South Asian Countries : Economic Growth and Fertility

Ghosh, Sudeshna

Scottish Church College

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Abstract

Analysis of data sets on contraceptive use is important to assess the effectiveness of policy decisions towards meeting the Millennium Development Goal that endeavours to ensure universal access to contraceptive use. The paper therefore attempts to estimate the trends in the contraceptive use and unmet need in India and her major neighbouring countries during the recent past based on the data base provided by the United Nations, Department of Economic, and Social Affairs, Population Division (2017). The study estimated the trends in the percentage of women who want to avoid pregnancy, by using modern contraceptives or used traditional methods or no methods. The paper concludes that for healthy upbringing of children birth spacing is important for women and the family. To meet the unmet need for use of modern contraceptives, the south Asian countries need to improve availability of resources for timely delivery of contraceptive services. The paper finally develops a statistical model to explore the causal relation between economic growth, fertility behaviour and contraceptive use in these set of countries. A long run relation is found to exist among the concerned variables in all the countries except Pakistan. Such, findings call for systematic intervention in terms of policy prescription.

Keywords: India, neighbouring countries, contraceptive use, fertility, United Nations, ARDL method.

JEL code: C1,J1, Z0

Introduction

Among the South Asian developing countries, the need for small families and drive for healthy birth spacing has progressively augmented, Westoff (2010). In order to obtain the desired child bearing preference patterns, the women of these countries need to

apply knowledge of proper contraceptive use to avoid unwanted pregnancies. Analysis of data on trends in contraceptive use in the developing countries is essential for proper planning for better health care services and efficient allocation of budgetary resources along gendered path of development. Commitment towards providing improved resources in the developing countries of South Asia will go a long way towards meeting the Millennium Development Goal (MDG:5). There is an urgent need to escalate the coverage and quality of services in meeting the women's needs in developing their maternal health. This paper utilizes contraceptive data sets from the United Nations, Department of Economic and Social Affairs, Population Division, Fertility and Family Planning Section, to examine the trend and pattern of contraceptive use in the countries of Bangladesh, India, Nepal, Pakistan and Sri Lanka during the period 1970 to 2018. Further, the paper tries to analyse the reasons for variation in use of contraceptives across these countries, particularly from the viewpoint of meeting the Millennium Development Goals. Last, the paper develops an ARDL model to discuss the causality association across economic growth, fertility behaviour and contraceptive use in these sets of countries.

Materials and Methods

Materials

The prevalence of contraceptive use is calculated as the percentage of women who state on the use of at least one contraceptive method of any category (traditional or modern) by themselves or their partners. To develop the ARDL methodology, annual data for total fertility rate and Gross Domestic Product is used. A detailed description of the variables is given in the Table (1). All the variables are in logarithmic terms. The countries chosen for the analysis are India, Bangladesh, Pakistan, Nepal and Sri Lanka.

Insert Table (1): Data Description

Methods

First the trend analysis of the contraceptive user behaviour is reported during the period 1970-2018 for the concerned set of countries. Next a statistical model is developed to obtain the long run association between fertility behaviour, contraceptive prevalence use and economic growth in these countries. The current study uses the Auto Regressive Distributive Lag (ARDL) method to cointegration to develop the long run association across the concerned set of variables.

Econometric Methodology

Stationary Test

The first step of this process is to ensure that all the variables satisfy the requirements for the ARDL. The order of the integration of the variables must not exceed one, i.e.. no variables must be of the order I (2). If the order of integration of the variable exceeds one, then the critical bound test of Pesaran et al. (2001) are inapplicable. The critical bounds are calculated on the foundation that the variables are I (0) or I (1). So, unit root testing is done to confirm that the underlying condition of the ARDL is satisfied before the bounds testing for cointegration can be followed. Here the test for stationarity is done using the Augmented Dickey Fuller (ADF) and Philip-Perron (PP) tests to obtain the order of integration. In the present study, a model of the determinants of fertility rates in the countries of India, Bangladesh, Nepal, Pakistan and Sri Lanka has been developed as follows,

$$TFR_t=\beta_0+\beta_1 GDP_t+\beta_2\, CONT_t\, +\omega_t \quad \ldots..(1)$$

Where TFR is the natural logarithm of total fertility rate, GDP is the natural logarithm of GDP per capita and CONT is the natural logarithm of contraceptive use. The error term is ω_t. The coefficients to be estimated are β_1 and β_2 . Though other factors may affect fertility rates, given the small sample size of the observations in the present study, the variables have not been incorporated with implications on the degrees of freedom, Narayan and Peng (2006).

Cointegration Test

The present exercise utilizes the ARDL process, the bounds testing method, formulated by Pesaran et al. (2001). ARDL has certain advantages in comparison to other cointegration methods. The improvements over other methods include its competency to (i) avoid endogeneity problems ;(ii) estimate long and short run parameters of the model concurrently, and (iii) the method is applied to small samples. The first step to the ARDL approach includes estimation of the long run relation across the variables, this is generally the bound testing. If a long run relation is obtained, then the second step is to estimate the long run and short run coefficients of the model. In the equation (1) the bound test is applied to the unrestricted error correction model (UECM). Here for the application of the ARDL method three model specification is constructed considering in each case, fertility rates, Gross Domestic Product, and contraceptives used as dependent variables. So the equations are formulated as follows:

$$TFR_t = \alpha_{0TFR} + \sum_{i=1}^{p1} \beta_{1iTFR} \Delta TFR_{t-i} + \sum_{i=0}^{p2} \beta_{2iTFR} \Delta GDP_{t-i} + \sum_{i=0}^{p3} \beta_{3iTFR} \Delta CONT_{t-i} + \sigma_{1TFR} TFR_{t-i} + \sigma_{2TFR} GDP_{t-i} + \sigma_{3TFR} CONT_{t-i} + \epsilon_{1t} \quad \text{.....(2)}$$

$$GDP_t = \alpha_{0GDP} + \sum_{i=1}^{p1} \beta_{1iGDP} \Delta GDP_{t-i} + \sum_{i=0}^{p2} \beta_{2iGDP} \Delta TFR_{t-i} + \sum_{i=0}^{p3} \beta_{3iGDP} \Delta CONT_{t-i} + \sigma_{1GDP} GDP_{t-i} + \sigma_{2GDP} TFR_{t-i} + \sigma_{3GDP} CONT_{t-i} + \epsilon_{2t} \quad \text{.....(3)}$$

$$CONT_t=\alpha_{0CONT}+\sum_{i=1}^{p1}\beta_{1iCONT}\,CONT_{t-i}+\sum_{i=0}^{p2}\beta_{2iCONT}\Delta GDP_{t-i}+\sum_{i=0}^{p3}\beta_{3iCONT}\Delta TFR_{t-i}+$$

$$\sigma_{1CONT}\,CONT_{t-i}+\sigma_{2CONT}\,GDP_{t-i}+\sigma_{3CONT}TFR_{t-i}+\epsilon_{3t}\ \text{.....(4)}$$

The variables used, in [equations (2), (3) and (4)], are already defined earlier, Δ is the first difference operator for the optimal lag length; the residuals are normally distributed. In the equations (2), (3) and (4) the F- test (Wald test) is applied, to study about the existence of a long run equilibrium relation. Here, the cointegrating relation is identified in the order of the lags in the first differentiated variables. The F- statistics, derived in each of the model represented by the equation (2); (3) and (4) respectively, are utilized for testing the existence of the long run relation. The null hypothesis of no cointegration for example, in the equation (2) is H0: $\sigma_i = 0$; $\forall$ i=1,2…3 which is tested against the alternative hypothesis H1: $\sigma_i \neq 0$; $\forall$ i=1,2…3.Two groups of critical values are found through the ARDL approach, the former is the I (0) series and the latter is the I (1) series. The critical values for I (1) are the upper bound critical values while the critical values for the I (0) are the lower bound. For, the existence of the long run relation it is required that the F-statistics is greater than the upper bound critical value. However, if the F-statistic lies in-between the upper and the lower bound of the critical values then the results remain inconclusive. Alternatively, if the calculated F-statistic falls below the lower critical value the series are not cointegrated regardless of whether the series are I (0) or I (1). The F-statistics, to be computed are as follows for each of the model represented by the equation (2), equation (3) and equation (4) respectively,

$F_{TFR}(TFR/GDP,CONT);$

$F_{GDP}(GDP/TFR,CONT)$ *and*

$F_{CONT}(CONT/TFR, GDP)$.

If a long run relationship is found through the bound testing approach, the subsequent step is to formulate the long run and short run estimates of the variables

Granger Causality Test

Here the direction of causality across the variables is obtained through the Granger causality test. According to the Granger Representation Theorem, there will be Granger causality in at least one direction if there is a long run cointegrating relation among the variables. Within the framework of vector error correction model (VECM) the Granger causality test is performed. The equation (5) shows the VECM framework.

$$((1\text{-}L)\begin{bmatrix} TFR_t \\ GDP_t \\ CONT_t \end{bmatrix}=\begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \end{bmatrix}+\sum_{i=1}^{p}(1-L)\begin{bmatrix} \varphi_{11i} & \varphi_{12i} & \varphi_{13i} \\ \varphi_{21i} & \varphi_{22i} & \varphi_{23i} \\ \varphi_{31i} & \varphi_{32i} & \varphi_{33i} \end{bmatrix}\text{X}$$

$$\begin{bmatrix} TFR_{t-i} \\ GDP_{t-i} \\ CONT_{t-i} \end{bmatrix}+\begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix}\text{X}[ECT_{t-1}]+\begin{bmatrix} \varepsilon_{it} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \quad \ldots\ldots(\ 5)$$

here (1−L) is the difference operator. The ECTt−1 is the lagged error correction term.ε_it (i=1,2,3) are the serially uncorrelated random disturbance term, which has a zero mean. The F-statistic of the lagged explanatory variable of the error correction model denotes the significance of the short run coefficients. The t-statistic of the coefficient of the error correction denotes the significance of the long run effect. The optimal lag length is selected using Akike information criteria (AIC).

