wrongly represents the results of the study so controlling this endogeneity is necessary for the conduction of this causal relationship to be hold.

It is examined by the researcher that female education causes family size to decrease for a number of reasons. Firstly, educated woman has more opportunities than uneducated woman. Opportunities include job employment and increases bargaining power in household decisions making. Secondly, it is observed that in a society where son preference is dominant, this view of society can be reduced by giving education to woman who changes the views of son preference for support in old age and social acknowledgment. Thirdly, educated women can better build up their children and make them productive by giving proper attention to their education and character building.

All of the above discussion can also apply to men as well as women. It is examined that by increasing

male education, fertility decreases. This leads to conclude that causal relationship exist between male education and fertility. But is also found that this causal relationship is weak due to the role of women is greater than men in child bearing ad in their nourishment so the causality is weak and the effect of male education on fertility is likely to be weak than female.

Development economists have been studying this phenomenon for last twenty five years. Conclusions of this wide ranging research proposed that association between female education and fertility is more complicated than relationship between female education and infant mortality rate which is much more shows linear relationship (Cleland and Van Ginneken) 1998. Female education and fertility rate has negative association but if was also found in some studies that female has low and high years of education showed positive relationship with fertility.

Jejeebhoy (1995) had done extensive and comprehensive research on the relationship between female education and fertility rate. Jejeebhoy utilized the results of 59 studies and divided the pattern of fertility with education of these results. The pattern of twenty six studies showed a monotonically negative relationship which means fertility continuously decreasing with increasing education. The prototype of some studies showed "shaped like seven" relationship. This pattern shows that there is no relationship exists at low level of female education. Some studies of jejeebhoy research showed concave downward relationship. This means fertility increases at low level of education and decreases at high level of education. Fourth prototype of study showed that there is no association exists between female education and fertility.

Casterline and singh (1985), Entwesle and Mason (1985) suggested an important finding of jejeebhoy's study is the link between education fertility relationship with macro level country's level educational and economic development process. Jejeebhoy's study identify four patterns of relationship monotonically negative relationship exhibit the countries that have high level of per capita income and high level of female literacy. But it is also suggested that heterogeneity at household level may influence this relationship with different results. To it is very useful to consider individual level data to investigate this relationship.

Kaufmann and Cleland argued that an important question need to be answered that why educated women have more conscious about reproduction preference after controlling for age and existing family size. This questions leads to conclude that fertility education relationship requires factors that affect reproductive decision making. Studies conducted in 1980's and 1990's mostly conducted on technique of proximate determinants which was very useful to know education attainment leads to change of behavior regarding reproductive decision making.

Elo (1990) argued that significant connection of female education and fertility can be analyzed with the help of chances of survival of their children. Educated mothers are more apt for the use of maternal and child health facilities than an illiterate mother. This changing behavior of educated women helps to improve their as well as their children life.

Etzioni (1979) proposed that "family planning" and other programs for controlling population works effectively unless people adopted those methods, where male and female are educated. They better understand the objective of programs and consequences of having large families. So all these programs to be successful, investment in female education is necessary condition, for checking population and other socio-economic indicators implicitly required female education.

Fertility transition in Pakistan

The initial indication of reduction in fertility rate was originated in the 1975 through Pakistan Fertility Survey. The survey anticipated a total fertility rate of 6.3 children as compared with the estimation from 'PGE' data which was 7 children per woman. Though, study conducted by Retherford's, *et al.* (1987) devastated all expectations regarding the rate of fertility change. The study revealed that the declining trend was relic of the observations. The study used the 'own children method' to justify the results of their study.

An additional study based on this demographic transition by Pullum, Irfan and Shah (1986) also confirmed that fertility decline was an artifact of the data publicized by the PFS data. Another survey named "The Pakistan Labor Force and Migration Survey" performed after five years in 1979-80 calculated total fertility rate of 6.5 children per women which was the an addition justification of spurious calculated made in the initial measurement. All these studies showed that total fertility rate was actually not declined.

