Determinants of Social Progress and its Scenarios under the role of Macroeconomic Instability: Empirics from Pakistan

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Abstract: This study has analyzed the determinants of social progress in the presence of macroeconomic instability in Pakistan over the period of 1980 to 2015. Under-five survival rate is used for measuring social progress and a comprehensive macroeconomic instability index is constructed by incorporating inflation rate, unemployment rate, budget deficit and trade deficit. Augmented Dickey-Fuller (ADF), Philips-Perron (PP) and Dickey-Fuller Generalized Least Square (DF-GLS) unit root tests are used for examining the stationarity of the variables. ARDL bound testing approach is used for co-integration among the variables of the model. Granger causality test is used for causal relationship among variables of the model. The estimated results of the study show that macroeconomic instability has negative and significant impact on under-five survival rate in Pakistan. The results reveal that female education, family planning & health cares and availability of food have positive and significant impact on under-five survival rate in Pakistan. Hence, for increasing social progress there is dire need of stable macroeconomic environment. Moreover, for increasing social progress much attention should be paid on female education, family planning & health cares and availability of food in Pakistan.

Keywords: social progress, macroeconomic instability, Pakistan
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I. Introduction

Societal progress/development is the central focus of traditional development economics but that social progress is only concerned with how much command a nation/person has on commodities and resources (Anand and Ravallion, 1993). The modern developmental economists disagree with this view point, as Sen (1983) mentions that the amount of goods is not social development, social development concerns with the capabilities to reduce mortality, morbidity and hunger. Death is unavoidable reality for every living being, but instead of developing countries the developed countries have postponed death for longer time period. Although overall life expectancy of developing nations has increased but under-five mortality rate is still very high (Cleland and Farooqui, 1998). Infant and under-five survival rate are considered most important indicators for social development and social progress. In millennium development goals of 189 countries, United Nations have focused on some main social indicators such as poverty reduction, enhancing the level of education, improving maternal health and reducing child mortality. Guillaumont (2009) mentions that under-five survival rate is the best indicator to overview the social progress of a country in first sight. Now there is vast body of literature is available which considered that high infant and under-five mortality rate is a sign of low social progress and this problem is mainly facing by developing countries of the world. Although this accomplishment is medical oriented but the conclusions of many studies show that there is strong relationship between macroeconomic environment and under-five mortality rate [Preston (1975), Shkolnikov et. al, (1998), Cornia and Paniccia (2000), Gakusi et. al, (2005)].

There is dire need about the precise identification of those channels through which macroeconomic environment impacts infant and under-five morality. There are four channels through which macroeconomic environment of country affects infant and under-five mortality. First, there is positive and direct relationship between national income and child survival. Anand and Revallion (1993) mention that the developed countries have more resources for investment in health

sector and this improved health sector have more opportunities for protecting child. Second, there is direct and positive relationship between economic growth and provision of better social services. Economic growth work as driving force behind economic development as economy grows urbanization and industrialization improve the living standard through easy access to medical cares and nutritional foods which decrease the infant and under-five mortality. Mosley and Chen (1984) explain that economic growth enhance provision of some basic social services such as health cares, sanitation, clean drinking water and epidemiological protection which further lower the mortality and higher the life expectancy. Third, economic growth reduces the poverty level, in this way basic necessities of life are easily accessible to general public like food, health cares and education. So, stable macroeconomic environment reduces infant and under-five mortality with the help of proper and improved provision of social services. Baird et al., (2011) conclude that income instability has direct impact on consumption pattern of households, as in highly instable economy when households have less amount of money for private consumption then they spend less on nutritional foods, infant health inputs and health cares of child when it got ill. Forth, maternal education and female labor force participation also reduce the infant and under-five mortality. Hojman (1994) argues that on one side maternal education put direct negative impact on mortality as educated female are more concern about the health cares and nutritional foods. On the other side, female labor force participation and working female can easily understand the time value between labor force participation and child rearing and caring. So couple decides to make gap among children and reduced fertility enable a couple to give more attention to child cares which reduces mortality.

The main objective of this study is to find the determinants of social progress in the presence of macroeconomic instability in Pakistan over the period of 1980 to 2015. The macroeconomic condition of Pakistan shows that Pakistan has been facing high budget deficit, high exchange rate, high inflation rate and high unemployment rate. The health status of Pakistan shows that people are gaining better health cares from last three decades. The main target of health sector is to increase the quality of life and brings changes in life style. For achieving this target many significant steps are taken such as health promotion towards prevention of diseases, family planning, increase the coverage of immunization and provision and better services of lady health workers. The main focus of national health policy under the umbrella of millennium development goals Pakistan should reduce child and maternal mortality in 2015. But empirics show that under-five mortality rate is 86.5 per 1000 which is highest in South Asian region (Economic Survey of Pakistan, 2015). This study uplifts the curtain that either macroeconomic instability and family planning and health cares impact under-five survival rate in Case of Pakistan or not. So Pakistan is very interesting case study for investigating the impact of macroeconomic instability on under-five survival rate and it will be a healthy contribution to existing literature. This type of exercise is hardly done in case of Pakistan.

II. Literature Review

In previous literature micro as well as macro level studies are available which investigates the relationship between different mortality rates and economic conditions. Some of very important and most relevant studies are presented here: Subbarao and Raney (1995) study the relationship of female education, family planning program on fertility and mortality. The results of this study show that health programs and family planning programs reduce the rate of mortality and fertility in sample countries. They mention that the results should be more strengthened with using female education as an independent variable, because educated women preferred low fertility and high health cares. Generally, for investigating the impact of macroeconomic instabilities on under-five mortality rate, it is necessary to check the way macroeconomic instability behave for social progress. On one hand, macroeconomic instability increases under-five mortality rate by decreasing economic growth of the country. On the other hand, inflation rate and unemployment rate has direct positive relationship with under-five mortality (Cleland, 2001).

