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FOREIGN AID AND GOVERNANCE IN PAKISTAN

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Abstract. This study analyzes the effect of foreign aid on governance in Pakistan by employing ARDL approach using annual data from 1984 to 2012. The study provides empirical evidence that foreign aid in Pakistan erodes the quality of governance, which has been measured by using indices of bureaucratic quality, corruption and rule of law in Pakistan. Aid dependence possibly damages the quality of governance by increasing corruption, weakening accountability, creating moral hazard, weakening policy learning, draining off talent and ability from the bureaucracy, and relieving burdens to restructure inefficient institutions and policies. Foreign aid programmes should be clearly understood and taken as a temporary and short-term development tool. There should be aid "exit strategy" and motivation for self-help.

Keywords: Foreign aid, Governance, Corruption, Rule of law, Bureaucratic quality, ARDL approach

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I. INTRODUCTION

Foreign aid and governance have been widely discussed by economists over the last three decades. Both variables play a vital role in determining the

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economic prosperity in developing countries. Still the exact relationship between foreign aid and governance remains clouded and, hence, creates an interest for the researchers. Good governance creates conducive environment for sustained and high economic growth that enables a country to attain its goals and become prosper. There is low quality of governance in the most of the developing countries. There is a need to explore the main reasons that lead to worsen quality of governance and resultantly hamper the process of development.

Pakistan is getting aid and also has become a victim of bad quality of governance. There is an immediate need to look for those hidden elements that are the causes of failure to attain the desired goal of sustainable development through foreign aid and quality of governance. This study tries to explore the effect of aid dependency on governance in Pakistan.

Foreign aid is a key source of income in Pakistan like many developing countries. Foreign aid inflows fill saving and investment gap and increase productivity by transmitting modern technology that promotes growth. However, it has been observed that foreign aid has not benefited the country, as is evident from poor state of social indicators, like education, health and employment, etc. As the foreign aid inflows are not used for development of the economy, therefore, as a result the savings and investment gap is enlarged. Apparently, the aid is used in the vested interests of powerful people.

Two views prevail about foreign aid. One view is that aid undermines government accountability to citizens because it goes into the pockets of corrupt bureaucrats and politicians. Foreign aid is used to import unsuitable technology, expand government bureaucracies and encourage a larger, unproductive and corrupt government in developing countries or it is just misused.

The other view is that aid contributes to improve critical administrative and fiscal capacity that supports governments to better serve for their people. In fact, neither view is entirely right or wrong.

International financial institutions, in particular the International Monetary Fund (IMF) and World Bank, emphasize much on issue of governance and mainly on corruption in developing countries. After the failure of structural adjustment programme initiated in 1988, importance of good governance was recognized to overcome the economic problems. The World Bank was the first to use the notion of good governance in its report "*From Crisis to Sustainable Growth – Sub Saharan Africa*: *A Long-Term*

Perspective Study" (World Bank, 1989). In this report aid ineffectiveness is connected with governance issues. Later on, Africa became the center of discussions on governance related issues. In the next years, the Bank considered good governance as a main part of its development policy. However, the World Bank in its report "*Assessing Aid*: *What Works, What Doesn't, and Why*" (Dollar and Pritchett, 1998), considered good governance as a selectivity criterion for granting aid. In above-mentioned report, the Bank described the collaboration between developmental aid and the quality of governance. The report highlighted the importance of quality of institutions and claimed that the effect of foreign aid on economic growth depended on the effective institutions and sound economic management. The report recommended that policy performance and reform commitment should be taken as selectivity criteria for the disbursement of aid instead of considering developmental wants or level of poverty of borrowing country. The report also recommended that the Bank should focus on giving more expertise and financial resources on governance issues to achieve developmental objectives in the fellow countries.

Other important international financial institutions including IMF, OECD, UNDP, ADB, regional developmental and multilateral agencies etc. are also actively endorsing governance issues. The variety of World Bank's programmes of governance that are related to conditionalities include public sector restructuring, civil service reorganizations, transparency, reorganization of delivery system, and judicial and legal reforms.

The effectiveness of foreign aid is a debatable issue. There are many countries like Republic of Korea, Uganda, Indonesia, Vietnam, Ghana, Taiwan, Tanzania, Mozambique and Bolivia, where foreign aid has played a substantial positive role in the development of the economy. There is also a list of several countries which received large amount of aid like Kenya, Papua New Guinea, Haiti, Somalia, Philippine, Congo, but failed to use it for their development.

According to recent *Global Competitiveness Report*, institutions of Pakistan are ranked at 115 out of 144 countries. Some indicators of institutions are given in Table 1.

A clear picture of the government performance can be perceived from Table 1. All the above indicators show poor governance in Pakistan according to *Global Competitiveness Report*. The Pakistani business community has identified corruption as the most problematic factor in Pakistan. Inefficient governmental bureaucracy has been ranked as second problematic factor for doing business in Pakistan.

TABLE 1

Indicators of Institutions

Indicators	Pakistan's Ranking out of 144 countries
Judicial independence	57
Property rights	116
Favouritism in decisions of government officials	129
Irregular payments and bribes	119
Organized crime	136

Source: Schwab (2012), *Global Competitiveness Report*, 2012-2013.

Pakistan has been relying on foreign aid since 1947. Foreign aid is one of the key sources of income in Pakistan but foreign aid has not remained effective to improve the economic circumstances of Pakistan. The question arises that if foreign aid does not contribute to our developmental purpose then where does this foreign aid go? There is one view that foreign aid weakens quality of governance through high level of corruption, weak rule of law, weak institutions and absence of accountability, and leads to bad management; that's why foreign aid does not contribute to the process of growth. Durbarry (1998), Javid and Qayyum (2011), and Burnside and Dollar (2004) point out that foreign aid contributes to economic development in the environment of good policy or good governance otherwise it has no effect or otherwise this effect is negative. That's why this study has been planned to explore the impact of foreign aid on governance in Pakistan. Presently, there exists no such study that explores the connection between foreign aid and governance in case of Pakistan.

OBJECTIVES OF THE STUDY

The present study will analyze the relationship between foreign aid and governance in Pakistan. The objectives of the present study are:

1. To empirically examine the effect of foreign aid on governance in Pakistan, and
2. To explore the channels through which foreign aid influences governance.

The present study attempts to analyze the relationship between foreign aid and governance in Pakistan. The rest of the study is organized as follows: the next Section provides an overview of the foreign aid in Pakistan, Section III gives a review of theoretical and empirical literature on the subject, and Section IV deals with model specification, description of the variables, data sources, and explains methodology. Section V discusses the results. Then concluding remarks and suggestions are provided in the last section.

II. AN OVERVIEW OF FOREIGN AID IN PAKISTAN

Pakistan has been the recipient of the foreign aid since 1947 and its volume has been increasing since then, however, with some periods of slow down. In 1960s and 1970s, this aid was available on easy terms and conditions. With the passage of time, Pakistan is facing difficulties in getting more aid.

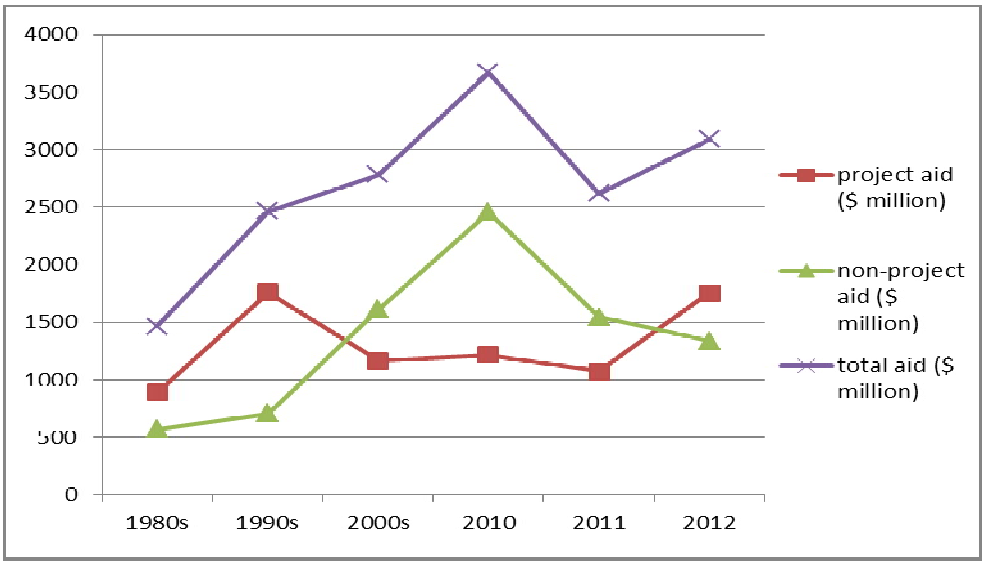
In 1960s, Pakistan received foreign aid equal to about 6.6 percent of the GNP. In early 1970s, Pakistan got foreign aid near to 4.2 percent of the GNP. The inflow of aid to Pakistan remained US $ 1.00 billion mark and the aid percentage to GNP was 5.5 percent in 1974-1975. The government started public investment programmes such as roads, social services, electric power and projects, like Pakistan Steel Mills and Indus Super Highway with the help these aid inflows. However, by late seventies (1977-78 and 1978-79), gross disbursements of foreign aid decreased as the United States cut down aid because of nuclear policy of Pakistan (Malik *et al.*, 1994).

Pakistan again got a huge amount of foreign aid (4.6 percent of GNP) during 1980s because of its frontline role in the America-Soviet Union clash over Afghanistan. In mid 1980s, the inflows of foreign aid touched US $ 2.0 billion mark per annum which boosted the credit worthiness of Pakistan (Le and Ataullah, 2006). Further, international aid sanctions, in particular by the Government of United States of America, were levied on Pakistan because of Pakistan's nuclear tests in 1998. As a result, other multilateral and bilateral aid also declined significantly during 1998-2001.

Nevertheless, things changed dramatically after 9/11. After joining the 'War against Terrorism', the inflows of aid to Pakistan increased by seven times and touched US $ 776.5 million mark. The United States started one more 5-year economic assistance package amounting to US $ 3 billion for Pakistan in June 2003. Other bilateral and multilateral institutions also approved aid and deferred payment of external debts of Pakistan. This situation shows how foreign aid inflows to Pakistan have always been subject to conditionalities and susceptible to strategic and geopolitical interests of the donors, in particular US.

FIGURE 1

Trend of Foreign Aid in Pakistan



Source: Self-generated using *Pakistan Economic Survey*.

Figure 1 shows the trend of foreign aid in Pakistan from 1980s to 2012. Project and non-project are two components of foreign aid. Project aid directly increases productive capacity of a country whereas non-project aid increases debt burden of aid receiving countries. Project aid shows increasing trend in the eras of 1980s to 1990s and is higher than non-project amount. Then projects aid shows increasing trend from 1990s to 2011 and non-project is higher than project. In 2012, project aid money is higher than non-project aid.

III. LITERATURE REVIEW

The existing literature on the relationship between aid and governance is inconclusive.

Svensson (2000) investigated the relationship between the prevalent level of corruption and concessional development assistance. The ordinary expectation of aid may be sufficient to escalate the indulgence of rent seeking activities and decrease productive public expenditure. However, this consequence may be overturned if the donor community can go into a binding policy promise. He found no evidence that the donors thoroughly assigned foreign aid to countries having less corruption.

Foreign aid is used to increase salaries for public employees including judges, police and tax collectors and improve training. As salaries rise, more competent civil servants can be hired and bribe solicitation can be reduced (Van Rijckeghem and Weder, 2001). In this way, aid can be used to improve the bureaucratic quality and it can also help in building sound institutions.