Results

The figures (1) and (2) plots together the country experiences over time in fertility

behaviour and contraceptive use in the modern method respectively. For fertility behaviour a convergence is noticed in trend analysis for all countries except for Pakistan. Again for contraceptive use behaviour Pakistan stands to show a divergent behaviour. So the use of contraceptives across these countries has direct bearing on the fertility behaviour over time. The figures (3), (4),(5),(6) and (7) shows the decadal growth rate of contraceptive prevalence use among women in the age group of 15-45, across Bangladesh, India , Nepal, Pakistan and Sri Lanka, using modern or traditional methods respectively. As far as Bangladesh is concerned the use of traditional contraceptive method in percent among women stand at 2.1 (1970), 4.5 (1980), 7.7 (1990), 9.2 (2000), 8.1 (2010) and 7.1 (2018) respectively, for India it is 3.5 (1970), 5.6 (1980), 5.7 (1990), 5.8 (2000), 6.1 (2010) and 5.7 (2018) respectively. For Nepal the use of traditional contraceptive method among women in the age group of 15-45 years stand at 0.3 (1970), 0.5 (1980), 0.9 (1990), 1.3 (2000), 2.8 (2010) and 3.1 (2018) respectively. The figures for Pakistan are 1.2 (1970), 1.2 (1980), 2.4 (1990), 5.3 (2000), 7.9 (2010) and 8.9 (2018). In Sri Lanka the prevalence pattern is 14.1 (1970), 18.5 (1980), 19 (1990), 16.7 (2000), 14.5 (2010) and 13 (2018) respectively. The pattern with respective use of modern methods for Bangladesh stand at 3.6 (1970), 10.6 (1980), 28.2 (1990), 44.3 (2000), 51.7 (2010) and 57.1 (2018) respectively. Again for India the decadal situation is 8.1 (1970), 22.9 (1980), 36.2 (1990), 43.2 (2000), 48.8 (2010) and 51 (2018). The trend in Nepal is 3.1 (1970), 8.6 (1980), 18.9 (1990), 32.9 (2000), 44.8 (2010) and 51.4 (2018) respectively. In Pakistan the situation is 3.1 (1970), 4.2 (1980), 9.2 (1990) 20.1 (2000), 23.9 (2010) and 31.7 (2018) respectively. The trend in Sri Lanka is 18.6 (1970), 31.7 (1980), 45.2 (1990,) 51.6 (2000), 56.4 (2010) and 58.6 (2018), [Table (2)].

Insert Figure (1): Fertility Rates, 1970-2018, Bangladesh, India, Nepal,

Pakistan, and Sri Lanka.

Insert Figure (2): Contraceptive use in percent, Modern Methods, 1970-2018, Bangladesh, India, Nepal, Pakistan, and Sri Lanka.

Insert Figure (3): Decadal Growth rate in use of contraceptives, Bangladesh.

Insert Figure (4): Decadal Growth rate in use of contraceptives, India.

Insert Figure (5): Decadal Growth rate in use of contraceptives, Nepal.

Insert Figure (6): Decadal Growth rate in use of contraceptives, Pakistan.

Insert Figure (7): Decadal Growth rate in use of contraceptives, Sri Lanka.

Insert Table (2): Percent in contraceptive use among women (15-45 age group), in the countries, 1970–2018.

Interesting bilinear relation is obtained across fertility behaviour and contraceptive use, Figures (8), (9), (10), (11) and (12) (scatter diagrams) for Bangladesh, India, Nepal, Pakistan and Sri Lanka respectively. The Figures (8) and (9) demonstrate a strong negative correlation across contraceptive use and fertility behaviour in Bangladesh and India, during the recent decade. Figure (11) shows the scatter plots across contraceptive use and fertility behaviour in Pakistan, there is a sparse negative causal relation. The Figure (12) shows a consistent negative scatter plot across contraceptive use and fertility rate in Sri Lanka. Such diagrammatic exposition affirms Langford, (2001) findings. After examining the relation across contraceptive use frequency and fertility behaviour among South Asian women through scatter diagrams, the paper subsequently discusses the major findings of the cointegration results based on ARDL for these sets of countries.

Insert Figure (8): Scatter Diagram contraceptive use and fertility rate, Bangladesh.

Insert Figure (9): Scatter Diagram contraceptive use and fertility rate, India.

Insert Figure (10): Scatter Diagram contraceptive use and fertility rate, Nepal.

Insert Figure (11): Scatter Diagram contraceptive use and fertility rate, Pakistan.

Insert Figure (12): Scatter Diagram contraceptive use and fertility rate, Sri Lanka.

Unit Root Test

The Table (3) shows the unit root test based on the ADF and PP test statistics. The Augmented Dickey fuller (ADF) test statistics and the Philips Perron (PP) test statistics indicate that all variables have a unit root at levels but become stationary in their first difference except for the variable CONT which is stationary at level, for Bangladesh and India. When Nepal is considered, for the GDP the series it is stationary at first difference. For TFR and CONT the series is stationary at level In case of Sri Lanka the GDP variable is stationary at first difference, however the other two variables are stationary at level. All the variables are stationary at first difference in Pakistan. Since none of the variables are of an order I (k) where k>1, the bounds testing procedure for cointegration is applicable.

Insert Table (3): Unit Root test.

Cointegration : The ARDL Approach

The results of the bounds testing for co-integration are reported in the Table (4) The bound test show that the cointegration is present at 5%level of significance when total fertility rates (TFR) are dependent variable (based on the equation 2) for all the countries under study except for Pakistan. Further, when Gross Domestic Product (GDP) is the dependent variable (based on equation 3) there is a cointegrating relation for India and Sri Lanka. Again in India, Sri Lanka and Nepal there exists a cointegrating relation when contraceptives (CONT) are considered as the dependent variable (based

on equation 4). This is due to the F-statistics for the concerned equations being higher than the upper bound critical value at 5% level of significance. So, except for Pakistan a long run relation is established for all the countries namely India, Bangladesh, Sri Lanka, and Nepal for at least one model. The question of finding the suitable lag length for each of the underlying variables in the ARDL model is very important because we would want to test that the standard normal error terms do not have the problem of nonnormality, autocorrelation, and heteroscedasticity. The optimum lag length following Akaike information criteria is used here. The existence of a long run relation implies that there must be a Granger causation in at least one direction among the variables.

Insert Table (4): Bounds testing approach for co-integration.

Insert Table (5): Results of Granger Causality.

Granger Causality Test

The Table (5) shows the results of the Granger causality test. Bidirectional Granger causality exists between economic growth and fertility rate in India. There is unidirectional causality from contraceptives towards fertility rate behaviour. The coefficient of the lagged error correction term for fertility rate and GDP in India is -0.34 and -0.12, it is negative and significant. This suggests when there is shock, convergence towards equilibrium is not rapid. The coefficient of the error correction reflects that a deviation from equilibrium level will be corrected by 34 percent in the next period when the TFR is the dependent variable and at 12 percent when GDP is the dependent variable in India. As far as Bangladesh is concerned, there is short run unidirectional causality from TFR to GDP. There is no long run relation in Pakistan so we have not reparametrized the equations in (2), (3) and (4) to obtain the error correction estimates. There is unidirectional causality from GDP and CONT towards fertility rate for Nepal.

The coefficient of the error correction reflects that a deviation from equilibrium level will be corrected by 32 percent in the next period when the TFR is the dependent variable and at 11 percent when CONT is the dependent variable in Nepal. For Sri Lanka there is bidirectional causality across TFR and GDP. Such findings are consistent with Jemna (2015) for the country case study based in Romania. There is unidirectional causality from CONT to TFR. There is also unidirectional causality from GDP to CONT. The coefficient of the lagged error correction is significant and negative for all the three concerned dependent variables in Sri Lanka. The coefficient for the error correction term for TFR and GDP suggest, when there is shock, convergence towards equilibrium is rapid Once the model has been calculated, Pesaran and Pesaran (1997) opines, on the application of the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests to estimate constancy of the parameter. The models were thus estimated based on the ordinary least squares and the residuals were then put to the CUSUSM and CUSUMSQ tests. The figures (13a), (13b), (13c), and (13d) and further (14a), (14b), (14c) and (14d) plot the result for Bangladesh, India, Nepal and Sri Lanka respectively. The results indicate the non-appearance of any instability of the coefficients as because the plot of the CUSUMSQ and CUSUM statistic are limited within the 5 per cent critical bounds of parameter stability. Further a battery of diagnostic tests is conducted to define the consistency of the model based on equation (5), for Bangladesh, India, Nepal, and Sri Lanka. The test statistic defines the normality of the model and it also shows that the model is free from serial correlation, (Table 6). The present study renews the scope for discussion across the long run causal association among fertility behaviour, use of contraceptives and economic growth. A number of studies discusses about fertility behaviour, economic growth, female education and labour market participation. Elo (1992) opines that rising education helps

women to concentrate on child health, so there are chances on declining infant mortality which in turn reduces the fertility behaviour of women. Jejeebhoy (1995) using 59 case studies has explored in detail the causal association across fertility behaviour and female education. The study shows that at lower levels of education the levels of fertility are high. With rising levels of education, fertility decreases. Cleland and. Jejeebhoy (1996) observed that there is a strong prevalence of use of contraceptives even among uneducated women in South Asia. The research observes that apart from education location and cultural contexts also affect the fertility behaviour of women. Bloom and Williamson (1998) opine that changes in fertility choices and infant mortality have changing consequences of the particular population distribution of a country, particularly so in the case of working people versus the dependent population. Mishra and Smyth (2010) develops a bidirectional causality relationship across female labour force participation and fertility rates in OECD countries during 1995 to 2005.