The impact of macroeconomic environment on infant and under-five mortality rate needs precise identification of those channels through which macroeconomic environment impacts infant and under-five morality. There are four channels through which macroeconomic environment affects infant and under-five mortality. First, there is positive and direct relationship between per capita income and child survival. Anand and Revallion (1993) mention that developed countries have more resources for investment in health sector and this improved health sector has more opportunities for protecting child. Second, there is positive relationship between economic growth and provision of better social services. Economic growth work as driving force behind economic development as economy grows urbanization and industrialization improve the living standard through easy access to medical cares and nutritional food which decrease the infant and under-five mortality. Mosley and Chen (1984) explain that economic growth enhance provision of some basic social services such as health cares, sanitation, clean drinking water and epidemiological protection which further lower the mortality and rise the life expectancy. Third, economic growth reduces the poverty level, in this way basic necessities of

life like food, health cares and education are easily accessible to general public. So, stable macroeconomic environment reduces infant and under-five mortality with the help of proper and improved provision of social services.

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Pritchett and Summers (1996) investigate the relationship of macroeconomic performance and child death in case of developing countries in 1990s. They used income for macroeconomic performance and control the effect of other instrumental variables so that reverse causation might not occur in cross country data. The results of the study highlight that income has negative relationship with child mortality in case of developing countries, as increase in income leads to better health facilities for improving child survival. The results explain that 1 percent increase in income reduced mortality by 1 out of 1000 in case of sample developing countries.

Pandey et al., (1998) highlight the socio-economic conditions impacting child morality in case of India based of survival analysis. The results of the study show that illiterate mothers, low sanitation facilities, birth in rural areas and low media information tend to increase the mortality in case of India. But they conclude that by including some other demographic variable the impact of the above variables can be reduced.

Bengtsson (1999) examines the hypothesis that macroeconomic fluctuations have an impact on child mortality and different occupational groups have different infant mortality rate. For this purpose the study uses the long run macroeconomic time series data combine with micro data on individual level. The results of the study show that there is no strong relationship with macroeconomic fluctuations, different occupational groups and child mortality. The results of the study confirm that infants are less vulnerable to insecurity and economic fluctuations. But on the other side, infant mortality is strongly influenced by maternal age at birth, breast feed, sex and their birth order.

Agha (2000) examines the socio-economic determinants of infant mortality at micro level in case of Pakistan by using household level data. The results of this study show that poverty at household level has positive relationship with infant mortality, as poor household has less expenditures on food which significantly impact the child survival. The results show that parent education, interval between child birth and the age of mother at child birth have negative and significant relationship with child mortality in case of Pakistan. Ezra and Kiros (2000) conduct a primary study about the child mortality in Ethiopia in the period of food crisis. The results of the study show that child mortality is on highest in the period of drought and famine but in normal times it is not very high. So hunger and lack of food increase the child mortality.

Ali (2001) investigates that the number of uneducated women is larger in rural areas than that of urban areas in Pakistan, and there is inverse relationship between women education and child survival rate. The results of this study show that child mortality decrease because of women education. Women education have strong and positive impact on child survival rate in urban than rural areas in Pakistan. Ezra and Gurum (2002) investigate the condition of child mortality in case of Southern Ethiopic by using the data of community and family survey. The study shows that breastfed and birth interval decrease the death of child and the most of registered death are occurred because of low breastfed and low birth interval.

Grigoriou and Guillaumont (2003) point out that under-five child mortality is a very sensitive indicator of social situation of a country. The rise of under-five mortality is because of shortfall of income but it will not be same decrease as income increase. This study has presented the best functional form for understanding the relationship of under-five mortality rate and income variation for large sample of countries. The results of this study show that macroeconomic instability has negative and significant relationship with under-five child mortality rate in case of developing countries.

While working for the World Bank, Charmabragwala et al., (2004) have investigated the determinants of child health on the basis of household data by using meta-analysis. The results of the study show that income has significant and

negative impact on child mortality. Moreover, parent education, birth interval and mother education has also negative and significant relationship with child mortality. Dehejia and Lleras-Muney (2004) examine the impact of unemployment on child health with the help of parental behavior and parental characteristics. The findings of the study show that high employment reduce the overall births in the society which further lower the infant and general child mortality. The parental characteristics (age of the mother, education of the mother) and parental behavior (breast feed) have negative and significant relationship with child mortality.

Paxson and Schady (2005) examine the relationship of infant mortality and macroeconomic shocks in case of Peru by using Demographic and Health Survey data. Gross Domestic Product (GDP) is used as an indicator of macroeconomic situation. The results of the study indicate that in the period of recession child mortality is increased in Peru, because both public and private expenditures come down in recession. The study concludes that macroeconomic fluctuations have positive and significant relationship with infant mortality in case of Peru.

Galiani et al., (2006) investigate the relationship of child mortality and privatization of water service in case of Argentina by using matching estimation on the basis of micro level data. The matching estimator is used for finding the effect of a programme intervention when other things remaining constant. The results of the study show that child mortality is decreased in those areas where water facilities are privatized. De Bruyn et al., (2006) examine the historical trends in marriages, births and death in case of Netherlands for the period of 1815 to 2000. The results of the study indicate that birth in recession most likely to increase the mortality in the coming years. The results of the study highlight that in Dutch society different occupational groups have different child mortality rates and society is showing inequality between rich and poor for attaining economic needs. Arulampalam and Bhalotra (2006) examine causal effect of infant mortality in case of India by using micro level data. The results of their study show that there is weak scarring effect in those states in India which have strong socio-economic structure and less birth interval has positive relationship with infant mortality.

Bhalotra (2007) examines the relationship of child mortality and macroeconomic shocks in case of different states of India by using demographic data based on cohorts. The overall results of the study conclude that macroeconomic shocks have positive relationship with child mortality at country level. On the other hand, states, level results show that income inequality and political conditions among the states have positive and significant relationship with child mortality. The results highlight that positive growth in agriculture sector becomes one of the big cause of reduction in child mortality in rural areas of different states. Mutinga (2007) investigates the socio-economic determinants of mortality in case of Kenya by using data of Demographic and Health survey. The results of this study show that education of mother, sanitation facilities, safe drinking water, better nutrition, housing condition and better education put negative impact on child mortality. But the households with less amount of these facilities have low child survival rate in case of Kenya.

Schady and Smith (2009) examine the relationship of macroeconomic shocks and infant mortality in case of middle income nations by using Demographic and Health Survey of 17 middle income nations. The results highlight that if the households have less access to credit then they are bound to spend less amount on health that results in high infant mortality. On the other hand, female time value decrease morality as working female less likes more fertility. The results of the study reveal that aggregate negative economic shocks have positive relationship with child morality in case of middle income nations.