Santiso (2001) argues that aid conditionality is not the best-fit methodology to support good governance in developing countries. This methodology faces significant difficulties when applied to restructuring the institutions of governance particularly parliamentary structures and judicial systems. Without considering the fundamental distribution of power, there is chance that parliaments will become submissive and judiciaries will be dominated by the influence of powerful officials. An important lesson learned is that if donors desire to create a real difference then it will be essential for donors to emphasize more clearly and more strictly on issues of power, interest groups and politics than they have done in the past although these things were often chaotic and problematic.

Tavares (2003) explores whether foreign aid recipient becomes corrupt by using cross sectional data of developing countries. He finds that foreign aid significantly reduces corruption. There are several possibilities through which aid reduces corruption. Firstly, foreign aid may be linked with conditions and rules that are helpful to decrease corruption by limiting their own preferences of the recipient country's officials. Secondly, foreign aid relieves the receivers from public revenue shortages and enables them to increase salaries of public employees that may reduce corruption.

Gupta *et al.* (2003) find that grants provided to countries are afflicted by high levels of corruption and grants are fully offset by decrease in the revenue effort. Consequently, grants do not supplement to the aggregate amount of capitals available to the recipients.

On negative side, the aid dependent country realizes that donors mean to design policy, thus, government becomes inactive and policy making cap-ability of aid recipient becomes weak. Individual officials have disincentives to disagree with the donors because this will result in delay of the receiving desirable resources (Bräutigam and Knack, 2004). Aid generates moral hazard in recipient country. Moral hazard is a state in which one party acquires risk because they know that it is secure against the risk and the other party will bear the cost. If aid is clearly a complement to the government own hard work in a programme or project then there would be a less chance of moral hazard and there would be a more chance of establishing a true partnership between aid and supporting programmes maintained by

governments. Though, over a period of time, history of foreign aid shows that the emphasis on self-help becomes weak and problem of moral hazard arises. History of aid shows that there would be more chance that a government will allow corruption in the customs department or there would be a continuation of unsuccessful in-house revenue service. Aid dependent countries may be motivated to underutilize their accessible sources of tax revenues (Bräutigam and Knack, 2004).

Moss *et al.* (2006) discuss that aid flows can have consequence in a decline in governmental accountability. It is because governing leaders are no longer interested to ensure the support of their public and the acceptance of their parliaments when they do not require raising revenues from the homegrown economy. If external donors are providing the large part of public finance of recipient country then governments are mainly accountable to those external agencies. Foreign aid allows politician and governments to ignore structural reforms to resolve issues and to spend aid money on popular purposes rather than on productive purposes.

Rajan and Subramanian (2007) discuss that one of the channels, through which foreign aid might adversely affect governance, is by restraining the growth of the manufacturing sector. They use contract enforcement and rule of law as a proxy for good governance. A possible channel through which they provide evidence in their paper is that aid might be mainly associated with weak governance because aid inflows decrease the requirement of governments to tax. Generally speaking, this paper suggests that even if the shortage of capital is the hurdle in the process of growth; hence, it may lead to the path of prosperity in developing countries. The form in which the capital is received as foreign aid could have negative spillover effects that limit its benefits. Indeed, if foreign aid decreases competitiveness by increasing the exchange rate or if foreign aid reduces the competence of manufacturing investment by badly disturbing governance then aid inflows may decrease the profitability of investment and limit the process of growth in particular in the export sectors.

Foreign aid may have negative effect on rule of law in a way that governments are not accountable to the international loaning agents if they do not reform rule of law.[1] International lenders are the principals instead of

[1]It is necessary to have knowledge of multidimensional principal-agent rapport to understand the relationship between rule of law reforms and foreign aid. In the perfect state citizen relationship, the citizens are the principals. They are the holders of the revenues and valuable resources that are shifted to the agent that is the state, through taxation.

the citizens in the case of foreign aid whereas the recipient state is just an agent. Then on this one facet, the recipient country is accountable to the international lenders. The aid agencies themselves are agents of other principals that are the citizens of the donor countries because they pay taxes to the aid agencies. There is an incentive for the aid agencies to carry on producing output (*i.e.* increase loans and grants), irrespective of the fact that recipient government is not interested in reforms. The reason behind that phenomenon is that the principals of the aid agency are the citizens of donor countries and these citizens have nearly no ability to observe the impact of foreign aid in improving rule of law in particular with the objective of reform. As a consequence, the accomplishment of the aid agencies is based on the amount of money given to developing countries. In other words, success of aid agencies does not depend upon real reform or output. Hence, the aid agencies have no incentives to demand real outcomes from recipient side, particularly when real results are hard to accomplish. In this manner, foreign aid negatively affects rule of law reforms although unintendedly (Erbeznik, 2011).

In case of multiple donors, donors' objectives often conflict with aid receiving countries' developmental agendas and donors' objectives also conflict with each other. There is a pressure on donor country to demonstrate tangible outcomes that usually leads donors to pay salary increments to the more brilliant local staff. This type of salary increments distorts motivation of civil servants that leads to change the direction of their attention from their own responsibilities. In this way, multiple donors hinder the functioning of bureaucracy (Knack and Rahman, 2007).

Busse and Gröning (2009) investigated the impact of aid flows on governance. They found that foreign aid had a negative rather than a positive effect on governance. Foreign aid creates rent seeking and moral hazard problems. Foreign aid could block or postpone much needed national reforms to improve governance.

Okada and Samreth (2012) conclude that aid money usually decreases corruption and its reduction effect is larger in less corrupt countries. One possible channel is that in less corrupt countries, there is less chance of misuse of resources by public officers and foreign aid may be used more effectively and in this way it improves the quality of institutions. Furthermore, result of foreign aid on corruption is not the same by different donor countries. Multilateral aid, from different institutions for instance the International Monetary Fund, World Bank and regional development banks, has larger reduction impact than that of total foreign aid. The reason behind

this may be that donor institutions usually bind recipients to commit to decrease corruption as a condition of providing financial aid.

Jaouadi and Hermassi (2013) illuminated the real impact of aid on governance in the developing countries including the MENA and Sub-Sahara region over the period 1990-2004 using the threshold theory. The threshold level represents the degree of economic absorption capacity of the recipient countries. After some threshold level, the assistance effect becomes damaging on stimulating the governance of the above mentioned countries. The aid amount above the threshold level is a severe threat to the institutional building of recipient governments because the additional aid will increase an environment of risk.

Qayyum (2013) attempted to discover the effect of foreign aid on governance for Asian developing countries. This study has taken annual data over the period of 1984 to 2010. The results indicated that foreign aid in an environment of conflicts deteriorated institutional quality. The reason is somewhat obvious as in the presence of foreign assistance government is not accountable to the general public and now government is not reliant on the earned revenue. The study has found that foreign aid stimulates corruption which infers that at every time if government officers are in a position to get foreign assistance then they would indulge in corruption and as a result weakening governance. Foreign aid also deteriorates bureaucratic quality and the reason behind is that donors may employ bureaucrats on higher salary packages and hire these bureaucrats on foreign funded projects.

Bonaglia *et al.* (2001) found that more open economies demonstrated lower level of bureaucratic corruption or low level of corruption and as a result there emerges better governance. Corruption increases when there is monopoly of power with discretion. There is no incentive for bribery in a society if the perfect competition prevails in an economy. In perfect competition, there are millions of agents and they can't affect price or the amount of the goods that one buys or sells. In the same way, corruption is decreased when economic rents are not influenced by the discretionary power of some government official.

Collier and Dollar (2004) argue that foreign aid can have an income and substitution. Foreign aid alters the relative price of good against bad governance and makes good governance cheaper and there are more chances that the bad governance will be substituted by the good governance. Compensating this effect, aid money directly supplements public resources and diminishes the need for the government to back its expenditures with taxation. Thus, it reduces internal pressure for accountability and we can

consider this effect as an adverse income effect. Usually, this suggests a change in the demand for accountability since this is related in taxation, which is reduced by resolving aid's fungibility issue. They concluded that the net effect of aid money on corruption and consequently on governance could be favourable or unfavourable. This all is the question which can only be resolved empirically.

Gatti (2004) presents some empirical evidence on the explicit connection between restrictions to trade and corruption. High trade barriers to international transactions openly motivate private agents to bribe public officials and bureaucrats in exchange for discrimination and diminish competition between foreign and local firms so that level of corruption does remain high.

Larrain and Tavares (2004) conclude that there is a positive relationship between FDI and corruption.

Acemoglu and Robinson (2005) highlight that globalization affects institutional quality. Inequality is a channel through which globalization affects institutional quality. They use trade and financial openness as a proxy for globalization. Based on the Heckscher-Ohlin model, they argue that if a labour abundant developing country opens trade or capital inflows then inequality is decreased because wages will rise comparative to the return to capital. With a lower level of inequality, there are more chances for democracy and it becomes less redistributive. Globalization decreases the income gap between factors and thus also decreases the risk of political conflict since voters of lower income groups demand less for highly redistributive policies. Endurance of democracy depends on income distribution and so on factor prices. According to this reasoning, globalization is likely to effect democracy and thus also corruption in developing countries both by financial openness and trade mainly over its effect on inequality. If the developing country is land abundant and it opens up trade then trade raises the income of landowners who usually represent small elite. As a result, inequality increases and there is less chance of the survival of democracy. Thus, they conclude that the effect of globalization on democracy and corruption remains an empirical question.

Larrain and Tavares (2007) conclude that trade policy is a vital source of rents when the government applies duties on the different kinds of products. Duties are subject to political influence and public officers use their extensive discretionary influence. Producers are ready to bribe officials for their private interests. In comparison, there is a little room for policymaker's discretion in case of free trade so it becomes an effective policy instrument in

the combat against corruption. They also find that political rights have negative impact on corruption.

Blouin *et al.* (2012) demonstrate that globalization affects positively governance through increasing a country's vulnerability to unexpected capital flight. This increased risk of capital flight can regulate governments and improve welfare and governance. If the country has solid economic essentials (*e.g.*, because of fundamentally diversified export sector) and is not sensitive to adverse shocks in the global economy then globalization is expected to have a positive effect. The effect of globalization on governance can go either way. Globalization is expected to improve well-being if a country is less susceptible to random shocks either because it is comparatively developed or has a varied export sector. In opposite situation, globalization has a negative effect on welfare, if the country has fragile fundamentals (*e.g.*, specializes primary goods that are volatile or in exporting mining) or faces a volatile and weak global economy. In these situations, globalization depresses welfare by having a negative inducement effect on governance.

Moore (2004) finds a positive connection between tax revenue and good quality of governance in the case of developing countries. The extent to which governments depend on general taxation for their financial resources defines their accountability towards their citizens. Many governments who depend more on non-tax income like gas, oil and minerals exports or on aid money do not make much tax effort and as a result state elites become economically independent of citizen taxpayers. This changes the political incentives that political elite face and the means in which they pursue to achieve, use and maintain their power. The long term consequences for aid dependence rather than tax dependence on governance are hurtful.

McDonald and Jumu (2008) analyze the impact of foreign aid, natural resources and tax system on governance. They also reveal that it should be examined that from where the revenues of a country are coming rather than to just consider where they have been used. They also point out that foreign aid seems like tax revenue so it should be allocated and used in a transparent way. They conclude that aid and natural resources have negative influence on governance but tax revenue has significant positive influence on governance.

Altunbas and Thornton (2011) argue that taxation can improve the quality of governance and also can produce good quality public sector institutions by making governments more accountable and responsive to their citizens. Taxes are also helpful in building capacity and improving

public policy. Using cross sectional data of developing and developed countries, they found that taxation develops the quality of governance and that those taxes that are collected most directly by citizens play the most vital role in improving governance.