Insert Table (6): Diagnostic Test.

Insert Figure (13a): Plot of CUSUM Test, Country: Bangladesh.

Insert Figure (13b): Plot of CUSUM Test), Country: India.

Insert Figure (13c): Plot of CUSUM Test), Country: Nepal.

Insert Figure (13d): Plot of CUSUM Test, Country: Sri Lanka.

Insert Figure (14a): Plot of CUSUMSQ Test, Country: Bangladesh.

Insert Figure (14b): Plot of CUSUMSQ Test), Country: India.

Insert Figure (14c): Plot of CUSUMSQ Test, Country: Nepal.

Insert Figure (14d): Plot of CUSUMSQ Test, Country: Sri Lanka.

Discussion

According to Basu (2003) scrutiny of the data of the Demographic and Health Surveys show that in countries other than in South Asia there is a choice for a balanced number of children of both the sexes. The countries in South Asia rather reveal in their fertility and reproductive behaviour preference towards the son. The most important cause of woman's not using contraceptives is related to her perceptions of society that use of contraceptives is not acceptable and she believes her changing attitude may create conflict in the family. Education, strong family planning motivation however, has affected the couples' family planning behaviour provided the women have access to affordable contraceptive services. Barro (1991) observes that the growth in the quantity of human capital per capita is likely to increase higher rates of investment in human capital and as well as physical capital, this will lead to higher per capita economic growth. The preference of households in having few but educated children will augment human capital formation and will ultimately raise the productivity of the nation. Becker (1993) opines that accumulation of human capital augments technological progress and enhances economic growth. The classical theories of fertility evolution propose that one of the prerequisites of fertility falloff is the shifting economic value of children. Caldwell (1976) in his wealth flow theory opines that with rise in economic growth the direction of wealth flow changes from upward (children to parents) to a downward direction (parents to children). So preference pattern moves towards having fewer children. Seetharam, (2002) observe that improved services of awareness, decline in child mortality accompanied by rising income levels have led to augmenting demand for contraceptives in most South Asian countries. Bangladesh and India have experienced, successful family planning programmes while Pakistan lacks sufficient commitment in making the family planning programs effective, Robinson

(2001).

The Millennium Development Goals, Bangladesh Progress Report (2008) opines that the fertility rates among the adolescent in Bangladesh will show further declining trend if the access to higher education is enhanced. There is a need for awareness towards the importance of safe motherhood and reproductive health behaviour. The report feels that there are lacuna towards achieving the Goal 5 of the Millennium Development Programme. The maternal mortality rate in Bangladesh is the highest among the South Asian countries. Ram. F, et al. (2014) observe that there is a strong need to introduce family education in India before adolescents and young women enter into the family making process. Misconceptions need to be done away with only through the spread of education. However a heartening feature is due to the introduction of Janani Suraksha Yojana the delivery of babies by registered medical practitioners has increased subsequently. Nepal has made significant progress in reducing maternal mortality rates from 1990 to 2005. The fraction of women delivering their babies under the supervision of a skilled birth attendant rose from just 7 percent in 1990 to 55.6 percent in 2014, this is an eightfold rise. However, these development efforts have not been identical and significant discrepancies occur between rural and urban areas and among different groups, Nepal and the Millennium Development Goals, Final Status Report,(2000-2015). Malik and Kayani (2014) observe that in Pakistan there is an urgency upon the need to create universal maternal health care delivery system to achieve the Goal 5 of the Millennium Development Programme. Unique options concerning preference of contraceptive systems occur across the varying regions of the country. Pakistan still needs to put in arduous efforts to meet the Millennium Development Goal's (5) target of 2.1 births per woman. Sri Lanka has attained substantial accomplishment in diminishing maternal mortality. However, strong

supervision by health authorities is necessary to accomplish the target of the Millennium Development Goal (5). The regional disparities need urgent attention. Concerted efforts for six decades in improving the maternal health care facilities has helped in reducing the maternal mortality rates and fertility rates. Millennium Development Goals, Country Reports, Sri Lanka (2014). To continue with the task of reducing fertility rate and improving upon the maternal health an improved commitment from governmental associations and other independent organizations is required to realize and inspect family planning policies in order to confirm the observance to and providing of the most suitable contraceptive method for couples.

Strong preference for male children explain to a certain extent the difference between the fertility behaviour and desired family size. In the South Asian countries under study the women do not have the ability to decide upon the reproductive goals. Family planning guidelines in the South Asian countries should unequivocally try to dampen the son preference in the family or subside the patriarchal arrangement of the family. The achievement and efficacy of family planning and reproductive health programmes may be incomplete if families carry on to have children until they have their preferred number of sons. The efforts should be directed towards methods to make daughters more respected and treasured in the families. The social, cultural organizations and religious heads can work together to influence the family's fertility behaviour in these countries. Religion affects the individual's fertility options through choice of marriage as the model of blissful conjugal life, union, and strength. The Governments should put more persuasive towards raising women's educational opportunities, employment options and bringing legal improvements for the property rights of women, which would augment her economic decision making behaviour, these would be crucial for enhancing the contraceptive use prevalence rates and

subsequently diminishing the fertility rates. Moreover, adequate consideration should be given in dealing with the difficulties in using contraceptives by our women.

Developing countries are exploring the subject matter, which is what is the threshold level of income that would influence fertility rates to decline to a specified level? Sinding (2009) observes that countries which have focused family planning policies have been successful in attaining high rates of economic growth, declining poverty levels and fertility rates. The study argues that fertility decline is a necessary condition for economic growth, however, for a sustained decline in the fertility levels the efforts of the government should be directed towards investment in human capital development. Das Gupta et al. (2011) discusses the importance of policies and institutions in influencing economic growth, poverty decline and its effect on reducing fertility rates. The study continues that low fertility rates are associated with better health opportunities for women, increased levels of schooling which increases the female labour force participation.

With rising economic growth in the industrial economies work opportunities augmented, this enhanced the productive use of women's time division. inspite of the substitution effect of enhanced incomes. There is a growing research which attempts to explain the fertility behaviour along with economic growth. The economic theories are initiated on the assumption that fertility actions of couples in a country are built chiefly on economic considerations. The advocates of the economic theory of fertility are Becker (1960); Leibenstein, H. (1974), Easterlin (1975) and Caldwell (1976). Becker (1960) described the fertility choices of a couple through an economic model. He explains that the negative correlation occurs between income and family size due to the negative connection between income and knowledge about contraceptive usage. Becker (1960) pioneering work develops two theories about total fertility rates founded

upon the household economics method. The former is founded on allocation of time, where having children and rearing them are structured to be more time consuming. (Becker, 1960). The second theory discusses on the substitution behaviour of households towards expenditure on children rather than having more babies, so it explains the quantity and quality trade off, as family income rises. So, with increasing income fertility decreases. According to Leibenstein, (1974), having children involve two types of costs (direct and indirect) and there are also utilities linked with it. The utilities related to having children include the subjective preference in upbringing children, the utility associated with the child moving towards the labour market- the third utility comes in the form of old age security to the aging parents. The choice of having children rests on the economic development chiefly the income of the parents. With increasing income of the parents the second and third utility of having children has a trend to decline. So fertility choices and economic growth are inversely related. Easterlin (1975) explains that the factors of fertility rest on the desire to have the children vis –a vis the costs for fertility control. The cost of fertility comprises of the individual assessment towards fertility and accessibility to fertility controls. According to Caldwell, (1976) there are two methods of family organization, differ chiefly in the method wealth moves through generations. The central point of the current research is explaining fertility behaviour as endogenous to the economy.

Since then a number of studies discusses about fertility behaviour, economic growth, female education and labour market participation. 2005. Cheng et al. (1997) discusses that a unidirectional causality is found between fertility rates and female labour force participation rate in Japan. According to Narayan (2006), while exploring the fertility behaviour in Taiwan in a cointegration framework, women's labour force participation, education, age of women during the time of first marriage along with institutional

factors explain the decline in fertility trends in Taiwan. Doran (2012) observes in the case of Ireland labour force participation among the female population explain crucially the changes in fertility rate. Lakhan (2015) explores the fertility behaviour among women in Pakistan. Using ARDL econometric approach the study explores the role education, female work participation in explaining the fertility behaviour of women in Pakistan. Siah and Lee (2015) discuss for Malaysia that mortality changes influence crucially the fertility behaviour in the long run. Further the study opines that presence of children does not restrict employment opportunities among women in Malaysia. The paper adopted an ARDL model for the analysis. Kengnal, and Bullappa (2016), using data sets for India , in a VECM and Granger causality framework concludes that urbanization, female labour force participation, rising per capita incomes influence in the long run the fertility behaviour among women in India.