On the other hand 1984-85's Pakistan Contraceptive Prevalence Survey which is abbreviate as PCPS predicted total fertility rate as 6 children per women. In the period of 1990-91 "Pakistan Demographic and Health Survey" as well established dilapidated trend as it anticipated total fertility rate as 5.4 children for the past 6 years. But Sathar and Juarez rejected this argument and argued that the data of PDHS (1990-91) undergo not only from immense misdating of the births but as well from grim omissions. Recent "Pakistan Demographic and Health Survey" estimated that TFR has declined to 4.1 children pre women in 2006-07. Survey found that on average TFR reduced 1.8 children per women in every successive decade is considerably showed a fast decline as compare with 1.5 in East and Southeast Asian countries. A survey of (2003) has analyzed that Demographic and Health Survey of 1990-91 and Family Planning survey of 1997 have miscalculated the TFR. However Pakistan places at the sixth rank among the most the crowded countries in the world, with approximately 177.1 million of population.

On the other hand, she has accomplished the aim of fertility reduction from 1970 to 2010. Fertility rate has lost momentum from 7 percent during period of 1970-75 to 4 percent during period 2005-10(World Development Indicators).

Objective of the study

This paper contributes to research based on demographic transition in Pakistan. An attempt to made to know the nature of relationship between female education and fertility rate in case of Pakistan and leads to policy recommendation which helps in making demographic transition policies, policies related to female education and also policies related to population control. Research hypothesis of the study are as follows:

i. To examine the causality of female education and fertility rate.
ii. To examine the long run and short run relationship between female education and fertility rate.

Methodological framework and data sources

To construct the empirical model of this study which involves fertility rate, female education and human development indicators in case of Pakistan, this paper uses the theoretical structure of Nayamete, Beegle and kingslay Davis. The simple linear regression model is represented as,

$$LTFR_t = \beta_1 LCMR_t + \beta_2 LFLR_t + \beta_3 LRGR_t + \beta_4 LSER_t + \beta_4 LCONT_t + u_t$$

Where,

$LTFR_t$ = log of total fertility rate
$LCMR_t$ = log of child mortality rate
$LFLR_t$ = log of female labor force participation
$LRGR_t$ = log of real growth rate
$LSER_t$ = log of female secondary enrollment ratio
$LCONT_t$ = log of contraceptive prevalence
u_t = disturbance term

Time series data has been used for this study is taken from statistical year book of Pakistan and Federal Bureau of Statistics of Pakistan. Time span for the study is from 1975 to 2013. Log of total fertility rate is used as regressand and log of child mortality rate, log of female labor force participation, log of real growth rate, log of female secondary enrollment ration and log of contraceptive prevalence is used as regressors to explore the relationship.

Econometric methodology:

Empirical literature showed that economists use to measure the short run and long run relationship among variables of interest. For the purpose of measuring, most studies extensively used "Standard Johanson Cointegration" and "Vector Error Correction Model" skeleton, but these frameworks experience some considerable faults.

We used ARDL technique to set up the course of dependency among parameters. One of the advantages of this technique is that this test does not engage in pretesting of variables, this suggests that an empirical test for the concern variables is appropriate without worrying about whether the considering variables are purely integrated at the level I (0), integrated of I (1), or a combination of both.

For the purpose of obtaining robust results, we make use of the ARDL technique to set up the existence of a long run and short run association among variables. ARDL is enormously helpful because it enables us to explain the presence of convergence among variables without losing long run information. Equation to be estimated is as follows

$$LTFR_t = \beta_1 LCMR_t + \beta_2 LFLR_t + \beta_3 LRGR_t + \beta_4 LSER_t + \beta_4 LCONT_t + u_t \quad (1)$$

Where,

$LTFR_t$ = log of total fertility rate $LCMR_t$ = log of child mortality rate $LFLR_t$ = log of female labor force participation $LRGR_t$ = log of real growth rate $LSER_t$ = log of female secondary enrollment ratio $LCONT_t$ = log of contraceptive prevalence u_t = disturbance term

An ARDL demonstration of equation 1 is as follows (2)

$$\Delta LTFR = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta LTFR_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta LCMR_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta FLR_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta LRGR_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta LSER_{t-i} + \sum_{i=0}^{n} \alpha_{6i} \Delta LCONT_{t-i} + \beta_1 LTFR_{t-1} + \beta_2 LCMR_{t-1} + \beta_3 LFLR_{t-1} + \beta_4 LRGR_{t-1} + \beta_5 LSER_{t-1} + \beta_6 LCONT_{t-1} + e_t$$

Where,

Δ denotes the first difference operator
α_0 is the drift component
e_t is usual white noise residual

The equation-2 also represents the technique of short run and long run estimation. First six expressions of the equation on the left hand side shown as (α_0 to α_6) represents short run dynamics and expression shown as (β_1 to β_6) represents the long run dynamics of the model.