Badinger and Nindl (2014) present new empirical evidence on the determinants of corruption. They conclude that political rights have negative effect on corruption and globalization has a negative relationship with corruption.

According to some economists, aid is not helpful to accelerate economic development because foreign aid has a negative effect on governance. Aid undermines government accountability to citizens that's why it goes into the pockets of corrupt politicians and expands unproductive government bureaucracies or it is just misused. While some economists say that aid has a positive effect on governance because foreign aid can force recipient to strengthen their policy and establish good and sound national institutions. It enables them to improve bureaucratic quality by paying attractive salaries to civil servants. With these mix results of hope and doubts, this study has empirically examined effect of foreign aid on governance in Pakistan. There exists no such study that explores the connection between foreign aid and governance in case of Pakistan.

IV. MODEL SPECIFICATION, DESCRIPTION OF THE VARIABLES AND DATA SOURCES

Following the earlier literature on the relationship between foreign aid and governance, we have specified the following model in case of Pakistan:

$$Gov_t = \beta_0 + \beta_1 odagdp_t + \beta_2 taxgdp_t + \beta_3 absenceofpolright_t + \beta_4 econglo_t + \eta$$

To measure the governance, International Country Risk Guide (ICRG) dataset has been used in this study. It's an index, ranges from 0 to 16. It is made by summing up the three measures: corruption, bureaucratic quality and rule of law. The higher value indicates good governance while value close to 0 indicates bad governance. The ICRG rankings are issued on monthly basis. We have calculated yearly values by calculating the average of the 12 months values for each year.

A disbursement of foreign economic assistance (loans and grants) is in million US Dollars. We have calculated foreign aid as a percentage of GDP. Source of this variable is *Pakistan Economic Survey* (various issues).

Economic globalization has two dimensions. One dimension is actual economic flows and second dimension is proxies for restrictions to trade and capital. Actual economic flows include data on FDI, trade and portfolio investment. Restrictions on trade and capital are measured as hidden import barriers that comprise taxes on international trade (as a percentage of current revenue), average tariff rates and an index of capital controls. This is KOF index of economic globalization introduced by Dreher (2006).

Taxes include both direct and indirect taxes (consolidated federal and provincial). Then we have calculated tax percentage of GDP. This has been taken from various issues *Pakistan Economic Survey*.

It's an index that ranges from 1 to 7. Higher value means absence of political rights in a country. Lower value means good condition or presence of political rights in a country. Data on political rights has been taken from Freedom House.

To examine the short-run and long-run relationship between foreign aid and governance, we have applied ARDL approach to co-integration, which allows for differences in the order of integration of the variables. This approach estimates short-run and long-run relationship concurrently and delivers efficient and unbiased estimates. Following Pesaran *et al.* (2001) the error correction representation of the ARDL model is as follows:

$$\begin{aligned}\Delta (GOV)_t = {} & \beta_0 + \lambda_1 (GOV)_{t-1} + \lambda_2 (polright)_{t-1} + \lambda_3 (odagdp)_{t-1} \\ & + \lambda_4 (ecoglo)_{t-1} + \lambda_5 (taxgdp)_{t-1} + \sum_{i=0}^{p} \beta_1 \Delta(GOV)_{t-i} \\ & + \sum_{i=0}^{q} \beta_2 \Delta(polright)_{t-i} + \sum_{i=0}^{r} \beta_3 \Delta(odagdp)_{t-i} \\ & + \sum_{i=0}^{s} \beta_4 \Delta(ecoglo)_{t-i} + \sum_{i=0}^{u} \beta_5 \Delta(taxgdp)_{t-i} + \varepsilon_{t1}\end{aligned}$$

The parameter β_i, where i = 1, 2, 3, 4, 5, is the corresponding long-run multipliers while the parameters λ_1, λ_2, λ_3, λ_4 and λ_5 are the short-run dynamic coefficients of the fundamental ARDL model.

Δ is a symbol for the first difference operator

β_0 is the drift component

ε_{t1} is the typical white noise residuals.

In the ARDL model, the long-run relationship among variables is carried out on the bases of calculating partial F-test on the first differenced portion

of Unrestricted Error Correction Model (UECM) of the above mentioned equation. In this step, the regression equation for Gov_{it} is quantified as:

$$\Delta Gov_{it} = a_0 + \sum_{i=1}^{p} b_i \Delta(Govi)_{t-i} + \sum_{i=1}^{p} c_i \Delta(odagdp)_{t-i} + \sum_{i=1}^{p} d_i \Delta(polrighti)_{t-i} + \sum_{i=1}^{p} f_i \Delta(ecogloi)_{t-i} + \sum_{i=1}^{p} g_i \Delta(taxgdpi)_{t-i}$$

To generate error correction mechanism, the one lag of each variable at the level is incorporated to above equation and Microfit 4.0 is used to test this variable addition. It is done by F-test. F-test finds the joint significance of all the new additional lagged level variables.

$$\Delta Gov_{it} = a_0 + \sum_{i=1}^{p} b_i \Delta(Govi)_{t-i} + \sum_{i=1}^{p} c_i \Delta(odagdp)_{t-i} + \sum_{i=1}^{p} d_i \Delta(polrighti)_{t-i} + \sum_{i=1}^{p} f_i \Delta(ecogloi)_{t-i} + \sum_{i=1}^{p} g_i \Delta(taxgdpi)_{t-i} + \theta_1 (Gov_i)_{t-1} + \theta_2 (ecoglo_i)_{t-1} + \theta_3 (polright_i)_{t-1} + \theta_4 (odagdp_i)_{t-1} + \varepsilon_i$$

The null hypothesis for no cointegration for the variable *Govi* against alternative hypothesis is given as:

H_0: $\theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$

H_1: $\theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 = 0$

This hypothesis is established by partial F-test.

Pesaran *et al.* (2001) have presented two arrays of suitable critical values. One array supposes that all variables under consideration are of integrated of order one, *i.e.* I(1) while the other set assumes that all variables are of integrated of order zero, *i.e.* I(0). This gives a group covering all likely arrangements of the variables into I(0) or I(1) or marginally integrated. If the estimated or calculated value of F-statistic is greater than the upper bound of critical values then null hypothesis (no cointegration exists) is rejected. This forms long-run connection among variables of interest. If the calculated F-statistic is less than the critical value of lower bound then the null hypothesis of no cointegration cannot be rejected. It means that there exists no

cointegration. If the calculated or estimated value falls between upper and lower bounds critical values then F-test will be inconclusive. Many factors determine F-value such as sample size, a number of explanatory variables and trend and/or a constant of ARDL. F-test is much affected by the number of lags used on each first differenced variable (Bahmani-Oskooee, 1999).

As per requirement, we have tested all the variables for unit root before applying ARDL approach; and the results have been reported in Table 2.

TABLE 2

Augmented Dickey Fuller Test for Unit Root

Variables	Level		1st Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Gov	–1.54	–2.07	–3.27**	–3.19
Abpolright	–1.63	–1.64	–4.32***	–4.24***
odagdp	–1.13	–3.49*	–7.36***	–7.54***
ecoglo	–0.95	–2.53	–6.01***	–6.00***
taxgdp	–0.37	–3.34*	–7.65***	–6.37***

Critical values for level and 1st difference are –3.7, –2.98 and –2.63 at 1%, 5% and 10% respectively with intercept. Critical values for level and 1st difference are –4.35, –3.59 and –3.23 at 1%, 5% and 10% respectively with intercept and trend.

***p < 0.01, **p < 0.05, *p < 0.1

TABLE 3

F-Test

Lag Length	F-statistics	Critical values at 1%		Results
		I(0)	I(1)	
1	6.2	3.29	4.37	Cointegration
2	7.79			Cointegration

K = variables are on the left hand side.

Table 2 shows that no a single variable is of I(2) or higher order. The results of F-test of ARDL approach for the existence of cointegration have been given in Table 3.

Table 3 shows that calculated F-statistics is greater than critical value of upper limit so we can conclude that cointegration exists at 1%. The next step is to determine the lag length for ARDL test, which is presented in Table 4.

TABLE 4

Lag Length Selection

Endogenous variables: ECOGLO GOV ODAGDP ABPOLRIGHT TAXGDP						
Exogenous variables: C						
Sample: 1984 – 2012						
Included observations: 27						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	–214.9912	NA	8.218822	16.29564	16.53561	16.36700
1	–141.0084	115.0843	0.226640	12.66729	14.10711*	13.09542
2	–102.8211	45.25905*	0.105608*	1.69045*	14.33012	2.47536*

* indicates lag order selected by the criterion

The result in Table 4 suggests the use of AIC at lag 2, SC at lag 1. The result of this study is based on AIC at lag 2. Based on the above prerequisites, we estimate the ARDL model, which is given in Table 5.

TABLE 5

ARDL (1, 0, 2, 0, 2) Selected Based on Akaike Information Criterion
Dependent variable is GOV
27 observations used for estimation from 1986 to 2012

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
GOV(–1)	0.62400	0.13048	4.7823 [0.000]
ODAGDP	–0.41674	0.14553	–2.8636 [0.011]
TAXGDP	0.01396	0.12401	0.1125 [0.912]

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
TAXGDP(–1)	0.29406	0.13698	2.1467 [0.047]
TAXGDP(–2)	0.24931	0.14672	1.6992 [0.108]
ECOGLO	0.13092	0.04500	2.9095 [0.010]
ABPOLRIGHT	–0.17989	0.11085	–1.6227 [0.123]
ABPOLRIGHT(–1)	–0.30239	0.15631	–1.9346 [0.070]
ABPOLRIGHT(–2)	0.12583	0.10306	1.2210 [0.239]
C	–5.6315	2.9959	–1.8797 [0.077]
R-Squared	0.86539	R-Bar-Squared	0.79413

The diagnostics are given below:

*Test Statistics * LM Version * F Version *

*A: Serial Correlation*CHSQ(1) = 0.84215 [0.359]*F(1, 16) = .51512 [0.483]*

*B: Functional Form *CHSQ(1) = 0.12281 [0.726]*F(1, 16) = 0.073112 [0.790]*

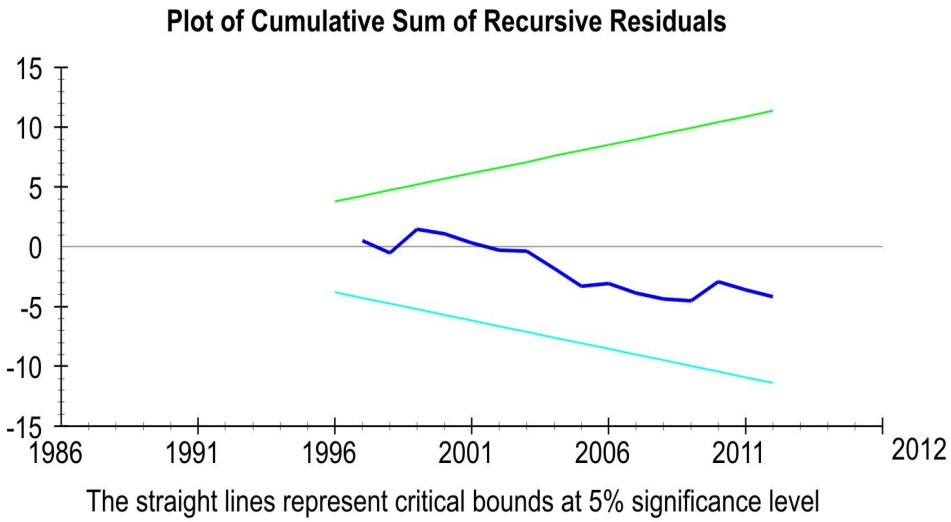
*C: Normality *CHSQ(2) = 0.28202 [0.868]* Not applicable *