The implications developed from the present study is crucial for policy decisions focusing on fertility and demography for the major South Asian countries. The results demonstrate that there is a negative association between fertility rates and economic growth in India, Nepal, Bangladesh, and Sri Lanka. So in the newly emerging industrial countries economic growth has favoured a drop in fertility. However, the causal relation between economic behaviour and demographic transition is more complex, more elaborative econometric exercises may be required to explain the manner in which the variables are associated. The issue does high fertility rates aggravates poverty and should thus receive adequate policy considerations has not been discussed in the present study. However, it must be understood that if the desire to have more children is the perceptions of the parents, it is their preference pattern and the will to forego alternative forms of consumption. Against this backdrop policy prescriptions to control fertility behaviour would yield little results. On the other hand, if the outcome of

fertility is owing to unwanted pregnancies then public policies to institutionalize the use of contraceptive will have a strong bearing on birth control and it will go a long way in improving the maternal health of the Asian women. Micro level research may throw important light on the issue of economic growth and fertility behaviour, which is beyond this research. The heavy centralized approach of the family planning programmes in the Asian countries explored here, based on the aggregate results may be confounding, because regional differences may create mismatch towards goals and attitudes of the local towards birth control.

Conclusion

In this paper, we have tried to restructure the discussion of how economic growth affects, the trends in contraceptive use and fertility affects along logical and quantifiable dimensions. We have tried to circumvent the procedural shortcomings that are evident in the previous literature. We first observe the trend behaviour in contraceptive use then subsequently we have investigated upon the factors responsible for such trends, based on the policy directives. Then we have attempted to obtain covariation with fertility behaviour and economic development, in order to specify the causal links. The paper utilizes the bounds testing methods to obtain the long run relation across fertility rate, contraceptive use behaviour across economic growth between India and neighbouring countries over 1970 to 2018. The findings from the current study is important in improving the quality of life among the women of South Asian countries against the backdrop of the millennium development Goal. Policies to reduce the fertility rate and education on the use of the contraceptives not only reduces women's health risks, especially in the rural areas, but also ensures better nutrition, and education among the fewer children in the early period of childhood development.

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List of Tables to insert

Table (1) : Data Description

Variables	Description	Source
TFR	Total Fertility Rate. It's the average number of children that would be born to a woman if she were to pass through all her childbearing years conforming to the age-specific fertility rates of a given year.	Period: 1970-2018. Source: World Development Indicators, World Bank
CONT	Contraceptive prevalence is defined as the percentage of women currently using any method of contraception among all women of reproductive age (i.e., those aged 15 to 45 years, unless otherwise stated) who are married or in a union. The "in-union" group includes women living with their partner in the same household and who are not married according to the marriage laws or customs of a country	Period: 1970-2018. Source: United Nations, Department of Economic and Social Affairs, Population Division, Fertility and Family Planning Section
GDP	GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy	Period: 1970-2018. Source: World Development Indicators, World Bank.

Table (2): Percent in contraceptive use among women (15-45 age group), in the countries, 1970–2018

Years	Countries					
	Bangladesh			India		
	TM	MM	AM	TM	MM	AM
1970	2.1	3.6	5.7	3.5	8.1	11.6
1980	4.5	10.6	15.1	5.6	22.9	28.5
1990	7.7	28.2	36	5.7	36.2	41.9
2000	9.2	44.3	53.5	5.8	43.2	48.9
2010	8.1	51. 7	59.7	6.1	48.8	54.9
2018	7.1	57.1	63.9	5.7	51	56.1
Years	Countries					
	Nepal			Pakistan		
	TM	AM	MM	TM	AM	MM
1970	0.3	3.1	3.5	1.2	3.1	4.3
1980	0.5	8.6	9.2	1.2	4.2	5.4
1990	0.9	18.9	19.7	2.4	9.2	11.6
2000	1.3	32.9	34.2	5.3	20.1	25.4
2010	2.8	44.8	47.6	7.9	23.9	31.8
2018	3.1	51.4	53.3	8.9	31.7	40.1
Years	Countries					
	Sri Lanka					
	TM	AM	MM			
1970	14.1	18.6	32.6			
1980	18.5	31.7	50.2			
1990	19	45.2	64.2			
2000	16.7	51.6	68.3			
2010	14.5	56.4	70.9			
2018	13	58.6	72			

Source: United Nations, Department of Economic and Social Affairs, Population Division

Note TM stands for Traditional Method, MM stands for Modern Method, and AM stands for Any Method

Table (3): Unit Root test

Variables at Level	Bangladesh		India	
	ADF	PP	ADF	PP
TFR	0.61	-1.77	-3.76	-0.27
GDP	-3.70	-7.12	-1.38	-1.77
CONT	-7.23	-29.32	-15.84	-36.21

Variables at first difference	Bangladesh		India	
	ADF	PP	ADF	PP
ΔTFR	-6.79	-32.01	-5.56	-29.53
ΔGDP	-4.77	-27.01	-7.84	-36.85
ΔCONT	-0.22	-10.72	-0.89	-0.32

Variables at Level	Nepal		Pakistan	
	ADF	PP	ADF	PP
TFR	-6.47	-31.21	2.39	0.60
GDP	-2.77	-6.24	-1.44	-7.31
CONT	-8.37	-26.01	-0.79	0.39

Variables at first difference	Nepal		Pakistan	
	ADF	PP	ADF	PP
ΔTFR	-1.33	-2.72	-7.33	-52.01
ΔGDP	-9.48	-52.01	-5.43	-32.43
ΔCONT	-1.43	-4.61	-8.14	-27.99

Variables at Level	Sri Lanka	
	ADF	PP
TFR	-6.3	-28.72
GDP	-2.77	-6.24
CONT	-18.68	-19.94

Variables at First Difference	Sri Lanka	
	ADF	PP
ΔTFR	6.47	1.21
ΔGDP	-8.18	-51.39
ΔCONT	-1.55	-2.76

Source: Authors' calculation. Note: Critical values -4.19; -3.52 for ADF statistics, at 1%and 5% levels of significance respectively. Critical values -25.06;-19.42 for PP statistics, at 1%and 5% levels of significance respectively.

Table(4): Bounds testing approach for co-integration

F statistics	Bangladesh	India	
FTFR(TFR/GDP,CONT)	11.35*	7.48*	
FGDP (GDP/TFR,CONT)	2.12	9.23*	
FCONT (CONT/TFR,GDP)	3.12	7.77*	
F statistics	Nepal	Pakistan	Sri Lanka
FTFR(TFR/GDP,CONT)	8.77*	2.62	12.38*
FGDP (GDP/TFR,CONT)	2.33	2.76	10.33*
FCONT (CONT/TFR,GDP)	7.77*	2.12	11.32*

Note: The results are based on unrestricted intercept and no trend."*"Denotes level of significance at 5%level.

Table (5): Results of Granger Causality

Bangladesh	F Statistics (Probability)			
Dependent Variable	ΔTFR	ΔGDP	ΔCONT	ECTt-1 (t statistics)
ΔTFR		-0.03	0.02	-0.35*
ΔGDP	-0.26*		0.23	-0.12
ΔCONT	-0.75	-0.081		0.31
India	F Statistics (Probability)			
Dependent Variable	ΔTFR	ΔGDP	ΔCONT	ECTt-1 (t statistics)
ΔTFR		-0.084*	-0.016*	-0.34*
ΔGDP	-0.58*		0.32	-0.12*
ΔCONT	-0.92	-0.03		0.11
Nepal			F Statistics (Probability	
Dependent Variable	ΔTFR	ΔGDP	ΔCONT	ECTt-1 (t statistics)
ΔTFR		-0.04*	-0.27*	-0.32*
ΔGDP	-0.23		0.091	0.29
ΔCONT	0.078	0.045		-0.11*
Sri Lanka		F Statistics (Probability)		
Dependent Variable	ΔTFR	ΔGDP	ΔCONT	ECTt-1 (t statistics)
ΔTFR		-0.011*	-0.091*	-0.79*
ΔGDP	-0.60*		0.31	-0.54*
ΔCONT	0.11	0.22*		-0.22*