Empirical results and discussion:

Table -1 represents the autoregressive distributed lag estimates using (SBC) Schwarz Bayesian Criterion. This estimate confirms the selection of lags which are desirable for the empirical estimation. Table no. 1 screening that the LTFR with two lags, LCMR at level, LCMR with two lags, LFLR at level, LRGR at level, LSER with two lags, and LCONT at level, is best model for investigating the relationship among selected variables. This ensures that we will proceed with this lag selection model. The above table also represents the diagnostic results regarding serial correlation, functional form and heteroscedasticity. As we can see that we fail to reject the hypothesis of no serial correlation as the probability 0.233 is more than 1%, 5% and10% level of significance (based on the F - statistic). Similarly, we fail to reject the correct functional form and homoscedasticity at 1%, 5% and 10% level of significance (based on the F - statistic). R-Squared shows the proportion of change in dependent variable due to explain part of the regression. Our chosen empirical model exhibits that the LTFR is 99 percent explained by the selected independent variables. Probability of F-statistic is 0.000 showing that overall model is significant.

Table-2 represents the results of estimated long run coefficients to quantify the long run behavior of variables using ARDL Approach. Our model explored that if CMR is increased by 1 % the LTFR is increased by 2.72 % in long run and this positive behavior is highly significant at 1% level. This suggested that improved demographic situations will reduce the LTFR in long run. The model also investigated that if LFLR is increased by 1% the LTFR decreases by 0.10 %. This negative behavior of LTFR with LFLR is significant at 1% level. The result shows that women empowerment will increase the bargaining power of women in deciding of having the number of children. It also shows that the cost of having more children rises, which reduce the overall household welfare. Some previous empirical studies explored the ambiguous relationship between income and total fertility rate. Our model confirms that in long run LRGR and LTFR is no connected with each other as shown by the probability calculated as (0.840).

There is a strong argument that if female is more educated then she will take better decisions about her household. Our model supports this argument and confirms that if LSER is increased by 1% it will cause LTFR to decrease by 0.11 % and this inverse behavior is highly significant at 1% level of significance. This model suggested that there is no significant relationship among contraceptive prevalence and total fertility. The analysis shows that coefficient of LCONT is not significant from zero confirming by the probability calculated as (0.237).

Table-3 revealed the short run dynamics of concern variables. The Second task of the analysis is to calculate the short run behavior of variables. This short run behavior is calculated by error correction model (ECM). The above table gave the picture that in short run DLCMR(1) is responsible for stabilizing the relationship again in equilibrium condition. The relationship of LCMR and LTFR is same as in the long run and significant at 5 percent level. Similarly DFLR and DSER are also significant (as shown in table) and play the role of active variables in achieving the long run equilibrium condition and stability in concern relationship.

The error correction term (ECT) is significant at 1% level and shows causality in at least one direction. The lagged error term (ECMt-1) in our model is calculated as -0.23392 is negative and highly significant. The coefficient of (ECT-1) indicates moderate rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 23.39% over each year. The lag length of the short-run model is selected on basis of the SBC.

Conclusion and policy recommendation:

The intention of the study is to form an idea of relationship among fertility rate, education and human development indicators. Time series data is used to conduct an empirical link among the said variables and data range from 1975 to 2013. ARDL is applied to evaluate the long run relationship among variables. ARDL confirms that variables have long run relationship as well as short run dynamics exist among variables of the concern. The results of the study highlighted that real growth rate have insignificant impact in total fertility rate in case of Pakistan whereas, child mortality rate, female secondary enrollment ratio and female labor force participation have significant impact on total fertility rate. These conclusions propose that child mortality, female education and increasing female labor force participation have imperative pointers for policy making and policy makers gain the potential of policy by considering these pointers.