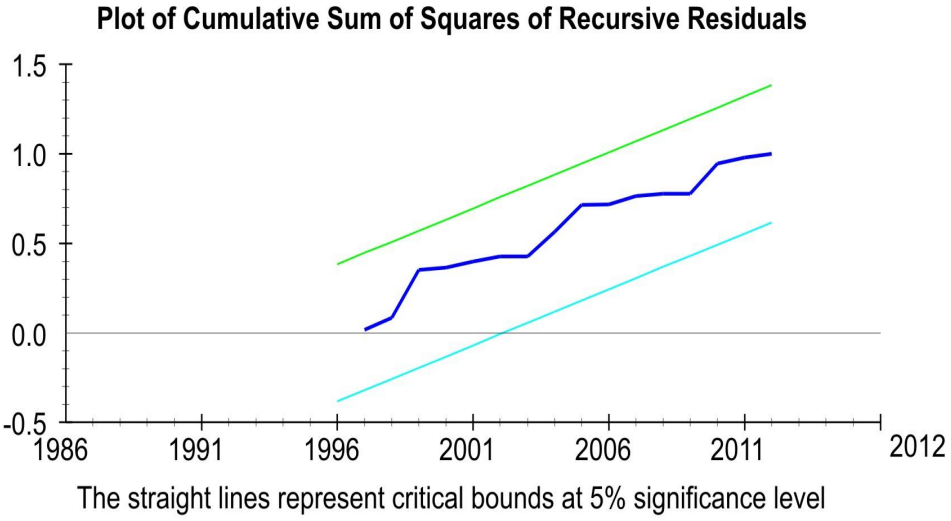
*D: Heteroscedasticity*CHSQ(1) = 0.084353 [0.771]*F(1, 25) = 0.078349 [0.782]*

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

Diagnostic test checking shows that there exists no serial correlation because p-value is greater than 0.05. Normality condition is also satisfied. It shows that variance is constant so model is normally distributed. Functional form shows that there is no specification error in the model proved by Ramsey's Reset Test showing value higher than 5%. There is no heteroskedasticity issue.

For testing stability, the technique of cumulative sum of recursive (CUSUM) and cumulative sum of square (CUSUMSQ) is introduced by Brown *et al.* (1975) and suggested by Pesaran *et al.* (2001). This technique is used to check the parameter constancy or stability of the model. Testing of stability is compulsory because the existence of cointegration does not necessarily mean that those estimated coefficients must be stable. Unstable coefficient produces unreliable information.





The null hypothesis in the case of CUSUM and CUSUMSQ is that all the coefficients are stable. It can be seen that CUSUM and CUSUMSQ are plotted against the break points. The null hypothesis cannot be rejected if the plots remain within the critical bounds which are created at 5% level significance. The above plots show the stability among the variables throughout the period under consideration. This confirms that the model is stable.

As Table 6 shows, economic globalization and oda have significant impact on governance in the short-run. Political rights and tax percentage of GDP have insignificant impact on governance in the short-run. If oda percentage of GDP increases by 1% then governance index decreases by 0.42 point. If economic globalization index increases by 1% then governance index increases by 0.13 point.

TABLE 6

Error Correction Representation for the Selected ARDL Model
ARDL (1, 0, 2, 0, 2) Selected Based on Akaike Information Criterion
Dependent variable is dGOV
27 observations used for estimation from 1986 to 2012

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
dODAGDP	–0.41674	0.14553	–2.8636 [0.010]
dTAXGDP	0.01396	0.12401	0.1125 [0.912]
dTAXGDP1	–0.24931	0.14672	–1.6992 [0.106]
dECOGLO	0.13092	0.04500	2.9095 [0.009]
dABPOLRIGHT	–0.17989	0.11085	–1.6227 [0.121]
dABPOLRIGHT1	–0.12583	0.10306	–1.2210 [0.237]
dC	–5.6315	2.9959	–1.8797 [0.076]
ECM(–1)	–0.37600	0.13048	–2.8816 [0.010]
R-Squared	0.54420	R-Bar-Squared	0.30289

R-Squared and R-Bar-Squared measures refer to the dependent variable; dGOV and in cases where the error correction model is highly restricted, these measures could become negative.

The coefficient of ECM shows the speed at which the variables converge to the equilibrium. Coefficient of ECM shows the speed of adjustment whereas the negative sign show that it is converging to the equilibrium rather than diverging. This means that 38% of disequilibria from the short-run shocks converge back in the long-run. 54% variation in dependent variable is explained by independent variable.

TABLE 7

Estimated Long-Run Coefficients using the ARDL Approach
ARDL (1, 0, 2, 0, 2) Selected Based on Akaike Information Criterion
Dependent variable is GOV
27 observations used for estimation from 1986 to 2012

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
ODAGDP	–1.1084	0.41694	–2.6583 [0.017]
TAXGDP	1.4823	0.55616	2.6652 [0.016]
ECOGLO	0.34818	0.12448	2.7971 [0.012]
ABPOLRIGHT	–0.94802	0.34338	–2.7609 [0.013]
C	–14.9775	9.0226	–1.6600 [0.115]

As Table 7 shows, all independent variable have significant impact on governance in the long-run. If ODAGDP increases by 1% then governance index decreases by 1.1 point. If index of absence of political rights increases by 1% then governance index decreases by 0.95 point. If tax percentage of GDP increases by 1% then governance index increases by 1.5 point. If index of globalization increases by 1% then governance index increases by 0.34 point.

V. DISCUSSION

This study finds a negative and significant effect of foreign aid on governance. The results support the findings of Bräutigam and Knack (2004), Rajan and Subramanian (2007), Knack and Rahman (2007), Busse and Gröning (2009), Qayyum (2013), Jaouadi and Hermassi (2013) who found that aid dependence could undermine the quality of public sector institutions and governance in many ways. It weakens accountability, enhances corruption and relieving pressures to modify ineffective policies, alleviate burden to restructure institutions. Foreign aid can deteriorate the bureaucratic quality of recipient governments. This deterioration happens directly by drain off scares or limited talent from the civil service. Aid donor countries mostly appoint the most skillful public bureaucrats at salaries packages that are much greater than the recipient government salaries packages. Each donor is concerned with development agenda in aid receiving country but its first priority is its national interest and goals. In case of multiple donors, donor objectives conflict with aid receiving country's

developmental agendas and donors' objectives also conflict with each other. There is a pressure on donor country to demonstrate tangible outcomes that usually leads donors to pay salary increments to the more brilliant local staff. This type of salary increments distorts motivation of civil servants. Foreign aid decreases the motivations of governments and political leaders to adopt a determination to reform. As a consequence, there will be very less chance of the success of the rule of law reforms (Erbeznik, 2011). Ordinary expectation of aid may be sufficient to escalate the indulgence in corruption and decrease productive public expenditure (Svensson, 2000).

The present study finds a negative and significant relationship between globalization and governance that is in line with the studies of Bonaglia *et al.* (2001), Gatti (2004), Larrain and Tavares (2004), Acemoglu and Robinson (2005), and Blouin *et al.* (2012) who found a positive relationship between globalization (trade openness) and governance. According to these studies, more open economies demonstrated lower level of bureaucratic corruption or low level of corruption and as a result better governance. Corruption increases when there is monopoly power with discretion and low level of accountability. There is no incentive or motivation for bribery in a society if the perfect competition prevails in an economy. Larrain and Tavares (2004) explored that foreign direct investment may reduce corruption because of the reason that the high levels of international capital mobility make foreign investors more expected to leave the market if corruption is not checked.

The present study finds a positive and significant effect of tax on governance that is consistent with the result of the Moore (2004), McDonald and Jumu (2008), and Altunbas and Thornton (2011) who found positive effect of tax on governance. According to these studies, citizens focus on information regarding spending of tax money, this increase accountability in state institutions and there will be less corruption. Donor will not think that aid is the only the solution for revenue problem. Instead donors will deliver aid to recipient countries with policies and reforms that help in improving governance.

This study finds a positive and significant effect of absence of political right on governance which is in line with the result of Larrain and Tavares (2007) and Badinger and Nindl (2014) who found that presence of political rights have negative impact on corruption. According to these studies, the level of political rights that are assured by a political system can also be connected with corruption. Some of the features of democratic political systems such as free press, open and regular electoral competitions can upturn the possibility of revealing corrupt activities.

VI. CONCLUSION AND SUGGESTIONS

Pakistan has been the beneficiary of foreign aid inflows since its independence. The present study investigates the effect of foreign aid on governance in Pakistan. The results of present study show that foreign aid has negative influence on governance in Pakistan. There can be a number of explanations and causes for this result. For example, foreign aid is stimulating corruption which infers that at every time if government officers are in a position to get foreign assistance then they would indulge in corruption that results in weak governance. Foreign aid also deteriorates bureaucratic quality and the reason behind is that donors may employ bureaucrats on higher salary packages from other countries and hire these bureaucrats on foreign funded projects. In this way the native bureaucrats become inefficient. Governments are not accountable to the international loaning agents if they do not reform rule of law. A weak mechanism of accountability is another major reason for poor governance resulting from foreign aid inflows in Pakistan.

Moreover, to receive foreign aid over a protracted span of time is deteriorating the quality of governance in Pakistan. That is the reason aid is not contributing to economic development and Pakistan is still dependent on foreign aid. Both the international aid donor community and Pakistan are locked into a situation that they are impotent to yield development predictably or consistently.

Suggestions must be formulated very cautiously, pending supplementary research. Further investigation can be done by disaggregates foreign aid by source (*e.g.*, multilateral vs. bilateral). This disaggregate analysis may create more insight into the accurate mechanisms by which aid money seems to undermine the quality of governance. Findings of this study recommend some possible suggestions.

1. Foreign aid programmes should be clearly understood as a temporary and short-term development tool. The notion of having an aid “exit strategy” is not a new thing. The successful Marshall Plan, evidently, was a temporary programme with in-built exit and motivation for self-help.
2. Donors should formulate such type of policies that there should be a margin for recipient governments to plan and formulate their own projects and policies.
3. A larger portion of aid money could be dedicated or tied for the enhancement in the quality of governance. For example, foreign aid will be tight to some kinds of programmes like to form meritocratic

bureaucracies and to form strong, corruption free and independent court systems.

4. Our results show that economic globalization has positive effect on governance. Pakistan should depend on much stable and sustainable external financing resource that has positive effect on governance instead of depending on unstable, volatile and insecure resources. Given the common features of FDI and trade, we can believe that both are more sustainable and stable external resources as compared to foreign aid. FDI and trade have not only positive impact on governance but also cause spillover effects.
5. In order to make aid productive and meaningful for growth and development, policy makers should focus on governance issues and ensure proper utilization of foreign resources with strict accountability.

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KNOWLEDGE SHARING, KNOWLEDGE MANAGEMENT STRATEGY AND PERFORMANCE
A Knowledge Based View

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Abstract. This study turns to investigate the impact of knowledge sharing (KS) practices on banks' performance in the presence of mediating mechanism of system-oriented strategy and human oriented strategy. Survey method (amended instrument) is used to collect the data from 810 middle level managers from a sample of 42 banks. Structural equation model (SEM) and confirmatory factor analysis (CFA) are employed to evaluate the overall fitness of the model. The results of CFA postulate that all the indices in the models satisfactorily meet the standardized cut off values, thus suggesting well fit of the models. However, results of standardized path coefficients reveal that all the hypotheses are supported except H3b, which implies that explicit KS practices are not significantly related with human oriented strategy. Furthermore, findings of the study shed light that system and human oriented strategy significantly mediates the relationship for both explicit and tacit KS driven performance, thus encouraging the mangers to emphasize more on KM strategies because it helps them to align the KM initiatives for better sharing of knowledge which may lead to sustainable performance. Nevertheless, this study finds that tacit KS practices more significantly contribute to the performance of banks than explicit KS practices which indicates that managers need to emphasize more on explicit knowledge sharing.