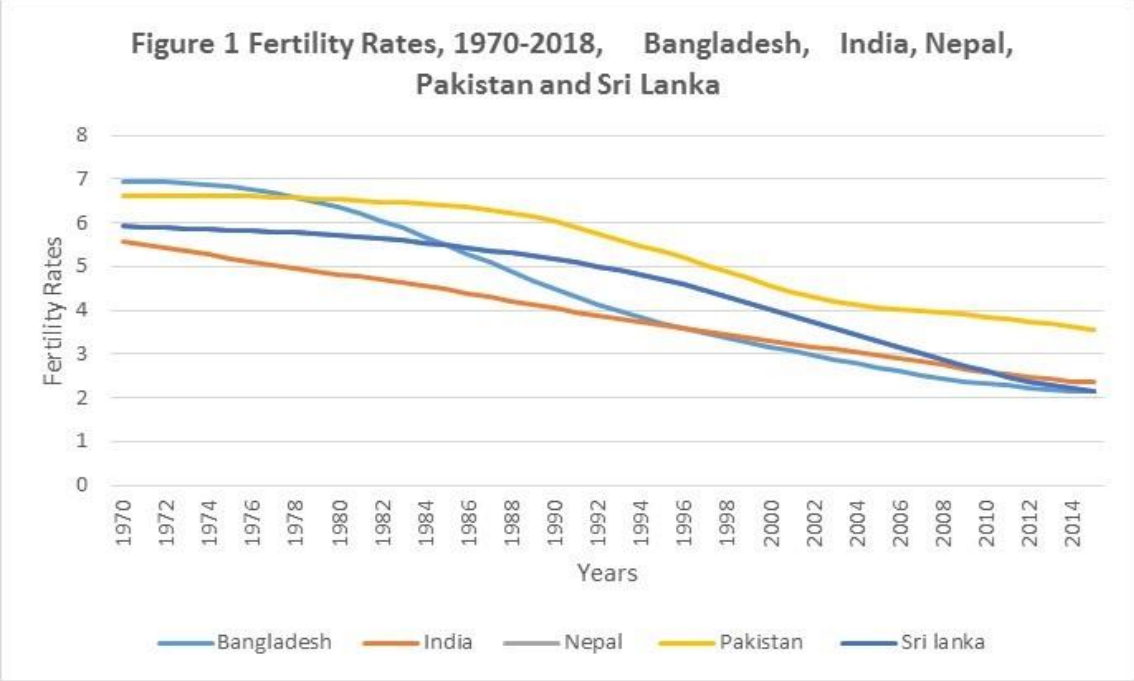
Note: * Denotes the level of significance at 5% level.. Compilation: Author

Table (6): Diagnostic Test

Countries	Bangladesh	India	Nepal	Sri Lanka
Serial Correlation	(0.17)	(0.15)	(0.29)	(0.55)
Heteroscedasticity	(0.45)	(0.34)	(0.23)	(0.32)
Normality	(0.23)	(0.21)	(0.45)	(0.22)
DW	1.34	1.89	1.43	1.32
R^2	0.85	0.77	0.87	0.89

Note: The numbers in parenthesis under diagnostic tests are the p - values. DW is the Durbin–Watson test statistic. Compilation: Author

List of Figures to insert



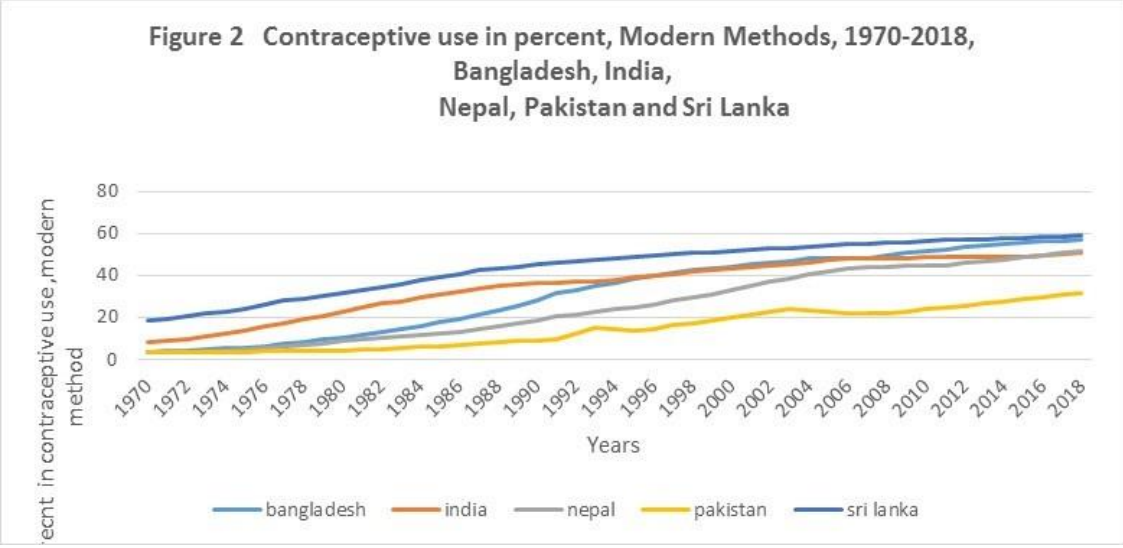


Figure 3 Decadal Growth rate in use of contraceptives, Bangladesh

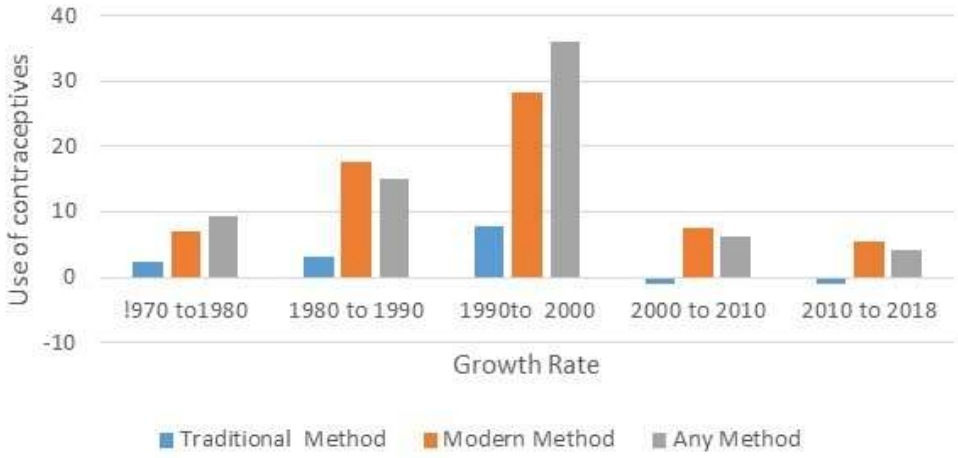
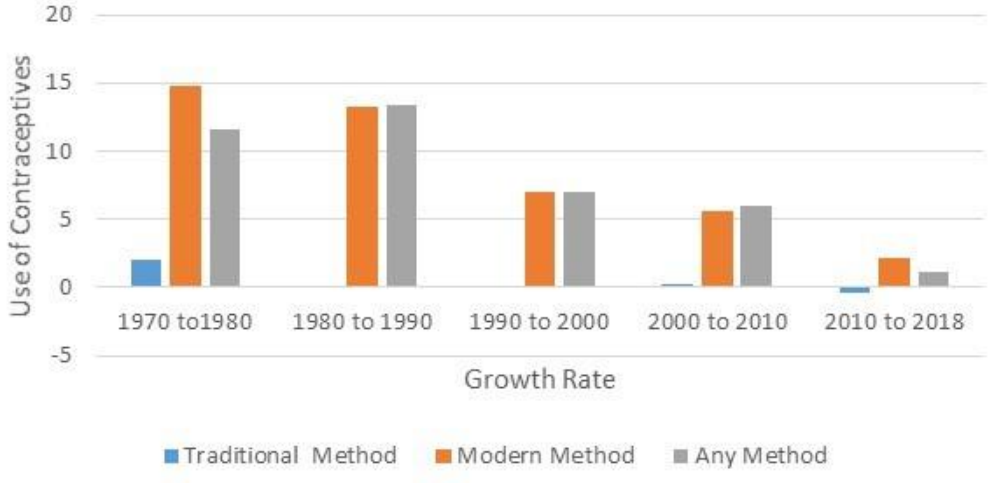


Figure 4 Decadal Growth rate in use of contraceptives, India



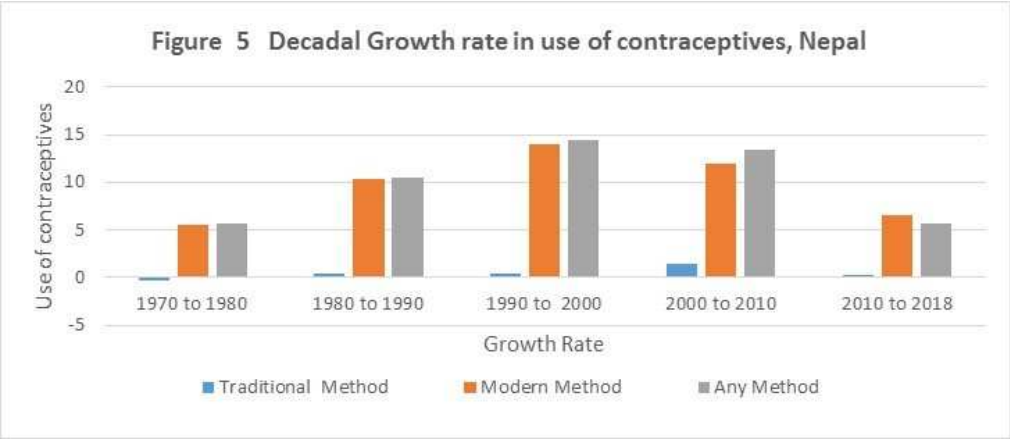


Figure 5 Decadal Growth rate in use of contraceptives, Nepal
Use of contraceptives
20
15
10
5
0
-5
1970 to 1980
1980 to 1990
1990 to 2000
2000 to 2010
2010 to 2018
Growth Rate
Traditional Method
Modern Method
Any Method