Effective policy instruments are education and child mortality rate. These instruments help to control population because if education increases people are able to know the cost of having more children and their behavior will change considerably. People will begin to realize the benefits of having quality children and cost of having quantity of children. Education especially for females helps to start virtuous circle process which is beneficial and society welfare increases. If life expectancy at birth increases the demand for children decreases because chances of survival of children increases which helps reduce the fertility rate therefore it shed light on policies regarding better health facilities. But all these facilities for better health must be approachable and provision of these policies must be efficient.

It is also searched that women empowerment has significant impact on fertility reduction. Government must make policies regarding gender equality which increases bargaining power of women and they play effective

in role in household decisions. Family planning programs have shown positive and immediate effect in reduction of fertility. Other important features of family planning includes these programs are provided at less expense and spread quickly.

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Table-1
Autoregressive Distributed Lag Estimates
ARDL (2,2,0,0,2,0) selection based on SBC

Variables	Coefficient	Standard Error	T-Ratio (Probability)
LTFR(-1)	1.7677	0.037092	47.658 (0.000)*
LTFR(-2)	-1.0017	0.030613	-32.719 (0.000)*
LCMR	-0.17599	0.19294	-0.9121(0.371)
LCMR(-1)	1.2289	0.30993	3.9653(0.001)*
LCMR(-2)	-0.41589	0.15388	-2.7027(0.012)**
LFLR	-0.023398	0.0055462	-4.2050(0.000)*
LRGR	0.704400	0.34370	0.20492(0.839)
LSER	-0.0090378	0.0037198	-2.4297(0.023)**
LSER(-1)	-0.0040277	0.0043485	-0.92624(0.364)
LSER(-2)	-0.013680	0.0036639	-3.7338(0.001)*
LCONT	0.0383700	0.33142	1.2215(0.234)
T	-0.0036305	0.3841	-9.4508(0.000)*
C	-1.0281	0.12777	-8.0461 (0.000)*
R-Squared 0.99999 R-Bar-Squared 0.99988 F-statistic (prob.) 367595.2 (0.000) DW- 1.4299 Serial Correlation 1.4983 (0.233) Functional Form 1.1263 (0.300) Heteroscedasticity 0.013640 (0.908)			

Source: tabulated and summarized by the authors: significant at *1%, **5%, and ***10% level of significance.

Table no-2
Long Run Coefficients using the ARDL Approach

Variables	Coefficient	Standard Error	T-Ratio (Probability)
LCMR	2.7235	0.10789	25.3137(0.000)*
LFLR	-0.10003	0.028146	-3.5538(0.002)*
LRGR	0.3011	0.1474	0.20424(0.840)
LSER	-0.11434	0.012419	-9.2068(0.000)*
LCONT	0.0016405	0.0013526	1.2128(0.237)
T	-0.015521	0.5704	-27.2122(0.000)*
C	-4.3930	0.24596	-17.8685 (0.000)*

Source: tabulated and summarized by the authors: *1%, **5%, and ***10% level of significance.

Table no-3
Error Correction Model

Variables	Coefficient	Standard Error	T-Ratio (Probability)
DLTFR(1)	1.0017	0.30613	32.7197(0.000)*
LDCMR	-0.17599	0.19294	-0.91213(0.370)
DLCMR(1)	0.41589	0.15388	2.7027(0.012)**
DLFLR	-0.023398	0.0055642	-4.2050(0.000)*
DLRGR	0.7044	0.3437	0.20492(0.840)
DLSER	-0.00903	0.0033198	-2.4297(0.022)**
DLSER(1)	0.013680	0.0036639	3.7338(0.001)*
LCONT	0.3875	0.3142	1.2215(0.233)
DT	-0.003630	0.12777	-9.4508(0.000)*
DC	-1.0281	0.3841	-8.0461 (0.000)*
ECM(-1)	-0.23392	0.018808	-12.4370(0.000)*
R-Sq. 0.99811 R-Bar-Sq. 0.99717 DW- Stat. 1.4299 F-Stat. (1268.5) 0.000			

Source: tabulated and summarized by the authors: *1%, **5%, and ***10% level of significance.