Keywords: Knowledge sharing, Knowledge management strategy, Performance

JEL classification: D23, D83, L25

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I. INTRODUCTION

In the era of global marketplace, management of intangible resources is very critical and important to survive in a global dynamic environment (Teece *et al.*, 1997; Subramaniam and Youndt, 2005). The knowledge based view (KBV) suggests that managing knowledge base resources are more likely to contribute in obtaining sustainable superior performance and competency for organizations than tangible resources. It postulates that knowledge sharing (KS) practices among individuals, groups and units are essential for organizations, to create, share, capture and application of knowledge that enables organizations to improve resource structuring and capacity building, which leads to superior organizational performance (Wang *et al.*, 2012; Lee and Sukoco, 2007). In addition, KS practices are regarded as synchronization, collaboration and sharing of existing knowledge and expertise within the organization (Haas and Hansen, 2007) which encompasses a set of shared meanings and understandings of related knowledge to employees with access to relevant information and knowledge (Lin, 2007; Gold *et al.*, 2001; Liu *et al.*, 2005).

Knowledge management (KM) strategies can capture and identify strategic procedures in managing knowledge base activities in organizations (Choi and Lee, 2003). The purpose of such strategic initiatives is to encapsulate the appropriate equilibrium of internal and external knowledge that are paramount firm's prerequisites or needs which turn to capitalize its resources most effectively (Bierly and Chakrabarti, 1996). However, there is still lack of consensus to adhere the concept of knowledge and knowledge management strategy in KM circles. Zack (2002) argues that term knowledge strategy is a competitive strategy which comprises of intellectual resources and capabilities of firms. The purpose of this strategy is to find out which knowledge is strategically most important for long term performance of business (Zack, 2002). In contrast, KM strategy encompasses strategic plans in order to define and formulate the processes, tools and infrastructures required to manage the knowledge gaps and its flow more effectively (Zack, 2002). The growing importance of KS practices has encouraged the mangers to emphasize more on KM strategies because it helps to align the organization processes, structure and culture for better sharing of knowledge which may lead to better performance outcomes. Previous studies point out that KS practices significantly determine firms' performance in terms of reduction of production and operation cost, improve the innovative capability of organization for production of new products and services, sales growth and better completion of projects (Wang and Wang, 2012; Huang and Wu, 2010). However, the following questions are unaddressed by prior studies

whether the KS directly influence the performance of organization or any mediating mechanism is over there which influence KS-driven performance. Keeping in view, this study attempts to explore the mediating role of KM strategy for evaluating the KS-oriented performance.

Extant of research has identified various KM strategies and its impact on performance: "Codification and personalization" (Hansen *et al.*, 1999), "Cognitive and community" (Swan *et al.*, 2000), "Innovators, explorers, exploiters, and loners" (Bierly and Chakrabarti, 1996), "Explicit-oriented and tacit-oriented" (Jordan and Jones, 1997), "Conservative and aggressive" (Zack, 1999), "Pure procedure and pure expertise" (Bohn, 1994), "Codification and experience accumulation" (Singh and Zollo, 1998), and "Systems-oriented and human-oriented" (Choi and Lee, 2002). However, the present study attempts to focus on system and human oriented strategy in order to find which one strategy more significantly influences the relationship between KS practices and performance of banks. Under the dynamic classification of KM strategies, this study adopts the Choi and Lee (2002) typology which views that both system and human oriented are most aligned KM strategies, which is not used in context of financial institutions.

II. THEORETICAL JUSTIFICATION AND HYPOTHESES

KNOWLEDGE SHARING (KS) AND PERFORMANCE

Knowledge sharing practices has got lot of significance, as it provides potential benefits to individuals and organizations (Yi, 2009; Davenport and Prusak, 1998; Jonsson and Kalling, 2007). KM literature explains two broad categories of knowledge known as explicit and tacit knowledge (Nonaka and Takeuchi, 1995). KBV argues that explicit and tacit knowledge provides solid foundation for firms to attain and sustain competitive position (Reus *et al.*, 2009; Felin and Hesterly, 2007). Explicit knowledge refers as visible, documented, articulated and constructible knowledge which can be stored independently (Junnarkar and Brown, 1997; Nonaka and Takeuchi, 1995). Whereas, tacit knowledge refers as implicit knowledge which is non-documented, unarticulated, non-expressible, based on cognitive thoughts and perceptions (*i.e.* embedded in minds of individuals in form of experiences and obtains from other people) and difficult to share (Polanyi, 1966; Wang *et al.*, 2006). However, Skyrme and Amidon (1998) argue that explicit knowledge is a formal and systematic knowledge easy to measure and codified in words or numbers. This formal knowledge can be obtained from various sources of organization including, company procedures, policies,

written manuals, internal and external data forms. So, explicit and tacit KS practices help to integrate the scattered knowledge to enhance the creativity and innovation which results better firms' performance (Gao *et al.,* 2009).

Explicit KS Practices and Performance

Explicit KS practices help to integrate the scattered knowledge, increase firm's innovativeness, and creativity to achieve superior performance outcomes (Gao *et al.,* 2009). In a broad spectrum many KS practices such training and development, technological support, sharing of official documents and reports are few examples to integrate the knowledge across the organization to enhance products quality and services in terms of operational optimization and customer intimacy (Wang and Wang, 2012). Organizations integrate explicit KS practices together to improve operational performance which constitutes the primary source for financial performance. Lawson *et al.* (2009) also advocate that organizations integrate explicit KS practices which are also referred to formal practices to improve products, services and business processes. However, studies also suggest that these formal practices within the organization and between the organizations enable the management to identify crucial issues regarding the product quality improvement and innovation which lead the way towards better firms performance (Carr and Kaynak, 2007; Wang and Wang, 2012).

H_1: There exists a positive relationship between explicit KS practices and banks' performance.

Tacit KS Practices and Firms' Performance

Tacit knowledge is an experimental and context specific interpersonal knowledge which enables the organizations' employees to share their experiences, intuitions and cognitions together for problem solving. It may provide massive benefits to organization (Down, 2001; Akbar, 2003; Matthew and Sternberg, 2009) in the form of product quality and services, improvement in existing processes, reduction in transaction cost, first mover advantage in case of earlier lunch of products and technological innovation which lead to superior performance (Law and Ngai, 2008; Sher and Lee, 2004). Harlow (2008) argues that tacit knowledge in terms of technical and non-technical know-how resides in the minds of engineers, marketers and operational managers bring competitiveness as a source of value creation for firms. Du *et al.* (2007) point out that sharing of tacit knowledge is an important determinant of firm's performance. Likewise, Wang *et al.* (2014) also state that tacit KS practices enhance firm's financial performance when it is linked to cost reduction, customer management, sales and outsourcing.

H_2: There exists a positive relationship between tacit KS practices and banks' performance.

KNOWLEDGE SHARING, KM STRATEGY AND PERFORMANCE

KM has attracted much of executive's interests as a corporate business strategy due to its capability to innovate, competitiveness, and ability to generate profit and value for the organization. In beginning era of KM, it was bit difficult to objectively determine the value of KM for organization. However, now we have number of KM maturity models which define and clarify the role of KM for value creation such as model of Tan *et al.* (1998), CRAI Model (Oluikpe, 2012), SECI model (Nonaka and Takeuchi, 1995) and Intellectual Capital Concepts (Edvinsson and Malone, 1997). Carrillo *et al.* (2003) claim that KM has deepened concern with organization performance. Further, Du Plessis (2007) also discusses the positive benefits of KM as the corporate business strategy and needs to emphasize for awareness of knowledge resources and its role for value creation. KM literature defines that developing KM strategies facilitate to identify the strategic assets that may yield positive business results, leveraging competitive advantage and sustainable performance (Nonaka, 1994; Sharp, 2006; Du Plessis, 2007). KM strategy is imperative for successful KM plan (Yu, 1999; Parlby and Taylor, 2000; Robertson, 2005). This argument is not simple as it could be realized because complexity of organizational factors and institutional forces are major obstacles for the implementation of KM strategies which is not in the scope of this study. Nevertheless, studies also suggest that firms need to align the KM as corporate strategy through KM maturity models in order to bring out superior business results (Greiner *et al.*, 2007).

Prior discussion in introduction part of study highlights the various types of KM strategies. However, this study only focuses on system and human oriented in context of research setting. Choi and Lee (2002) assert that organizations focus on system and human oriented KM strategies due to its more viability in knowledge base organizations like banks. Therefore, this study tends to focus that system orientation strategy which formally capture and store the codified knowledge in KM processes through IT whereas, human orientation strategy attempts to capture or acquire the tacit knowledge via social interactions or face to face discussions.

H_{3a}: There exists a positive relationship between explicit KS practices and system oriented strategy.

H_{3b}: There exists a positive relationship between explicit KS practices and human oriented strategy.

H_{4a}: There exists a positive relationship between tacit KS practices and system oriented strategy.

H_{4b}: There exists a positive relationship between tacit KS practices and human oriented strategy.

H_5: There exists a positive relationship between system oriented strategy and performance.

H_6: There exists a positive relationship between human oriented strategy and performance.

III. METHODOLOGY

INSTRUMENTATION

A survey method questionnaire is used to collect the data from respondents. This study adopts the random sampling technique drawing the sample from banking sector from the province of the Punjab which is relatively more developed. The choice for sample consideration based on that banking sector is more knowledge oriented sector in services sector and where KS practices extensively matter for sustainable performance of banks in terms of operational and financial performance, customers' satisfaction and product development. Further, using the key informant approach, this study realizes that middle and senior level managers are more relevant information providers. We distributed 1250 questionnaires among banks' employees and 965 questionnaires were received from respondents. Only 810 responses were considered for analysis and remaining were discarded due to the incomplete response or selecting same answer for each questions thus representing 64.8% which is quite good. The instrument given in Appendix is comprised of four parts. First part of instrument presents the basic information of respondents at nominal scales and remaining parts of instrument attempts to capture the respondents' response about independent (KS practices), mediating (KM strategy) and dependent variables (overall performance). All the measurement items were reused from existing literature to ensure the reliability and content validity of instrument, particularly for measuring the latent constructs. The KS practices were identified and adapted from the work of Wang *et al.* (2014), Wang and Wang (2012), and Liebowitz and Yan (2004), KM strategy was adapted from the work of Choi (2002), Choi and Lee (2002), and Hansen *et al.* (1999) and the overall organizational performance is measured based on four value

disciplines, *i.e.* operational excellence, customer intimacy, product leadership and financial achievement, and adapted from the work of Treacy and Wiersema (1995), Kaplan and Norton (2001), Rai *et al.* (2006), Bowersox *et al.* (2000), Zack *et al.* (2009), Inman *et al.* (2011), and Vaccaro *et al.* (2010) among others. Little amendments are made according to setting of study. Pre-testing was based on little revisions and a final questionnaire was developed on five point Likert scale (1 = strongly disagree and 5 = strongly agree) after re-modification as per the feedback of anticipants.