Aguero and Valdivia (2010) investigate the interdependence of income and child mortality in case of Peru. The results of the study show 1 percent decrease in income increase the infant mortality between 0.30 to 0.39 percent in case of Peru. The child mortality is positively and significantly related to macroeconomic shocks, especially in recession times.

Baird et al., (2011) examine the relationship of infant survival and macroeconomic shocks in case of middle and low income nations by using Demographic household data. The results show that there is negative and significant relationship between infant mortality and negative shocks in per capita GDP. In case of developing nations when negative shock of per capita GDP is occurred, infant mortality is increased but this increase is most likely to occur in infant girls. Dribe et al., (2011) examine the relationship of agriculture output and infant mortality in case of Sweden for the period of pre-industrialization. The results show that there is negative and significant relationship between grains output and child morality and this relationship has contemporaneous and lag impacts. The results point out that 10 percent decrease in grains output increase 1.1 percent in child mortality in the same year and 1.8 percent in the following year.

III. Family Planning & Health Cares, Macroeconomic Instability and Under-Five Survival: A Theoretical Basis

The main aim of economic theory is to construct economic models that define the economic behavior of an individual and society as whole. Normally, an economic model represents real economic situations of different units in the presence of some assumptions and abstractions. These abstractions depend on the purpose for which the economic model has been constructed. The basic objective behind the construction of an economic model is to analyze and predict. The predicting power, provided information, realism and simplicity of assumptions and generality would decide the validity of an economic model (Lange, 1946 and Nagel, 1963). This study examines the impact of macroeconomic instability on social progress in Pakistan. Inflation rate, unemployment rate, trade deficit and budget deficit are used for the construction of macroeconomic instability index and human well-being, under-five survival rate and income inequality are used for measuring social progress in Pakistan. The detail theoretical background of the model provides strong basis for construction of this model.

III.I The Model

Mosley and Chen (1984) introduce a theoretical framework for child survival, this is the first time when biological as well as socio-economic factors are used to determine the child survival in case of developing countries. They mention that socio-economic factors need proximate factors for affecting child survival, because proximate factors or biological factors have direct whereas socio-economic factors have indirect relationship with child survival. The basic model of Mosley and Chen (1984) explains the main factors which have direct and indirect impact for community health. On one side maternal factors, environmental contamination, nutrient deficiency and injury have direct influence for sickness and on the other side personal illness control has indirect relationship with sickness. The sickness they call transitory variable. It has two impact complete recovery or irreversible factors by increasing the permanent growth faltering and death.

This study is extended the model of Mosley and Chen (1984) for examining the impact of family planning & health cares and macroeconomic instability on social progress in Pakistan. Under-five survival rate is taken for measuring social progress in Pakistan. There are number of social and economic factors that impact on child survival in Pakistan. Social factors are consisted on parental factors (father and mother education, mother age, birth interval), health cares (number of doctors, number of nurses, number of hospital, number of mid-wives, number of primary health units, number of lady health visitors) and calories per person taken. Sickness has direct relationship with child survival. Parental factors and calories affect the child survival through personal illness control and sickness. Bicego and Boerma (1993) and Masset and White (2003) mention that low birth interval, low calories and younger mothers encourage high mortality. Health cares have three ways to impact on sickness; these are personal illness control, prevention and treatment. The economic factors consist on macroeconomic instability (inflation, unemployment, budget deficit, trade deficit, exchange rate), macroeconomic instability decides the amount of public and private health expenditures. Public and private health expenditures have direct impact on personal illness control which affects the child survival through prevention, sickness and treatment. Availability of food is necessary not only for adult but also under-five survival, it is the quality of food which has direct impact on human life span. Senturk (2009) mentions that quality of food decides the willingness to pay of consumers, normally good quality of food is upper priority of all. There is hardly any study which investigates direct link between under-five survival rate and availability of food in case of Pakistan. Hussain and Akhram (2008) study the determinants of food security in Pakistan. They mention that with growing population the government of Pakistan has made some useful precautions for food security, as there is sufficient amount of food necessary for health and long life.

So following the methodology of Mosley and Chen (1984), Guillaumont (2009), Ali (2015) and Audi Ali (2016) the model will become as:

$$UFSR_t = f\left(MII_t, FSSE_t, HII_t, FOOD_t, FLF_t\right) \quad (1)$$

$UFSR =$ Under-five survival rate
$MII =$ Macroeconomic instability (Macroeconomic Instability Index)
$FSSR =$ Female education (Female Secondary school enrollment rate)
$HII =$ Family planning and health cares (Health infrastructure index)
$FOOD =$ Availability of food (Food production index)
$FLF =$ Female labor force participation rate

$t =$ time period

For finding the responsiveness of dependent variable to independent variable, the equation can be written in the following form:

$$UFSR_t = \alpha_1 MII_t^{\beta_5} FSSE_t^{\beta_6} HII_t^{\beta_7} FOOD_t^{\beta_8} FLF_t^{\beta_9} e^{t+u_{1t}} \quad (2)$$

where

e is the base of natural logarithm and u is the white noise error term taking the natural log of both sides of equation (2)

$$\ln UFSR_t = \alpha_1 + \beta_5 \ln MII_t + \beta_6 \ln FSSE_t + \beta_7 \ln HII_t + \beta_8 \ln FOOD_t + \beta_9 \ln FLF_t + u_{1t} \quad (3)$$

III.II Family Planning & Health Cares

Family planning & health cares is measured by health infrastructure index. This is constructed by using total number of hospitals, total number of doctors, total number of dispensaries, basic health units, maternity and child health centres, rural health centres, registered mid-wives and registered lady health visitors with the help of Principle Components methods.

III.III Macroeconomic Instability Index (MII)

The study of business cycles remained under discussion since the late 19th century but these studies got a separate discipline of macroeconomics in 1930s when Keynes wrote his book "*General Theory of Employment, Interest and Money*". After that macroeconomics becomes a compulsory part of economic theory which mainly discusses fluctuations in overall business activities, determinants of interest rate, inflation and exchange rate following the fiscal and monetary policies at national level. So the solution of macroeconomic instability becomes the central of concern of policy makers, but measuring the macroeconomic instability still needs discussion. Simply, everything going wrong with the above variables is called macroeconomic instability. Few economists have tried to define the precise conditions for macroeconomic instability but they do not have theoretical underpinning for precise policy implications. Fischer (1991), Shigoka (1994), Ramey and Ramey (1994), Drugeon and Wignolle (1996), Caballero (2007), have used inflation as a proxy for macroeconomic instability. Ocampo (2005) presents a concept of macroeconomic stability by involving price stability, fiscal policies and well working of real economies, public debt that is payable by government and private as well as public sector balance sheets. Ali (2015) and Ali and Rehman (2015) uses inflation rate, unemployment rate, budget deficit and trade deficit for measuring macroeconomic instability in Pakistan. Following the methodology of Ismihan (2003), Ali (2015) and Ali and Rehman (2015) this study uses variables like inflation rate (*Inf*), unemployment rate (*Un*), trade deficit (*TD*) and budget deficit to GNP (*BD*). The equal weight is given to each variable following the standard deviation of that variable. The data for all the variables from various issues of Economic Survey of Pakistan and World Development Indicators maintained by World Bank data bases.