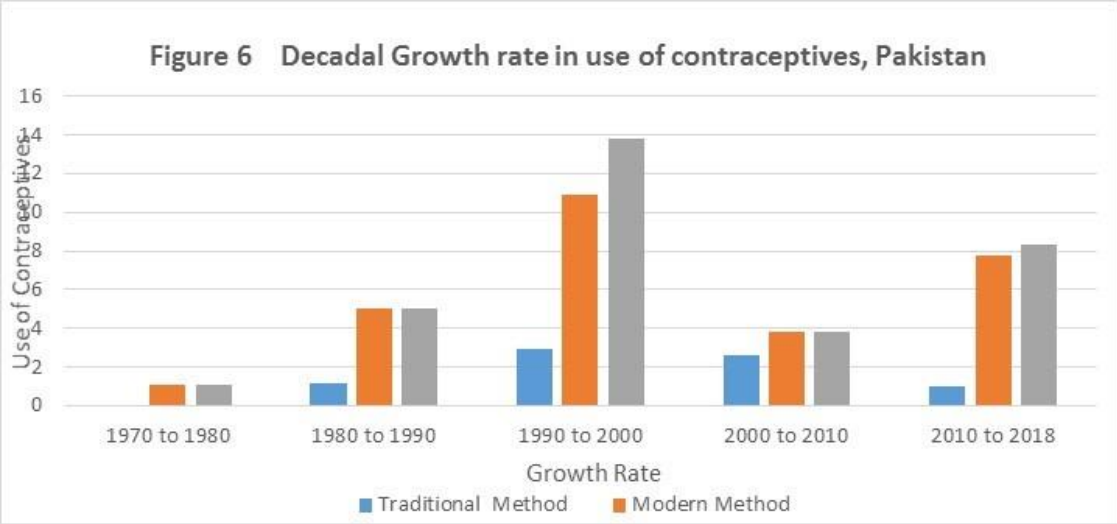


Figure 6 Decadal Growth rate in use of contraceptives, Pakistan
Use of Contraceptives
16
14
12
10
8
6
4
2
0
1970 to 1980
1980 to 1990
1990 to 2000
2000 to 2010
2010 to 2018
Growth Rate
Traditional Method
Modern Method

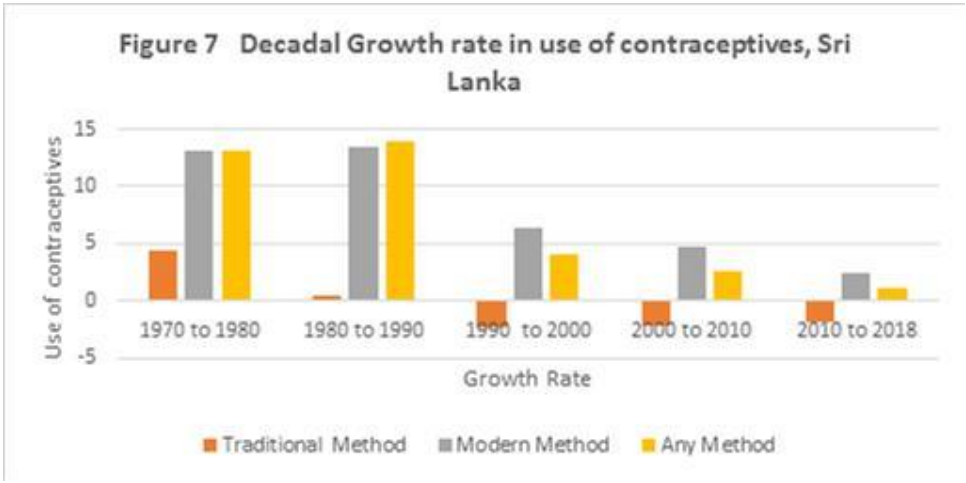


Figure 7 Decadal Growth rate in use of contraceptives, Sri Lanka
Use of contraceptives
15
10
5
0
-5
1970 to 1980
1980 to 1990
1990 to 2000
2000 to 2010
2010 to 2018
Growth Rate
Traditional Method
Modern Method
Any Method