IV. FINDINGS OF STUDY

MEASUREMENT MODEL EVALUATION

The study employs the confirmatory factor analysis (CFA) through structural equation model to assess the fitness of overall measurement model. CFA is to measure the convergent and discriminant validity of constructs for further model examination (Fornell and Larcker, 1981; Hurley *et al.*, 1997). At first stage, we have estimated the convergent validity by assessing the value of factor loadings (λ) which should be statistically significant and larger than minimum threshold of 0.35 (Hair *et al.*, 1998). Bagozzi and Yi (1988) recommended the minimum thresholds for ($C\text{-}\alpha \geq 0.7$; $AVE \geq 0.5$) for further model investigation. However, Hair *et al.* (1998) suggest that loading items greater than 0.35 have practical significance.

TABLE 1

Factor Loadings and Internal Reliability Testing

Constructs	Measure-ment Items	Mean	SD	Standard Loading	Cronbach alpha's (C-α)	Average Variance Extracted (AVE)
Explicit KS Practices	EKSP1	3.470	1.021	0.706	0.887	0.6882
	EKSP2	3.601	0.974	0.835		
	EKSP3	3.694	1.023	0.884		
	EKSP4	3.541	0.951	0.862		
	EKSP5	3.493	1.038	0.861		
Tacit KS Practices	TKSP1	3.589	0.989	0.638	0.800	0.5015
	TKSP2	3.476	0.882	0.685		
	TKSP3	3.475	0.910	0.743		
	TKSP4	3.589	0.953	0.781		
	TKSP5	3.623	0.900	0.716		
	TKSP6	3.657	1.005	0.686		

Constructs	Measure-ment Items	Mean	SD	Standard Loading	Cronbach alpha's (C-α)	Average Variance Extracted (AVE)
System oriented strategy	SOS1	3.477	0.983	0.695	0.735	0.589
	SOS2	3.670	0.940	0.827		
	SOS3	3.689	0.895	0.782		
Human oriented strategy	HOS1	3.441	1.052	0.568	0.761	0.50
	HOS2	3.415	1.027	0.833		
	HOS3	3.421	1.005	0.716		
Overall Performance	OE1	3.707	0.997	0.806	0.873	0.5881
	OE2	3.680	0.920	0.846		
	OE3	3.707	0.997	0.809		
	CI1	3.681	0.921	0.854		
	CI2	3.674	0.939	0.860		
	PL1	3.753	0.946	0.757		
	PL2	3.784	0.924	0.799		
	FE1	3.785	0.937	0.724		
	FE2	3.754	0.998	0.781		
	FE3	3.693	0.975	0.739		

Table 1 presents results of factor loadings and internal consistency which suggests that loading items (λ) lie between 0.706 to 0.884 for explicit KS practices, 0.638 to 0.781 for tacit KS practices, 0.695 to 0.827 for system oriented strategy, 0.568 to 0.833 for human oriented strategy and 0.724 to 0.860 for overall performance of banks. However, reliability lies between 0.735 to 0.887 and AVE lies between 0.50 to 0.688. These results show that measurement model meets the criteria of convergent validity suggesting better internal consistency which exceeds the minimum threshold of 0.70 (Nunnly and Bernstein, 1994).

Table 2 presents the results of inter-correlations between the constructs. We used the Fornell and Larcker (1981) typology to assess the discriminant validity. This approach suggests that "average variance extracted (AVE) for each constructs should be larger than correlation between the same constructs and any other constructs" (Wang *et al.*, 2014, p.18). In Table 2, the diagonal values indicate that square root of average variance extracted is greater than correlation of constructions, hence, discriminant validity is established, so both convergent and discriminant validity lead to better construct validity to proceed for further analysis.

TABLE 2

Inter-Correlations Between the Constructs

Variables	EKSP	TKSP	HOS	SOS	OP
EKSP	0.58	—	—	—	—
TKSP	0.082*	0.253	—	—	—
HOS	0.071*	0.452**	0.767	—	—
SOS	0.125**	0.542**	0.427**	0.707	—
OP	0.201**	0.441**	0.382**	0.458**	0.766

NOTE: Diagonal value: Square root of the AVE, Non-diagonal value: Correlation

**Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

TABLE 3

CFA Results of Models Fitness for Explicit and Tacit KS Practices

Fit Index	Scores*	Score**	Standardized cut-off value
Absolute fit measures			
χ^2/df	1.803	1.422	$\leq 2^a$; $\leq 5^b$
GFI	0.911	0.931	$\geq 0.90^a$; ≥ 0.80
RMSEA	0.044	0.047	$< 0.08^a$; < 0.10
Incremental fit measures			
NFI	0.923	0.912	$\geq 0.90^a$
AGFI	0.913	0.924	$\geq 0.90^a$; $\geq 0.80^b$
CFI	0.917	0.920	$\geq 0.90^a$
Parsimonious fit measures			
PGFI	0.782	0.731	The higher, the better
PNFI	0.775	0.728	The higher, the better

NOTES: Acceptability Criterion: [a]acceptable; [b]marginal.

* Presents the score fit indices of CFA model-I for explicit KS-driven performance)

** Presents the score fit indices of CFA model-II for tacit KS-driven performance)

This study proposes two measurement models explicit KS-driven performance and tacit KS-driven performance. The overall fitness of models is evaluated using confirmatory factor analysis (CFA) and values of absolute, incremental and parsimonious fit measures are compared with recommended cut-off. Table 3 represents the results of CFA models with scores and recommended cut-off value which indicates that all values meet satisfactory levels of fit indices thus confirmed that models were fit and hence suitable for testing the proposed hypotheses.

Table 4 shows the results of structural model using standardized path coefficients which show the relationship among latent variables. Results of the study support the first two hypotheses (H_1 and H_2) thus suggesting a positive and significant relationship of both explicit and tacit KS practices with overall performance of banks. Likewise, hypotheses H_{3a}, H_{4a}, H_{4b}, H_5 and H_6 are supported. However, H_{3b} is not supported, thus, indicating that explicit KS practices are not significantly related with human oriented strategy.

TABLE 4

Standardized Path Coefficients

Hypothesis		Estimates	P-value	SE	Remarks
H_1	EKSP → OP	0.175*	< 0.001	0.033	Supported
H_2	TKSP → OP	0.641*	< 0.001	0.029	Supported
H_{3a}	EKSP → SOS	0.078*	< 0.010	0.027	Supported
H_{3b}	EKSP → HOS	0.019	> 0.100	0.045	Not Supported
H_{4a}	TKSP → SOS	0.547*	< 0.001	0.060	Supported
H_{4b}	TKSP → HOS	0.612*	< 0.001	0.064	Supported
H_5	SOS → OP	1.049*	< 0.001	0.059	Supported
H_6	HOS → OP	0.583*	< 0.001	0.074	Supported

NOTE: * significant at the 0.001 level (2-tailed), ** significant at the 0.05 level (2-tailed), *** significant at the 0.10 level (2-tailed).

MEDIATION ANALYSIS

We have used the Baron and Kenny (1986) typology for mediation analysis in Amos 16.0. The direct effect of independent variable on dependent variable and indirect effect of independent variable on dependent variable through mediating variables are examined. Table 5 presents the direct effect of independent variable (*i.e.* both explicit and tacit KS practices) on dependent variable (*i.e.* overall performance), which is statistically

significant at ($p < 0.001$) and thus confirms the first assumption of mediation (*see* Baron and Kenny, 1986).

TABLE 5

Direct Effect (Before Mediating Variables)

Variables	Beta Estimate	SE	CR	P-value	Result
EKSP → OP	0.175	0.034	5.143	0.000	Significant
TKSP → OP	0.641	0.064	9.974	0.000	Significant

Tables 6 and 7 highlight the mediating role of system and human oriented strategy for determining the KS-driven performance. Table 6 shows that while testing the mediating role of both system and human oriented strategy, the effect of explicit KS practices on performance reduced from 0.175 to 0.104 and 0.175 to 0.123 respectively which still remained significant ($p < 0.01$), thus, indicating that all the system and human oriented strategy partially mediated the relationship between explicit KS practices-driven performance. Further, Table 7 represents indirect effect of tacit KS practices on organizational performance through mediating role of system and human oriented strategy. Results indicate that while testing the indirect effect of tacit KS practices on performance, the value of beta estimate reduces from 0.641 to 0.143 which does not remain significant thus confirm that system oriented strategy completely mediates the relationship between tacit KS practices and performance. However, in Table 7 results of mediation reveal that human oriented strategy partially mediates the relationship for tacit KS driven performance.

TABLE 6

Indirect Effect of Explicit Knowledge Sharing Practices on Banks' Performance Through System and Human Oriented Strategy as a Mediator

Variables	Beta Estimate	SE	CR	P-value	Result
EKSP → OP	0.104	0.030	3.438	0.000	Significant
EKSP → SOS	0.094	0.028	3.309	0.000	Significant
SOS → OP	0.756	0.084	8.973	0.000	Significant
EKSP → OP	0.123	0.032	3.859	0.000	Significant
EKSP → HOS	0.042	0.018	2.268	0.023	Significant at 5%
HOS → OP	1.232	0.215	5.753	0.000	Significant

TABLE 7

Indirect Effect of Tacit Knowledge Sharing Practices on Banks Performance Through System and Human Oriented Strategy as a Mediator

Variables	Beta Estimate	SE	CR	P-value	Result
TKSP → OP	0.143	0.099	1.451	0.147	Insignificant
TKSP → SOS	0.645	0.057	11.339	0.000	Significant
SOS → OP	0.759	0.139	5.469	0.000	Significant
TKSP → OP	0.355	0.078	4.531	0.000	Significant
TKSP → HOS	0.633	0.065	9.740	0.000	Significant
HOS → OP	0.445	0.092	4.829	0.000	Significant

TABLE 8

Scale Level Fit Indices for Structural Model of Explicit KS Practices with System and Human Strategy as Mediators

Fit Indices	Scores*	Scores**	Recommended Thresholds
Absolute fit measures			
χ^2/df	3.949	4.003	$\leq 2^a$; $\leq 5^b$
GFI	0.939	0.939	$\geq 0.90^a$; ≥ 0.80
RMSEA	0.060	0.061	$< 0.08^a$; < 0.10
Incremental fit measures			
NFI	0.935	0.934	$\geq 0.90^a$
AGFI	0.911	0.910	$\geq 0.90^a$; $\geq 0.80^b$
CFI	0.951	0.949	$\geq 0.90^a$
Parsimonious fit measures			
PGFI	0.642	0.633	The higher, the better
PNFI	0.711	0.699	The higher, the better

Acceptability Criterion: [a]acceptable; [b]marginal

* presents score of fit indices for structural model of explicit KS-driven performance using SOS as mediator

** presents score of fit indices the structural model of explicit KS-driven performance using HOS as mediator

Tables 8 and 9 exhibit the results of scale level fit indices for structural models of explicit and tacit KS practices with intermediates measure (*i.e.*

system and human oriented strategy) to assess the fitness of measurement models using various fit indices. The study has assessed the fitness of the structural models at scale level through estimating (1) Absolute fit measures, (2) Incremental fit measures, and (3) Parsimonious fit measures. Tables 8 and 9 reveal overall fit indices of structural model at scale level with scores and recommended cut-off values thus suggest that all values satisfactorily met the levels of fit indices, thus confirming that models were fit and hence suitable to test the proposed hypotheses as discussed above.