IV. Econometric Methodology

The use of econometric tools on macroeconomic models is one of the most important aspects within quantitative economic analysis. In most of macroeconomic data, the involvement of time trend makes the time series data non-stationary and the regression results of this data may be spurious. Nelson and Plosser (1982) mention that mostly time series data of macroeconomic variables have unit root problem. They conclude that the existence or non-existence of unit root helps to check the authenticity of data generating process. In literature, several unit root tests are available for checking the stationarity of the time series data. This study uses Augmented Dickey-Fuller (ADF) unit root test (1981), Phillips Perron (PP) unit root test (1988) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root test (Elliott *et al.*, 1996).

Dickey and Fuller (1981) proposes the Augmented Dickey-Fuller (ADF). The general forms of the ADF can be written as:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{1t} \quad (4)$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{2t} \qquad (5)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{3t} \quad (6)$$

Applying OLS and computing τ statistic of the estimated coefficient of X_{t-1} and comparing it with the Dickey Fuller (1981) critical τ values, if the calculated value of τ statistic is greater than the critical value then data is stationary. On the other hand, if vice-versa the series is non-stationary.

Phillips and Perron (1988) present unit root and PP test is viewed as DF test that made robust to serial correlation with the help of Newey-West (1987) heteroskedasticity and autocorrelation consistent covariance matrix estimator. PP has two main advantages over ADF. First PP test has strong power to predict the heteroskedasticity and serial correlation in error term. Second, user does not need to specify the lag length of test regression. The PP test has following procedure:

$$y_i = \alpha + \beta y_{i-1} + \mu_i \qquad (7)$$

where we include the time trend and exclude the constant term. In this way Z_ρ and Z_τ are two statistic calculated as:

$$Z_\rho = n\left(\hat{\rho}_n - 1\right) - \frac{1}{2}\frac{n^2\hat{\sigma}^2}{s_n^2}\left(\hat{\lambda}^2 - \hat{\gamma}_{0,n}\right) \qquad (8)$$

$$Z_\tau = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2}}\frac{\hat{\rho}_n - 1}{\hat{\sigma}} - \frac{1}{2}\left(\hat{\lambda}^2 - \hat{\gamma}_{0,n}\right)\frac{1}{\hat{\lambda}_n}\frac{n\hat{\sigma}}{s_n} \qquad (9)$$

$$\hat{\gamma}_\rho = \frac{1}{n}\sum_{i=j+1}^{n} \hat{\varepsilon}_i \hat{\varepsilon}_{i-j} \qquad (10)$$

$$\hat{\gamma}_n^2 = \hat{\gamma}_{0,n} + 2\sum_{j=1}^{q}\left(1 - \frac{j}{q+1}\right)\hat{\gamma}_{j,n} \qquad (11)$$

$$s_n^2 = \frac{1}{n-k}\sum_{i=1}^{n}\hat{\varepsilon}_i^2 \qquad (12)$$

where ε_i error term of OLS, k represents the number of covariates, q represent number of lags, $\hat{\gamma}_n^2$ and $\hat{\sigma}$ is standard error of $\hat{\rho}$. In eq. (10) when $j = 0$ this represents the variance of the error terms and when $j > 0$ this represents covariance lies between two error term. In eq. (11) when covariances are zero or –ve the auto correlation between the residuals $\hat{\gamma}_{i,n}$ is zero for $j > 0$. Then the second term of the eq. (10) disappears and $\hat{\gamma}_n^2 = \hat{\gamma}_{0,n}$ and they can be replaced with each other.

If $\hat{\gamma}_n^2 - \hat{\gamma}_{0,n} = 0$ the in the second term of the eq. (9) disappear.

$$Z_\tau = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2}}\frac{\hat{\rho}_n - 1}{\hat{\sigma}}$$

and $\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2} = 1$ then its reduce form is as

$$Z_\tau = \frac{\hat{\rho}_n - 1}{\hat{\sigma}} \tag{13}$$

Hence there is no autocorrelation or unit root problem between the error terms. In this way by applying this procedure on all variables, we can easily find their respective orders of integration of all variables.

Elliott et al., (1996) proposed modifying DF test statistic by using Generalized Least Squares (GLS) approach. They claim that modified DF test has best explanatory power for small sample size data as compare to simple DF and ADF. Moreover, DF-GLS unit root test has improved predicting power when an unknown mean or trend is present. DF-GLS test has following process:

Let

$$z_t = (1, t) \tag{14}$$

In case of y_t time series,

$$\left[y_1, (1-\alpha L) y_2, ..., (1-\alpha L) y_T \right] \tag{15}$$

$$\left[z_1, (1-\alpha L) z_2, ..., (1-\alpha L) z_T \right] \tag{16}$$

regress eq. (15) on eq. (16) and get

$$\tilde{\beta}_{GLS}$$

where $\alpha = 1 + \bar{c}/T, \mu_0 = 0$ and $\bar{c} = -13.5$ for without trend statistic. Without trend $y = \tilde{y}_t - z_t' \tilde{\beta}_{GLS}$ and then regress ADF with no time trend and intercept. The t-statistic of $\tilde{y}_{t-1}$ is DF GLS statistic. For demeaned case, t is omitted from z_t and $\bar{c} = -7.0$

IV.I Autoregressive Distributive Lag (ARDL) Approach to Co-Integration

In literature, a number of cointegration tests for econometric analysis are available. Most famous and traditional cointegration tests are the residual based Engle-Granger (1987) test, Maximum Likelihood based on Johansen (1991/1992) and Johansen-Juselius (1990) tests. One thing common in these tests is that they require same order of integration for their analysis. These cointegration tests become invalid and inefficient when the variables of the model have different level of integration.