Figure (8): Scatter Diagram contraceptive use and fertility rate, Bangladesh

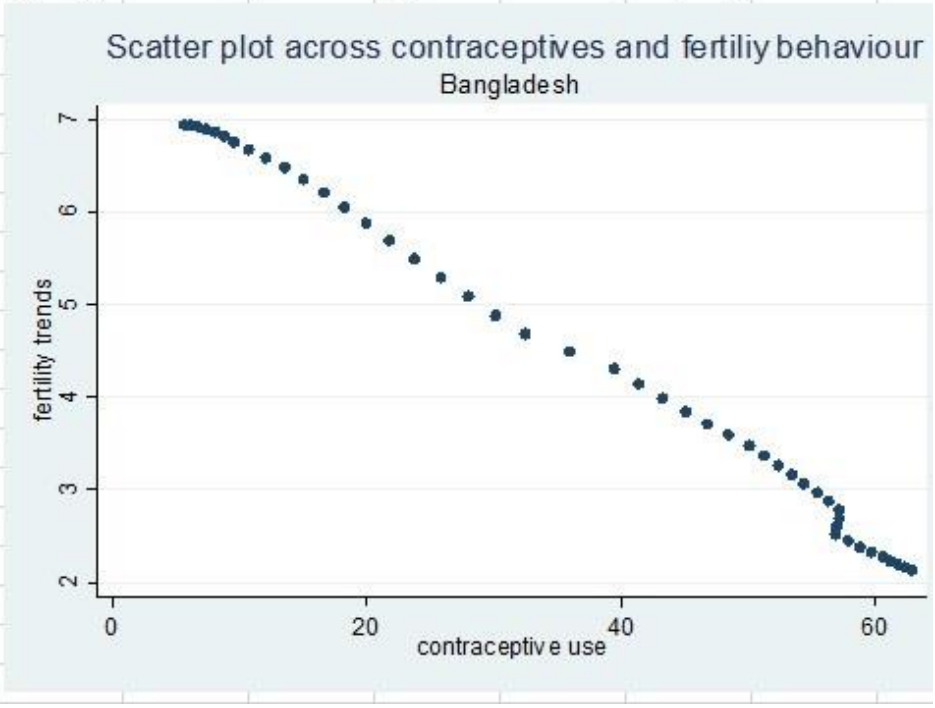


Figure (9): Scatter Diagram contraceptive use and fertility rate, India

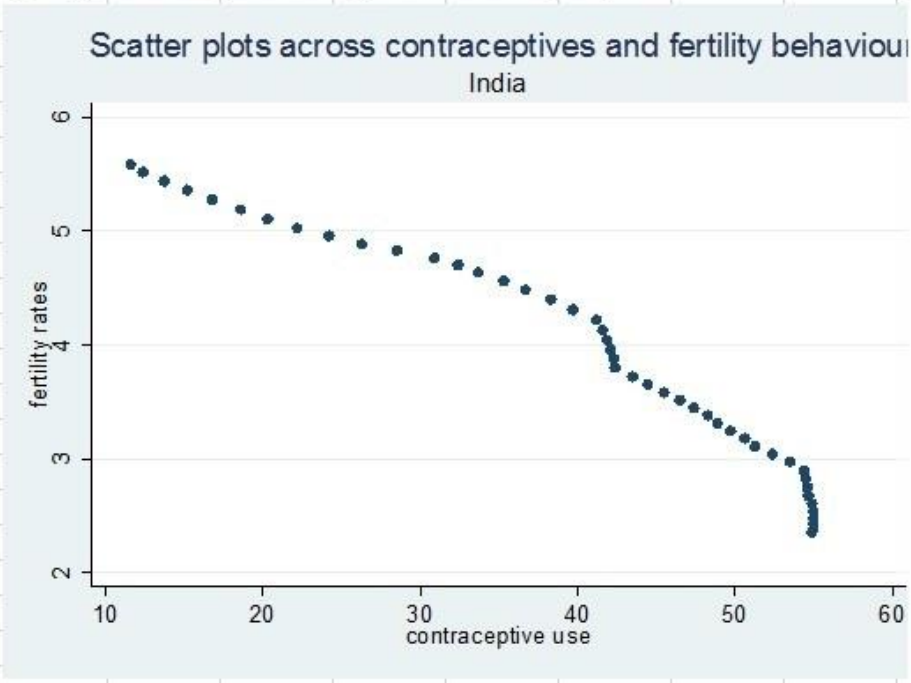


Figure (10): Scatter Diagram contraceptive use and fertility rate, Nepal

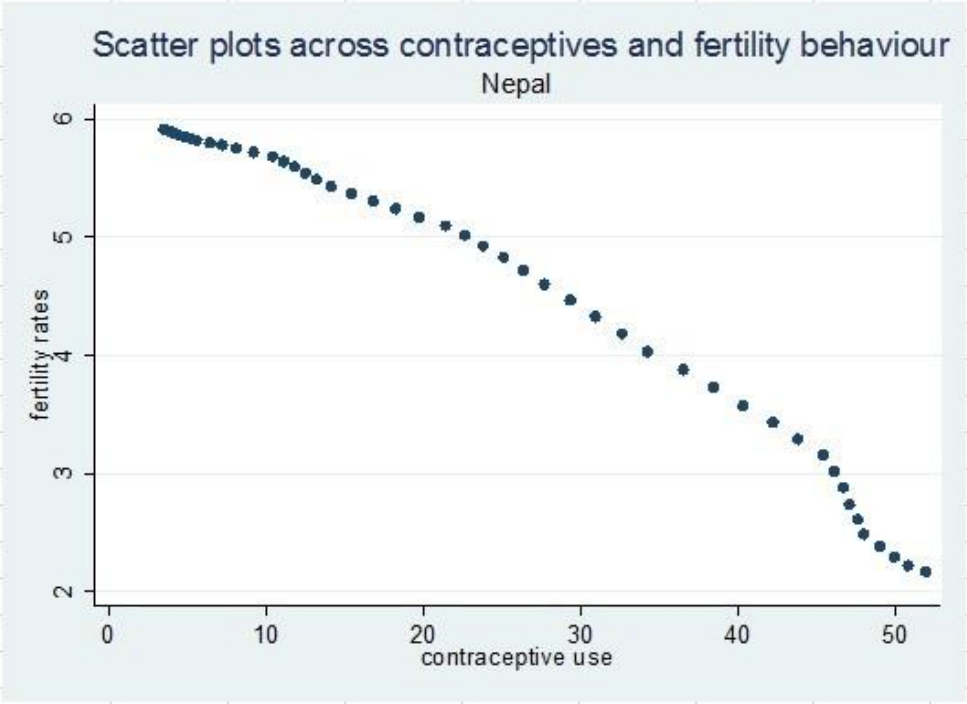


Figure (11): Scatter Diagram contraceptive use and fertility rate, Pakistan

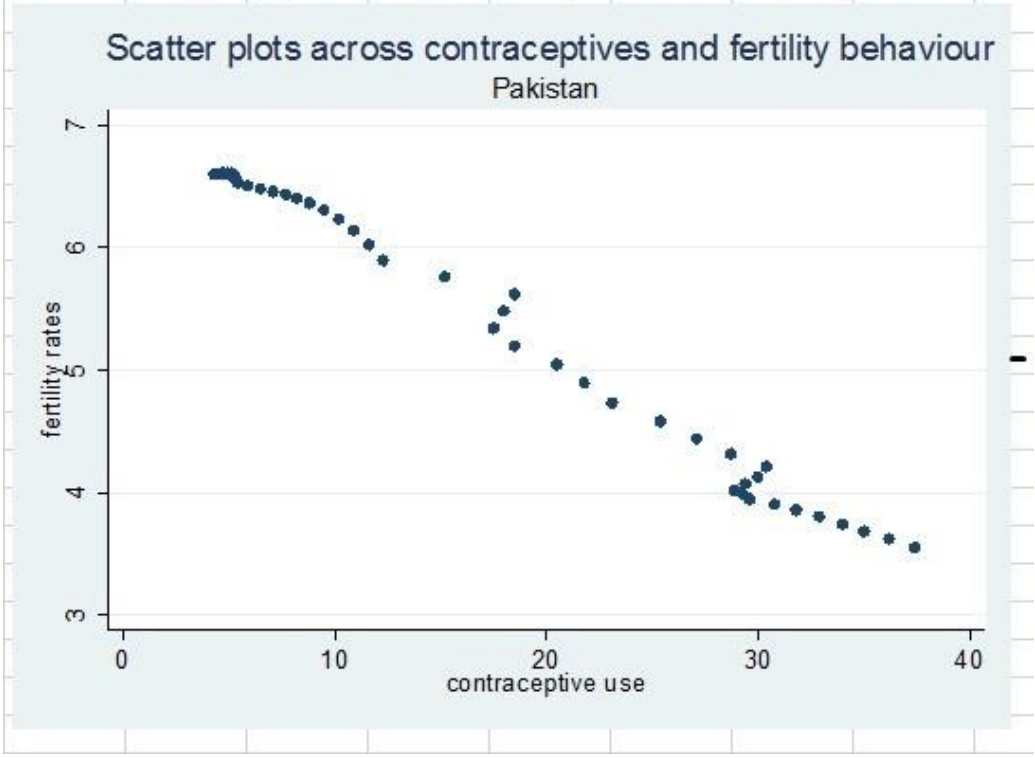


Figure (12): Scatter Diagram contraceptive use and fertility rate, Sri Lanka

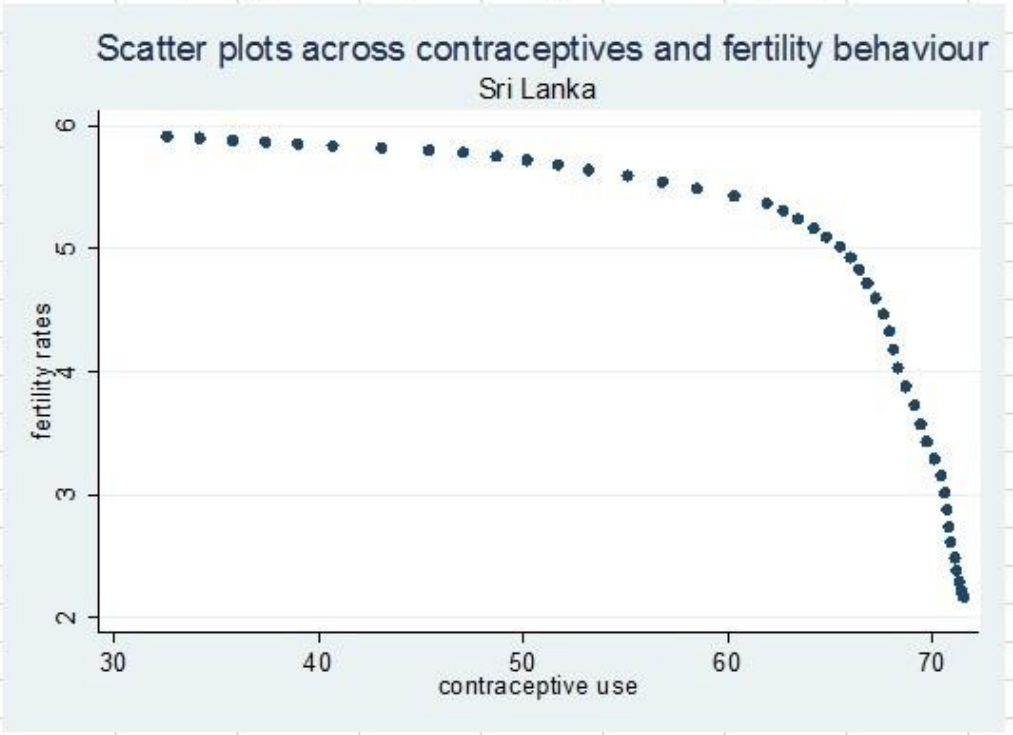


Figure (13a): Plot of CUSUM Test ,Country :Bangladesh