TABLE 9

Scale Level Fit Indices for Structural Model of Tacit KS Practices with System and Human Strategy as Mediators

Fit Indices	Scores*	Scores**	Recommended Thresholds
Absolute fit measures			
X^2/df	2.042	2.620	$\leq 2^a$; $\leq 5^b$
GFI	0.965	0.956	$\geq 0.90^a$; ≥ 0.80
RMSEA	0.036	0.045	$< 0.08^a$; < 0.10
Incremental fit measures			
NFI	0.959	0.945	$\geq 0.90^a$
AGFI	0.949	0.936	$\geq 0.90^a$; $\geq 0.80^b$
CFI	0.978	0.965	$\geq 0.90^a$
Parsimonious fit measures			
PGFI	0.662	0.660	The higher, the better
PNFI	0.727	0.721	The higher, the better

Acceptability Criterion: [a]acceptable; [b]marginal

* presents score of fit indices for structural model of tacit KS-driven performance using SOS as mediator

** presents score of fit indices the structural model of tacit KS-driven performance using HOS as mediator

V. DISCUSSION AND IMPLICATIONS

This study provides many valuable insights, first with respect to direct effect of explicit KS practices on KM strategy (*i.e.* system and human oriented strategy) and performance, the results indicate that explicit KS practices significantly ($\beta = 0.078$; $p < 0.01$) influence the system oriented and performance ($\beta = 0.175$; $p < 0.01$). However, explicit KS practices are not

significantly related with human oriented strategy. Further, with respect to mediating role of system and human oriented strategy, results indicate the system oriented strategy partially mediate the relationship between explicit KS practices and performance whereas human oriented strategy completely mediate the relationship for determining the explicit KS-driven performance. Nevertheless, results indicate that direct effect of explicit KS practices on performance is consistent with past studies (Carr and Kaynak, 2007; Wang and Wang, 2012). Further, based on theoretical lenses of RBV and KBV, this finds that explicit knowledge sharing not only directly influence the banks performance but also indirectly influence the banks performance through strengthening the knowledge management strategies.

The findings of study confirm the argument that business value is extensively based on explicit KS practices and two components of KM strategy (Choi and Lee, 2002; Carr and Kaynak, 2007; Lawson *et al.*, 2009; Wang and Wang, 2012). One possible explanation of above results may be that formal practices tend to help and encourage employees to share the knowledge related to business processes which enable the management to solve the identified crucial issues regarding the product quality improvement, reduction is operation cost and innovation. Therefore, it is expected that formal KS practices tends to improve the both operational and financial performance. These findings also underpin the arguments of Wang and Wang (2012) and Wang *et al.* (2014) who found that formal KS practices consolidated the financial and operational performance of organization through sharing knowledge relating to business processes which further helped to increase the productivity and quality of products and services (McAdam *et al.*, 2012) thus providing the competitiveness (Gao *et al.*, 2009; Reus *et al.*, 2009). Further, keeping in view the direct effect of explicit KS practices on system oriented strategy, human oriented strategy and performance of banks, this study also sheds light that explicit KS practices positively and significantly related with system oriented strategy ($\beta = 0.175$; $p < 0.01$) and performance ($\beta = 0.078$; $p < 0.01$) of banks. However, explicit KS practices are not significantly related with human oriented strategy. These findings are also consistent with Bierly and Chakrabarti (1996) and Choi and Lee (2002) who found that KM strategies helped to identify and capture the knowledge and then later its' sharing to improve corporate performance. Research suggests that knowledge processes and KM strategies are essential for knowledge management (Choi and Lee, 2002). KM strategies are also important because without them, implementation of knowledge processes and later knowledge sharing is difficult and costly (Soliman and Spooner, 2000).

The positive relationship among tacit KS practices, KM strategy and performance of banks is a unique finding in the arena of KM. The results postulate that tacit practices more significantly influence the intermediate measures and performance. One of the possible reasons in context of the study may be that knowledge which comes through informal ways (*i.e.* experience, skills and expertise) which is embedded in the minds of people through social network and interactions. Such informal sharing of knowledge tends to help the employees in problem solving through unique way, improves the product quality and services and as well reduces the operational cost. So, it may be postulated that tacit knowledge is a source for employees to share past failures in order to improve their future course of actions. However, positive relationship of tacit KS practices with human oriented strategy set the evidence that human oriented strategy is suitable for sharing tacit knowledge. However, this research supports the argument and suggests that more the informal conservation or socialization among employees, the more will be tendency to share the tacit knowledge (Nonaka and Takeuchi, 1995; Polanyi, 1997) which may eventually enhanced the performance. Moreover, results also provide the considerable support to the findings of Choi and Lee (2002) who found that system oriented strategy (*e.g.* video conferences, virtual reality, telecommunications and intranet) could be employed for facilitation of tacit knowledge.

Focused view advises that organization should use one strategy (Hansen *et al.*, 1999; Swan *et al.*, 2000). In contrast, balanced view intends that organization should maintain a right balance between two strategies (Bierly and Chakrabarti, 1996; Jordon and Jones, 1997; Zack, 1999). Whereas, dynamic view proposes that selection of KM strategies depend upon nature of knowledge and its' characteristics (Bohn, 1994; Singh and Zollo, 1998; Choi and Lee, 2002).

This study uses the Choi and Lee's (2002) typology of system and human oriented strategy as important mediator for KS-driven performance. Results of the study indicate that both system and human oriented strategy significantly mediate the relationship between KS practices and banks performance therefore, this study recommends that dynamic view may be more suitable particularly in context of this study. Moreover, system and human oriented strategy are more significantly related and mediates the tacit KS-driven, thus suggesting systems oriented support (*e.g.* telecommunications and intranet and video conferences etc.) and social interactions among organization actors tends to help to share tacit knowledge among them.

VI. CONCLUSION AND IMPLICATIONS

The objective of study is to uncover how the KS practices improve the banks' performance in the presence of KM strategy. Recently, many studies have invested the impact of KS practices on firms' performance in the presence of critical success factors of KM. However, very few studies attempted to examine the impact of KS practices on firms' performance in the presence of KM strategy as the mediator variable. To bridge up this gap, we tested the mediating model and found that both explicit and tacit KS practices not only directly influenced the performance of banks, but also indirectly influenced the performance of banks through encouraging KM strategy. The results of study postulates that KS practices significantly augment the overall performance of banks in terms of better delivery of product knowledge to customers which turns to improve the customer services, operational performance, and financial achievement (*i.e.* sales growth, profitability etc.) thus validating the findings of Wang and Wang (2012) and Wang *et al.* (2014). Moreover, this study finds that system oriented strategy partially mediates the explicit KS-driven performance and human oriented strategy completely mediates the explicit KS-driven performance. Similarly, this research finds that both human and system oriented strategy partially mediates tacit KS-driven performance. Our findings related to tacit KS practices' relationship with KM strategy and banks performance provides intriguing insights. It indicates tacit KS practices more substantially contribute to performance of banks where both human and system oriented strategy are significant mediators for tacit KS driven performance.

Further, results of study indicate that system oriented strategy significantly related with explicit KS practices and performance of banks, thus suggesting that documented and codified knowledge in terms of manuals, meetings and procedures are easy to share among organizational members which positively influence the performance of firms'.

Further, this study reveals that explicit KS practices are not significantly related with human oriented strategy which suggests that managers should increase the human interactions in terms of formal conservations and meetings etc. that are important ways to share the explicit knowledge (*i.e.* documented and codified knowledge) to support the daily management activities which may provide the unique way to solve the problems. These findings are somewhat consistent with Bierly and Chakrabarti (1996) and Choi and Lee (2002) who have found that KM strategies help to identify and

capture the knowledge and then later its' sharing to improve corporate performance.

Managers who are more concerned with KM initiatives know significance of stock and flow of knowledge, knowledge processes and KM strategies because without these KS is difficult and costly. Further, this study implies that for transforming corporate vision into operationalized business units or physical products, the tacit knowledge transformation into explicit knowledge and as well human oriented strategy such as person to person interaction are imperative for knowledge transformation. Finally, based on findings, it may be concluded that for effective KM and its' sharing is guided by KM strategies which positive influence the KS-driven performance.

VII. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

No doubt, this study substantially contributes to existing literature. Besides that it also restricts the implications of study. First, this study considers KM as important mediator for KS-driven performance however future researchers may consider other important factors of KM such as KM capabilities and intellectual capital (IC) for KS-driven performance. Second, this study is based on cross-sectional research design however future researchers may adopt longitudinal design to draw better causal inferences. Finally, this study considers the banking sector as one of the knowledge oriented sector out of services sector. However, future researchers may test this mechanism in other high-tech manufacturing sector like software, pharmaceutical, chemical and power etc.

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APPENDIX I

Measurement Items

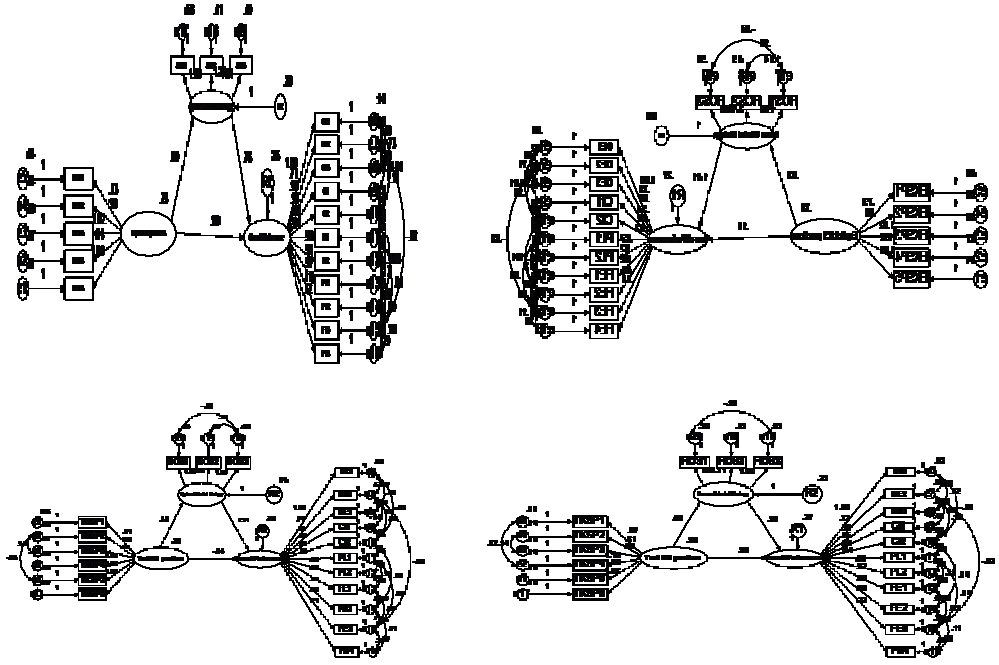
1 = Strongly disagree; 2 = Strongly agree; 3 = Neutral; 4 = Agree; 5 = Strongly agree

Knowledge Sharing Practices						
	A. Explicit Knowledge Sharing Practice	1	2	2	3	5
1	Employees in my organization frequently share existing reports and official documents with colleagues.					
2	Employees in my organization frequently collect reports and official documents from others in their work.					
3	Employees in my organization are frequently encouraged by knowledge sharing mechanisms.					
4	Employees in my organization are frequently offered a variety of training and development programmes.					
5	Employees in my organization are facilitated by IT systems invested for knowledge sharing.					
	B. Tacit Knowledge Sharing Practices					
1	Employees in my organization frequently share knowledge based on their experience.					
2	Employees in my organization frequently share knowledge of know-where or know-whom with others.					
3	Employees in my organization frequently collect knowledge of know-where or know-whom with others.					
4	Employees in my organization frequently share knowledge based on their expertise					
5	Employees in my organization frequently collect knowledge from others based on their expertise.					
6	Employees in my organization will share lessons from past failures when they sense that it is necessary.					
	Knowledge Management Strategy					
	A. System Oriented Strategy					
1	In our company, knowledge like know-how, technical skill, or problem solving methods is well codified.					
2	In our company, results of projects and meetings are documented.					
3	In our company, knowledge is shared in codified forms like manuals or documents.					