ARDL bound testing approach presented by Pesaran and Pesaran (1997), Pesaran and Shin (1999), and Pesaran, Shin and Smith (2001) has numerous advantages over traditional methods of cointegration. Firstly, ARDL can be applied regardless of the order of integration. Secondly, ARDL bounds testing approach to cointegration can be used for small sample size (Mah, 2000). Thirdly, this approach allows to take sufficient number of lags for capturing the data generating process in a general to specific modeling framework (Laurenceson et al., 2003). Lastly, ARDL gives efficient and valid detailed information about the structural breaks in data.

This technique is based on Unrestricted Vector Error Correction Model (UVECM) which have better properties for short and long-run equilibrium as compared to traditional techniques (Pattichis, 1999). Pesaran and Shin (1997) and later on Pesaran et al. (2001) mention that under certain environment long-run correlation among macroeconomic variables can be found with the help of Autoregressive Distributive Lag Model (ARDL). After lag order selection for ARDL procedure, simply OLS can be used for identification and estimation. Valid estimates and inferences can be drawn through the presence of unique long-run alliance that is crucial for cointegration.

$$\Delta \ln Y_t = \beta_1 + \beta_2 t + \beta_3 \ln Y_{t-1} + \beta_4 \ln X_{t-1} + \beta_5 \ln Z_{t-1} + ... + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{t-k} + ... + u_{it} \quad (17)$$

If there exits long-run cointegration relationship among the variables, then for finding short-run relationship the study uses the Vector Error Correction Model (VECM). The VECM is explained as under:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (18)$$

IV.II Granger Causality Test

Granger (1969) proposed a causality test which is based on time series data. If X variable Granger cause variable Y then X is suitable for forecasting Y. Granger (1987) and Engle and Granger (1988) further strengthen the properties of Granger (1969) causality test. This test has following methodology:

$$X_{it} = \alpha_1 + \sum_{i=1}^{q} \beta_i Y_{it-k} + \varepsilon_t \quad (19)$$

$$Y_{it} = \alpha_1 + \sum_{i=1}^{q} \theta_i X_{it-k} + v_t \quad (20)$$

For investigating the optimal lag length Schwarz Information Criteria (SIC) or Akaike's Final Prediction Error (FPE) are used. For checking the equation (19) X Granger Causes Y if $H_0 : \beta_i = o$ there is no causal relationship but $H_A :$ at least one $\beta_i \neq o$ there is causal relationship and for equation (20) Y Granger Causes X if $H_0 : \theta_i = o$ there is no causal relationship but $H_A :$ at least one $\theta_i \neq o$ there is causal relationship between variables.

V. Empirical Results and Discussions

The main objective of this study is to empirically investigate the determinants of social progress in the presence of macroeconomic instability in Pakistan over the period of 1980 to 2015. Guillaumont (2009) mention that under-five survival rate best indictor to represent social progress of nation. The Table 1 presents the descriptive statistics of the model. The results of the Table 1 reveal that under-five survival rate, female education, family planning & health cares, availability of food and female labor force participation are negatively skewed but macroeconomic instability is positively skewed. The results show that all variables of the model have positive Kurtosis. The values of Skewness reveal that all the variables of the model are normally distributed. The estimated values of Jarque-Bera indicate that all the variables have zero mean and finite covariance, this also confirms that the selected variables are normally distributed.

Table 1

Descriptive Statistics						
	UFSR	**MII**	**FSSE**	**HII**	**FOOD**	**FLF**
Mean	6.776	0.449	2.861	1.400	4.297	2.728
Median	6.776	0.428	2.924	1.590	4.370	2.681
Maximum	6.817	0.819	3.388	2.285	4.780	3.148
Minimum	6.732	0.304	2.168	0.028	3.674	2.424
Std. Dev.	0.026	0.107	0.438	0.667	0.342	0.229
Skewness	-0.048	1.280	-0.380	-0.656	-0.273	0.491
Kurtosis	1.695	5.336	1.628	2.254	1.836	1.954
Jarque-Bera	2.353	1.838	3.385	3.138	2.272	2.832
Probability	0.308	0.398	0.184	0.208	0.320	0.242
Sum	223.611	14.819	94.431	46.213	141.832	90.028
Sum Sq. Dev.	0.022	0.370	6.150	14.668	3.760	1.688
Observations	33	33	33	33	33	33

Correlation matrix among the variables is presented in Table 2. The estimated results reveal that under-five survival rate has positive and significant correlation with macroeconomic instability, female education, family planning & health cares, availability of food and female labor force participation in Pakistan. The results reveal that female education, availability of food and female labor force participation have high correlation with under-five survival rate. The results show that macroeconomic instability has positive correlation with female education, family planning & health cares, food availability and labor force participation rate in case of Pakistan. Female education has positive and significant correlation with family planning and health cares, food availability and female labor force. The results highlight that family planning and health cares have positive and significant correlation with food availability and female labor force participation in case of Pakistan. The estimated results indicate that availability of food has positive and significant correlation with female labor force participation in Pakistan. The overall results indicate that all independent variables of the model have positive and significant correlation with dependent variable. This shows that Pakistan is an interesting case to study the impact of family planning & health cares and macroeconomic instability on under-five survival rate.

Table 2

Pairwise Correlation Matrix						
UFSR	1.0000					
MII	0.353 (1.86)*	1.000				
FSSE	0.978 (26.5)***	0.236 1.352	1.000			
HII	0.792 (7.2)***	0.064 0.357	0.812 (7.76)***	1.000		
FOOD	0.993 (46.8)***	0.255 1.469	0.987 (34.60)***	0.835 (8.45)***	1.000	
FLF	0.951 (17.2)***	0.367 (2.19)**	0.902 (11.68)***	0.656 (4.84)***	0.927 (13.8)***	1.000
	UFSR	MII	FSSE	HII	FOOD	FLF
Note: The asterisks ***, ** and denote the significant at 1% and 5% levels, respectively.						