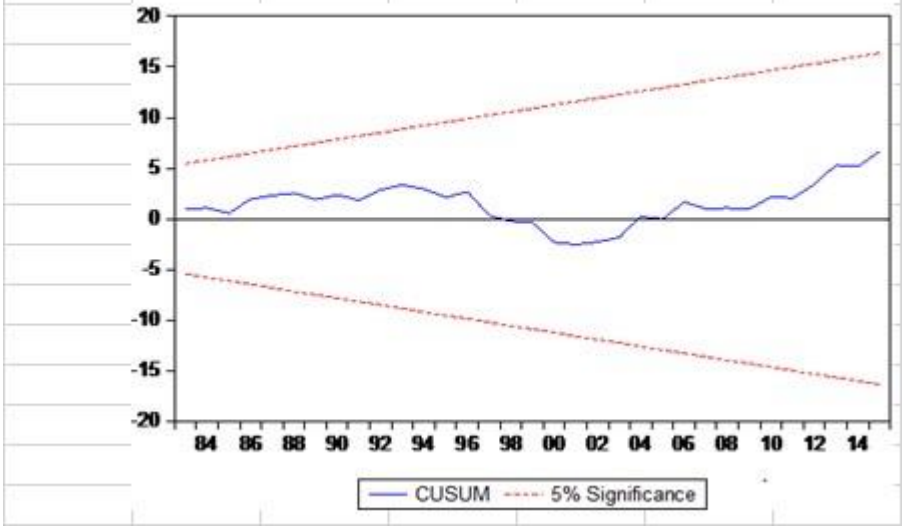


Figure (13b): Plot of CUSUM Test), Country: India

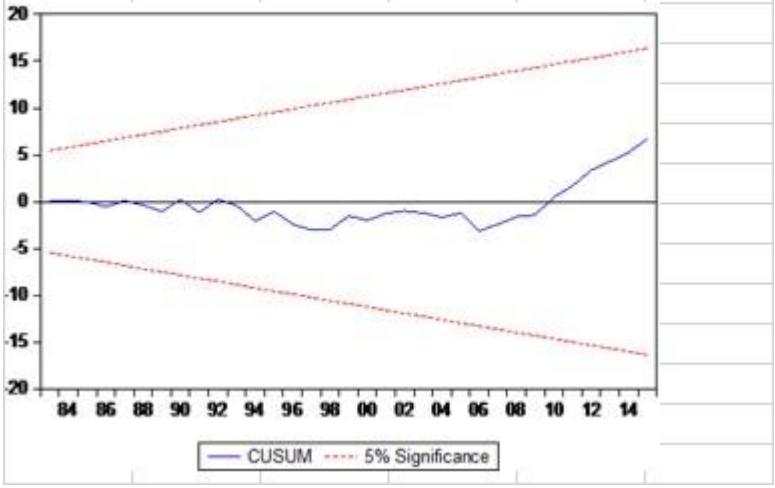


Figure (13c): Plot of CUSUM Test), Country: Nepal

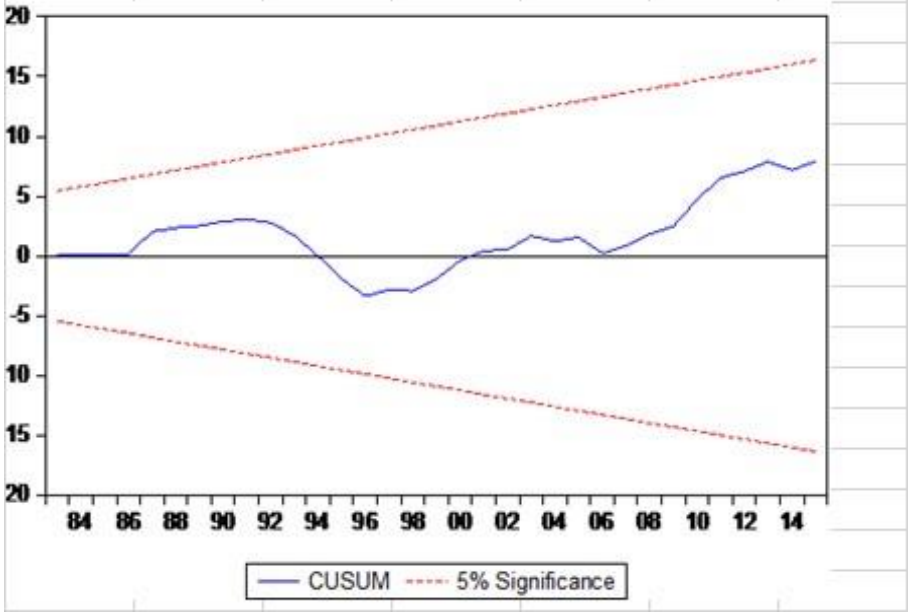


Figure (13d): Plot of CUSUM Test, Country: Sri Lanka

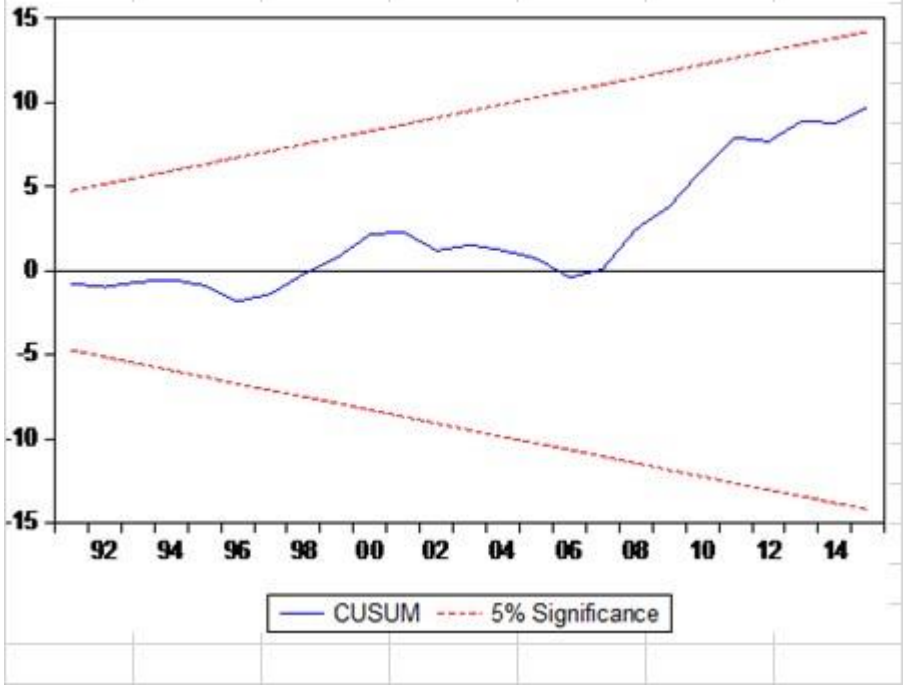


Figure (14a): Plot of CUSUMSQ Test, Country: Bangladesh

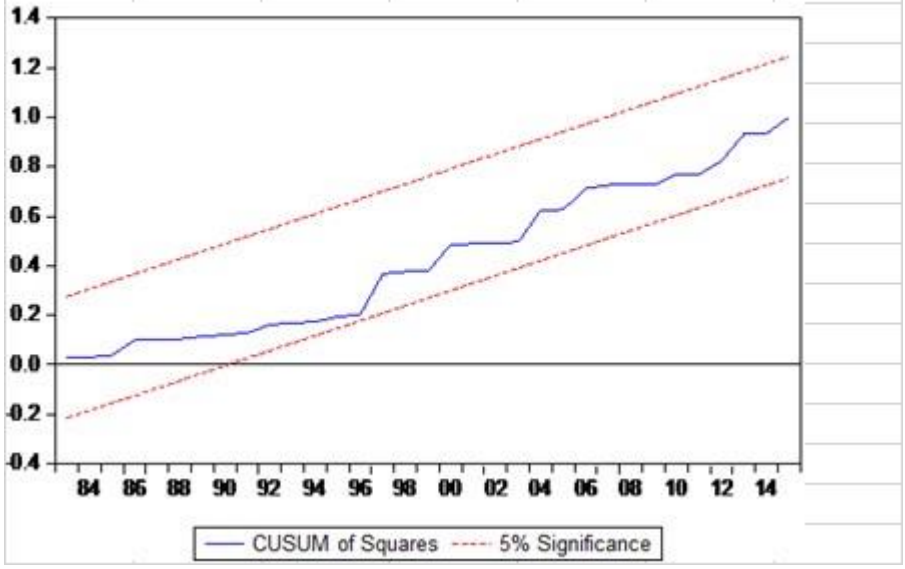


Figure (14b): Plot of CUSUMSQ Test), Country: India

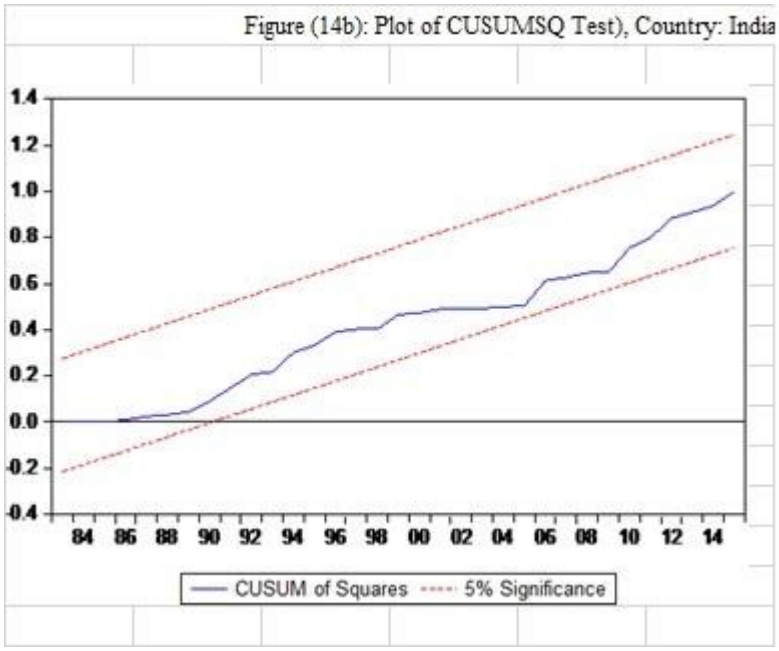


Figure (14c): Plot of CUSUMSQ Test, Country: Nepal

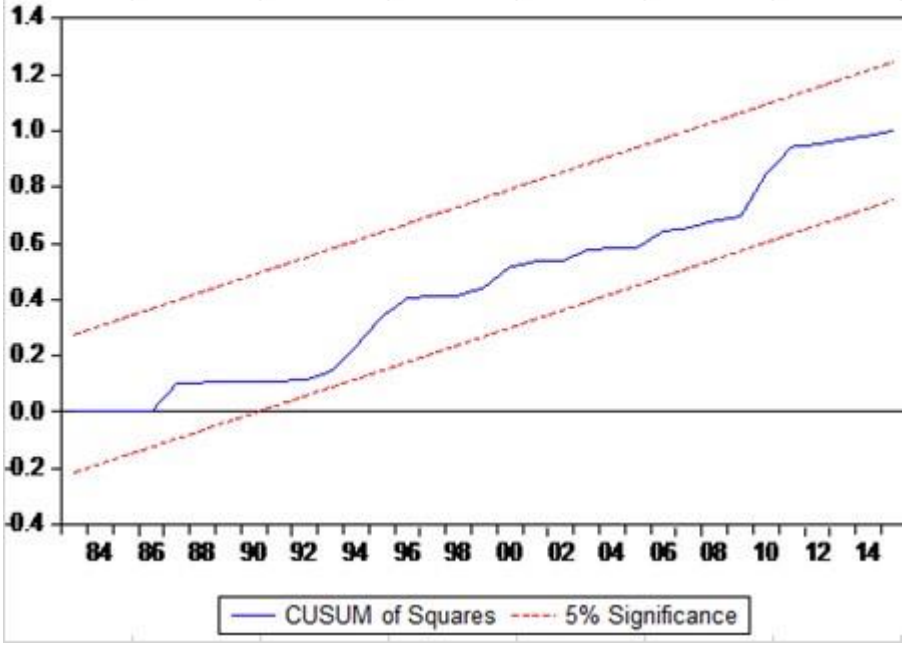


Figure (14d): Plot of CUSUMSQ Test ,Country: Sri Lanka