As explained above that non-stationary data makes the regression results spurious and policy implications based on such type of data is not reliable. ADF, PP and DF-GLS unit root tests are used for analyzing unit root problem in data. The results of the unit root tests are presented in the Table 3. The results of ADF and DF-GLS indicate that under-five survival rate is stationary at level but PP test results show that under-five survival rate is not stationary at level. The results indicate that macroeconomic instability is stationary at level in all three ADF, PP and DF-GLS tests. The results of PP and DF-GLS tests reveal that family planning & health cares is stationary at level but not stationary in case of ADF test. The results of PP test show that availability of food is stationary at level but non-stationary in case of ADF and DF-GLS tests. The estimated results of ADF, PP and DF-GLS tests show that female education and female labor force participation are not stationary at level. At first difference the results of ADF, PP and DF-GLS tests reveal that under-five survival rate, macroeconomic instability, female education, family planning & health cares, food availability and labor force participation become stationary. The overall results of ADF, PP and DF-GLS tests indicate that all variables of the model have mixed order of integration which is suitable condition for applying ARDL co-integration approach.

Table 3

Unit Root Tests			
Variables	**ADF**	**PP**	**DF-GLS**
UFSR	-3.655***	-0.725	-2.985***
MII	-2.953**	-3.033**	-2.862***
FSSE	-1.121	-1.262	-0.218
HII	-0.047	-12.776***	1.751*
FOOD	-2.134	-2.706*	0.102
FLF	0.328	0.864	0.776
At First Difference			
ΔUFSR	-2.855***	-3.655***	-1.723*
ΔMII	-7.902***	-8.348****	-7.547***
ΔFSSE	-4.461***	-4.347***	-4.310***
ΔHII	-5.258***	-10.871***	-2.611**
ΔFOOD	-5.415***	-5.415***	-5.069***
ΔFLF	-5.450***	-5.457**	-5.314***
Note: The asterisks ***, ** and * denote the significant at 1%, 5% and 10% levels, respectively. The figure in the parenthesis is the optimal lag structure for ADF and DF-GLS tests, bandwidth for the PP unit root test is determined by the Schwarz Bayesian Criterion.			

Table 4

VAR Lag Order Selection Criteria						
UFSR, MII, HII, FSSE, FOOD, FLF						
Time Period: 1980-2012						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	230.193	NA	1.30e-14	-14.946	-14.666	-14.856
1	500.143*	413.923*	2.31e-21*	-30.542	-28.581*	-29.915*
2	519.604	22.055	9.53e-21	-29.440	-25.797	-28.274
3	586.409	48.990	3.31e-21	-31.493*	-26.169	-29.790
* indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error AIC: Akaike information criterion SC: Schwarz information criterion HQ: Hannan-Quinn information criterion						

Considering the importance of number of observations and number of variables and maximum lags required for co-integration approach, two maximum lags are allowed for Vector Auto-Regressive process. The results of lag selection criteria are presented in Table 4. The results of the Table 4 reveal that all criterion allow optimal lag length 1, except Akaike information criterion. Thus following the sequential modified LR test statistic, Final prediction error, Schwarz information criterion and Hannan-Quinn information criterion lag length 1 is used for all variables of the model. The overall results of VAR lag order selection criterion show that maximum 1 lag length is selected for the model.

The Table 5 presents ARDL bound testing approach results of under-five survival rate, macroeconomic instability, female education, family planning & health cares, availability of food and female labor force participation rate. F-statistic and W-statistic are used for testing the null hypothesis of no co-integration among the variables of under-five survival rate model. The calculated F-statistic (39.936) is greater than the upper bound (4.518) value of Pesaran et al., (2001) at 5 percent and the calculated W-statistic (239.620) is greater than the upper bound (27.108) value of Pesaran et al., (2001) at 5 percent. So null hypothesis of no co-integration is rejected and alternative hypothesis is accepted which supports co-integration among the variables of the model. This confirms that under-five survival rate, macroeconomic instability, female education, family planning & health cares, availability of food and female labor force participation have long run relationship in case of Pakistan.

Table 5

ARDL Bounds Testing Approach				
Dependent Variable UFSR ARDL(1,1,0,0,0)				
Critical Value	**F-Statistics 39.936**		**W-statistic 239.620**	
	Lower Bound	**Upper Bound**	**Lower Bound**	**Upper Bound**
95%	3.069	4.518	18.415	27.108
90%	2.559	3.788	15.357	22.730

The results of bound testing approach confirm the existence of co-integration among the variables of the model. Now the study examines the long run relationship among under-five survival rate, macroeconomic instability, female education, family planning & health cares, availability of food and female labor force participation in case of Pakistan. The long run results of under-five survival rate are presented in the Table 6. The estimated results reveal that macroeconomic instability has negative and significant impact on under-five survival rate in Pakistan. Ali and Khalil (2014) and Ali (2015) mention that macroeconomic instability especially inflation rate has negative impact on overall life expectancy. The estimates indicate that 1 percent increase in macroeconomic instability in Pakistan decreases under-five survival rate by (-0.003) percent. The estimated results reveal that female education has positive and significant relationship with under-five survival rate in Pakistan. Subbarao and Raney (1995) and Ali (2001) conclude that female education becomes the main source of decreasing under-five mortality as educated mothers are more health causation. The results show that 1 percent increase in female education, increases under-five survival rate by (0.015) percent in Pakistan. The results show that family planning & health cares has positive and significant relationship with under-five survival rate. Ali (2015) mentions that it is health cares facilities which decrease infant and under-five mortality. The estimates show that 1 percent increase in family planning & health cares increases under-five survival rate by (0.004) percent in Pakistan.

The coefficient of availability of food indicates that there is positive and significant relationship between availability of food and under-five survival rate in Pakistan. Ezra and Kiros (2000) mention that hunger increases child mortality. Ali and Khalil (2014) and Ali (2015) conclude that availability of food impact significantly both child as well as adult life expectancy in long run and short run. The estimated results reveal that 1 percent increase in availability of food in Pakistan increases under-five survival rate by (0.061) percent. The results show that female labor force participation has negative and insignificant relationship with under-five survival rate in Pakistan. Hojman (1994) mentions that female labor force participation decreases child mortality in case of developed countries but vise-versa in case of developing countries. The overall long run results of under-five survival rate show that macroeconomic instability and female labor force participation have negative relationship with under-five survival rate in Pakistan. So it is suggested that macroeconomic instability and female labor force participation have inverse relationship with social progress in Pakistan. Hence, for increasing social progress macroeconomic environment should be stable. Moreover, for increasing

social progress much attention should be paid on female education, family planning & health cares and availability of food in Pakistan.

Table 6

Estimated Long Run Coefficients using the ARDL Approach ARDL(1,0,1,0,1,0) Dependent variable is UFSR Time Period 1981-2012			
Regressor	**Co-efficients**	**Standard-Error**	**T-Ratio (Prob)**
MII	-0.003	.002	-1.836[.079]
FSSE	0.015	.008	1.819[.082]
HII	0.004	.002	1.964[.062]
FOOD	0.061	.014	4.315[.000]
FLF	-0.021	.011	-1.790[.120]
C	0.576	.048	136.500[.000]

After examining the long run relationship among the variables of the model now with the help of Vector Error-Correction Model (VECM) short run dynamic among the variables can be investigated. The results of short run dynamic are presented in Table 7. The results reveal that macroeconomic instability has negative and significant relationship with under-five survival rate. The estimates show that 1 percent increase in macroeconomic instability in Pakistan decreases under-five survival rate by (-.190E-3). The estimated results indicate that female education and availability of food have positive but insignificant relationship under-five survival rate in Pakistan. The coefficient of family planning & health cares reveal that family planning & health cares have positive and significant relationship with under-five survival rate in Pakistan. The results indicate that 1 percent increase in family planning & health cares in Pakistan increases under-five survival rate by (.211E-3) percent. Female labor force participation has negative and significant relationship with under-five survival rate in case of Pakistan. The overall short run dynamic shows that macroeconomic instability has negative but family planning & health cares has positive and significant impact on under-five survival rate in Pakistan and they have same type of impact in long run. Ali and Khalil (2014) and Ali (2015) mention that life expectancy its determinants normally same type of long and short run relationship. The negative and significant value of (-.049) ECM is theoretically correct. The negative and significant value of ECM shows the speed of adjustment from short run to long run equilibrium. The estimates of ECM reveal that short run needs more than 20 years to converge in the long run equilibrium. This shows that for achieving a desired level of under-five survival rate government of Pakistan should need sound policy actions because this aim needs a long time span to fulfill.

Table 7

Short Run Representation ARDL(1,0,1,0,1,0) Dependent variable is dUFSR Time Period 1981-2012			
Regressor	**Co-efficients**	**Standard-Error**	**T-Ratio (Prob)**
dMII	-.190E-3	.113E-3	-1.772[.099]
dFSSE	.616E-3	.416E-3	1.480[.151]
dHII	.211E-3	.824E-4	2.566[.017]
dFOOD	.375E-3	.001	.353[.727]
dFLF	-.001	.408E-3	-2.656[.014]
ECM(-1)	-.049	.010	-4.621[.000]
R-Squared (.912) R-Bar-Squared (.882) Equation Log-likelihood (251.196) Akaike Info. Criterion (242.196) Schwarz Bayesian Criterion (235.600) DW-statistic (2.057)			

For examining the serial correlation, functional form, normality and Heteroscedasticity among the variables of the model, diagnostic Tests are conducted. The results of diagnostic tests are presented in Table 8. The results of Lagrange

multiplier test of residual serial correlation show that there is no serial correlation among the variables of the model. Ramsey's RESET test using the square of the fitted values reveal that the model has correct functional form. Normality based on Skewness and Kurtosis explains that the time series data of all variables is normally distributed. The results show that there is no heteroscedasticity in data.

Table 8

Diagnostic Tests		
Test Statistics	**LM-Version**	**F-Version**
A-Serial Correlation CHSQ(1)	.197[.755]*F(1,22)	.067[.798]
B-Functional Form CHSQ(1)	.703[.401]*F(1,22)	.494[.489]
C-Normality CHSQ(2)	.846[.655]	Not-applicable
D-Heteroscedasticity CHSQ(1)	.265[.606]*F(1,30)	.251[.620]
A: Lagrange multiplier test of residual serial correlation B: Ramsey's RESET test using the square of the fitted values C: Based on a test of skewness and kurtosis of residuals D: Based on the regression of squared residuals on squared fitted values		

The stability of model is very important because the stability tests enable researchers to see whether the estimated model shifts or not over the selected time period. The Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) tests are used for this purpose. The results of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) tests are reported in Fig 1 and Fig 2. The figures show that Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) are between the two critical lines and do not go outside the critical boundaries. The figures of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) confirm that selected model is correctly specified.

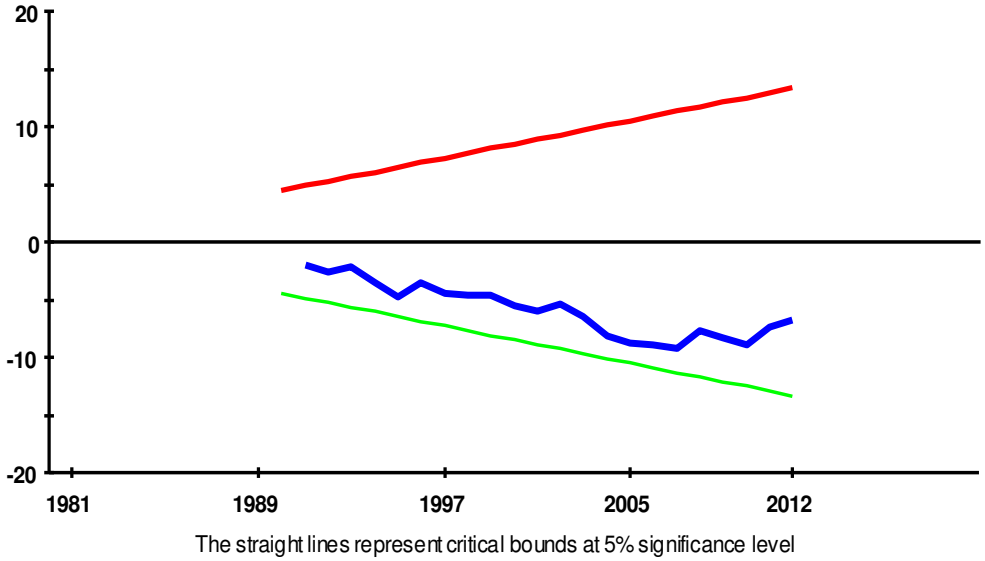

Fig 1 Plot of Cumulative Sum of Recursive Residuals

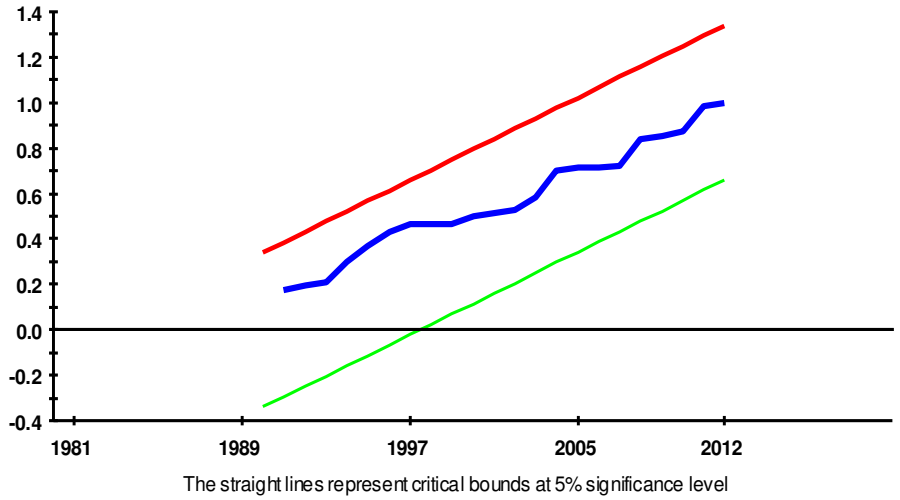

Fig 2: Plot of Cumulative Sum of Squares of Recursive Residuals

Granger causality test (1969) is used for examining the causal relationship among the variables of the model. The results of Granger causality test are reported in the Table 9. A bidirectional causality is running between macroeconomic instability and under-five survival rate in Pakistan. The results show that unidirectional causality is running from female secondary school education to under-five survival rate in Pakistan. The results indicate that unidirectional causality is running from family planning & health cares to under-five survival rate and from availability of food to under-five survival rate in Pakistan. But there is bidirectional causal relationship between female labor force participation and under-five survival rate in case of Pakistan. Ali (2015) mentions that high survival rate encourages more women to work and working women are health conscious which increase child survival rate. The estimated reveal that macroeconomic instability has no causal relationship with female secondary school education, family planning & heath infrastructure and female labor force participation in Pakistan. Whereas, unidirectional causality is running from availability of food to macroeconomic instability in Pakistan. The results reveal that unidirectional causality is running from health infrastructure to female secondary school education in Pakistan. The overall Granger causality test results show that for enhancing under-five survival rate the government of Pakistan should reduce macroeconomic instability at the same time female secondary education, health infrastructure, availability of food and female labor force participation rate should be increased.

Table 9

Pairwise Granger Causality Tests		
Sample: 1980 2012		
Null Hypothesis	**F-Statistic**	**Prob.**
MII does not Granger Cause UFSR UFSR does not Granger Cause MII	2.522 2.789	0.073 0.054
FSSE does not Granger Cause UFSR UFSR does not Granger Cause FSSE	20.577 1.464	9.E-05 0.250
HII does not Granger Cause UFSR UFSR does not Granger Cause HII	44.202 1.320	3.E-07 0.296
FOOD does not Granger Cause UFSR UFSR does not Granger Cause FOOD	13.868 0.271	1.E-05 0.892
FLF does not Granger Cause UFSR UFSR does not Granger Cause FLF	32.377 3.197	4.E-06 0.034
FSSE does not Granger Cause MII MII does not Granger Cause FSSE	0.642 0.666	0.638 0.622
HII does not Granger Cause MII MII does not Granger Cause HII	1.739 0.382	0.181 0.818

FOOD does not Granger Cause MII MII does not Granger Cause FOOD	62.889 0.758	1.E-08 0.564
FLF does not Granger Cause MII MII does not Granger Cause FLF	1.061 1.241	0.401 0.325
HII does not Granger Cause FSSE FSSE does not Granger Cause HII	3.229 1.111	0.033 0.378
FOOD does not Granger Cause FSSE FSSE does not Granger Cause FOOD	0.706 0.314	0.597 0.864
FLF does not Granger Cause FSSE FSSE does not Granger Cause FLF	0.795 1.305	0.542 0.301
FOOD does not Granger Cause HII HII does not Granger Cause FOOD	1.517 0.503	0.235 0.733
FLF does not Granger Cause HII HII does not Granger Cause FLF	1.483 0.352	0.244 0.838
FLF does not Granger Cause FOOD FOOD does not Granger Cause FLF	1.067 0.679	0.398 0.614

VI. Conclusions and Policy Implications

This study has investigated the determinants of social progress in the presence of macroeconomic instability in Pakistan over the period of 1980 to 2015. Under-five survival rate is used for measuring social progress and macroeconomic instability is measured by incorporating inflation rate, unemployment rate, budget deficit and trade deficit. The long run results of the study show that macroeconomic instability has negative and significant impact on under-five survival rate in Pakistan. The long run results reveal that female education, family planning & health cares and availability of food have positive and significant impact on under-five survival rate in Pakistan. Whereas female labor force has negative and insignificant impact on under-five survival rate in Pakistan. The short run dynamic highlights that macroeconomic instability has negative and significant impact on under-five survival rate in Pakistan. The estimated short run results reveal that female education and availability of food has positive but insignificant impact on under-five survival rate in Pakistan. The short run coefficient of family planning & health cares show that it has positive and significant impact on under-five survival rate in Pakistan. Whereas female labor force participation has negative and significant effect on under-five survival rate in Pakistan. The coefficient of ECM has theoretically correct sign which shows that short run needs more than 20 years to converge in the long run. The diagnostic tests results reveal that there is no serial correlation, heteroscedasticity and model has correct functional form with normally distributed data. The findings of this study supported findings of Ali and Khalil (2014) and Audi and Ali (2016).

The results show that macroeconomic instability has negative and significant impact on under-five survival rate in Pakistan. So if government of Pakistan reduces macroeconomic instability it can achieve highest level of under-five survival rate which is now lowest in the region. Pakistan can increase under-five survival rate by providing better family planning & health care facilities both at rural and urban areas. Family planning & health care facilities can be improved if modern tools and medication can be provided to health care centres and hospitals. Under-five survival rate can be increased by providing better availability of food. Female empowerment has positive impact on under-five survival rate, so government may increase quota and financial access to female for enhancement of female empowerment. Finally, government may increase its expenditures on social sector for getting targeted social progress in Pakistan.

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