	B. Human Oriented Strategy					
1	In our company, knowledge can be easily acquired from experts and co-workers.					
2	In our company, informal conversations and meetings are used for knowledge sharing.					
3	In our company, knowledge is acquired by one-to-one mentoring.					
	Overall Performance					
	A. Operational Excellence					
1	My organization performs well in improving efficiency of products.					
2	My organization performs well in improving dependability of delivery processes.					
3	My organization performs well in cost management than that of key competitors					
	B. Customer Intimacy					
4	My organization performs well in improving customer satisfaction.					
5	My organization performs well in improving quality of customer service.					
	C. Product Leadership					
6	My organization performs well in improving quality of products.					
7	My organization performs well in improving functionality of products.					
	D. Financial Achievements					
8	My organization performs well in improving revenue growth.					
9	My organization performs well in improving profit margins.					
10	My organization has better Return on investment than that of key competitors.					
11	My organization has better Return on assets than that of key competitors.					

APPENDIX II

Structural Models



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TECHNOLOGY MATTERS: EVIDENCE FROM PAKISTANI BANKING SECTOR USING FLEXIBLE TRANSCENDENTAL LOGARITHMIC PRODUCTION FUNCTION

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Abstract. Technology has revolutionized the global banking industry. Most studies on the role of technology on Pakistan's banking sector end up without quantifying the change in production due to the adoption of ICT. This study, therefore, is an attempt to investigate the production change due to the adoption of ICT by employing Cobb-Douglas and Transcendental Logarithmic Production Function (Translog production function) using Ordinary Least Squares (OLS) and Seemingly Unrelated Regression Estimation (SURE) techniques. Secondary data of 30 banks for the period of 2006-2013 has been used for analysis. The study finds that most of the ICT surrogates have positive impact on the production of banking sector in Pakistan. It is recommended for the banks to increase investment in such ICT surrogates that are positively impacting the banking sector production in Pakistan.

Keywords: Information and Communication Technology (ICT), Transcendental logarithmic production function, Panel Seemingly Unrelated Regression Estimation (Panel SURE)

JEL classification: C24, C29, O33

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I. INTRODUCTION

Impact of information and communication technology (ICT) is a subject that has attained enormous attention from number of economists in the last twenty years. They found its impact on business and economic growth at different levels; *i.e.* industrial, national and international. During 1990s, researchers claimed that impact of ICT on production and economic development was insignificant or non-existent, which they referred as with Solow's Paradox. Solow's Paradox shows the lack of the rise in productivity due to ICT. Recent literature on impact of ICT shows positive contribution of ICT in production processes. Level of production is measured through production function which is the technical relationship between inputs and output. Stella (2010) considered that production process creates wealth that increases the welfare of people, because it tries to satisfy unlimited wants with available resources. Van Biema and Greenwald (1997) suggested that in modern ages, efficiency of production process has become the main issue for executives, both in the industrial and the service sectors. Accordingly, ICT as a factor for increasing efficiency of production process has been considerably debated and investigated by policymakers and researchers.

Banking, during last two decades, has experienced an observable transformation due to ICT that leaders in the field of ICT have started to anticipate the extinction of physical structure of banks.[1] Adeoti (2005) considered ICT as a tool of modernization of processes, controls, and information production by means of computers, telecommunication, software and other utensils that make activities more smooth and efficient. Anayasi and Otubu (2009) state that if technological innovation is at its peak, then one of the main sectors of the economy where technology is at its helm of affairs with reference to customer service is banking. Banking has transformed from a traditional brick-and mortar type to mobile banking where customers queuing for banking services is not required. In today's business, ICT has become one of the prime indicators of competitiveness and development where Solow's Paradox seems to fade away with the evolution of ICT.

Many researchers, such as Gordon (2000), communicated various inferences in some previous studies but now confirm that increasing investment in ICT boost economic growth. Thus, after probably ten years of declaring the paradox, Solow himself confessed that figures now commenced

[1]We need banking but we don't need banks anymore. Do you think someday we can open bank account or ask for loan without physically have to come to the bank? – Bill Gates.

to quantify the technological era, even if discrete at the moment. ICT has become inevitable because without ICT it is not possible to sustain in global banking industry. Spending in ICT has been on the rise during the last decade in Pakistan's banking industry, so there is need to assess the effectiveness to justify the major spendings on it. Although, studies have been conducted related to the impact of ICT in banking sector of Pakistan. But many researchers end up without knowing the contribution of ICT in banking industry of Pakistan. To overcome this problem, this research focuses on studying production change due to deployment of ICT. More specifically, this research quantifies the effect of ICT in banking sector. We use two production functions; Cobb-Douglas production function and Transcendental logarithmic production function for this purpose. Further, we use a number of alternative proxies of ICT, since ICT is diverse and evolving. We think that ICT as an input has the tendency to affect the output in diverse ways.

OBJECTIVES OF THE STUDY

The objective of this research work is to quantify the impact of ICT on the production of Pakistan's banking sector during the period of 2006 to 2013. In terms of hypothesis, it can be written as:

H_0: Information and Communication Technology (ICT) does not contribute in production of banking sector in Pakistan.

H_A: Information and Communication Technology (ICT) contributes in production of banking sector in Pakistan.

II. LITERATURE REVIEW

Relevant studies are reviewed here to explicate the gap in literature. Banker and Kauffman (1988) presented a realistic study of the deliberate influence of ATMs for taming a bank branch's market share of local deposit at the cost of its opponents. They developed an instrument to access the response and evaluated the impact of IT that was not formerly accessed. Their results show that ATM system affiliation is important for increasing bank deposits. Harold and Jeff (1995) find that financial service suppliers should change their outdated working ways to stay in the market. According to them, the main noteworthy deficiency in the banking business at that time was the failure of higher management officials to understand the role of IT.

Woherem (2000) contends that only banks that renovate their complete systems through ICT in their processing would continue and succeed in

future. He recommends that banks should re-check their complete system to bring changes according to the requirement of new technology. Whereas Hall and Khan (2003) clarify in their study that the benefit from latest technology could only be achieved when it is used extensively. Further, they argued that the regulatory bodies and parliamentary establishments have more impact on influential implementation of ICT. According to them, economic by-laws have noticeable effects on banks' performance.

Lee, Gholami and Tong (2005) used data from the Iranian industrial sector for the period of 1993-1999; and assessed the productivity at industry level by using panel data. They followed Shao and Lin (2002), and evaluated the impact of ICT on the production in two stages. In the first step, they estimated a production function (both by using Cobb-Douglas and Translog) and abstracted the productivity chain from the residuals. In the second step, they used a separate regression for accessing the effect of ICT on production. The results approved a positive and significant impact of ICT investments on production.

Ovia (2005) mentioned that ICT has made many changes in the banking industry; it completely changed the way banks provided services. By its usage efficiency of banks increased, further its reduced cost of installation encouraged many banks to adopt ICT which improved the bank's likelihood of ICT adoption. Further, Agboola (2007) studied the impact of ICT deployments on Nigerian banks. He used the data for 36 banks out of 89 banks at the end of 2005. He used questionnaires for obtaining data from customers, employees and managers of banks. The study showed that the banking sector has experienced many changes with respect to content and quality during the period 1990-2005. Technology was found to be the main reason of competition in banking sector during the spell. He added that the implementation of ICT in banks provided ease to customers and further improved the business in banking.

Osabuohien (2008) recognizes that the gender of bank executives does not have any link with the use of ICT adeptness; dynamics like age, qualification and computer knowledge are important factors that persuade ICT practice. Further he found that ICT increased the productivity and profitability of banks. Stella (2010) evaluated the production impact of ICT on Nigerian banking industry. He found that impact on productivity was positive after the deductions had been made for depreciation and labour payments. Results revealed that banks' output increased as a result of ICT.

Muhammad, Gatawa and Kebbi (2013) also measured the ICT effects on the banking industry of Nigeria by employing data of eleven selected

Commercial Banks. They found an inverse relationship between surplus persistent investment in ICT and productivity. Their study emphasized more on policies that increase efficiency and encourage proper utilization of ICT gadgets rather than sustained investments. Mehmood, Shafique and Rafaqat (2014) investigated Solow's Paradox for world's leading capital markets in 47 countries. They used ICT expenditure and market capitalization and stock traded turnover ratio as indicators of capital market activity. Pooled mean group technique of cointegration showed long run relationship between the two variables.

Abbas *et al.* (2015) analyzed the service quality of Branchless Banking in Lahore using SERVEQUAL model. Using the primary data from 311 respondents, they subjected factors such as age, gender, education, marital status, monthly income and residence to confirmatory factor analysis (CFA). Results of SERVEQUAL model showed that service reliability, responsiveness and assurance are the most important factors of services quality. Khan, Mehmood and Sair (2015) estimated an unconventional production function known as Constant Elasticity of Substitution (CES) production function for Pakistani banking industry. As per estimates using time series data from 1980-2013, increasing returns to scale (IRS) were found. Econometric tests for stationarity and cointegration were employed in addition to fully modified OLS to estimate the cointegration equation. Results showed that elasticity of substitution between capital and labour is greater than one, reflecting considerable level of substitution between labour and capital.

The recent study of Mustafa and Mehmood (2015) examined the technical efficiency of 11 selected commercial banks in Pakistan using pre and post digital reforms era for the period from 1998 to 2012. Their results proved that technical efficiency considerably increased during post-digital reform period and hence productivity. In addition, their study showed that MCB Bank constantly scored the maximum efficiency and productivity scores. Iqbal, Mehmood and Ahmed (2015) examined the impact of ICT on banks' performance in Pakistan by subjecting the annual data from 2005 to 2013. Fixed effects and random effects models were used. ICT variables did not show statistically significant relationship with banks' performance. Results confirmed the presence of Solow's Paradox.

Till date empirical evidence on Pakistan's banking sector lacks the application of a multi-input production function that quantifies the role of technology (ICT). The literature on impact of ICT on banking sector is still in its infancy and inconclusive. This study is an attempt to overcome the

mathematical, statistical and proxy related shortcomings of previous studies. It does so by using flexible form of production function, seemingly unrelated regression estimation and a number of proxies for ICT. Results of this paper can better help to resolve the enigma of Solow's Paradox.

III. DATA COLLECTION AND METHODOLOGY

For empirical analysis, the sources of data are the annual reports of commercial banks and State Bank of Pakistan (SBP). Data of 30 banks (including public, private and foreign banks) in Pakistan is used for the period of 2006 to 2013. The data comprises of total deposits as dependent variable and fixed assets (FA), salaries and wages (SA) of bank employees and various proxies of ICT as independent variables. These are Number of ATMs (NOA), Point of sale (POS), Number of credit cards (CC), Number of debit cards (DC), Number of e-banking transactions (NEBT), Value of e-banking transactions (VEBT), Number of ATMs transactions (NATMT), Value of e-banking transactions (VEBT), Number of point of sale transactions (NPOS), Value of point of sale transactions (VPOS), Number of other e-banking channels transactions (NEBCT), Value of other e-banking channels transactions (VEBCT), Number of real time online branches transactions (NOBT) and Value of real time online branches transactions (VOBT).

SELECTION OF ANALYTIC APPROACH

Commercial banking is considered a very challenging service industry for the purpose of measuring output, technological change and production growth. Many studies with regard to the productivity of banking industry struggle with the most important matter of what should be considered as the 'output' of a bank. There are three methods that researchers used to estimate the output of banks that may be categorized into three main categories: the assets approach, the user-cost approach, and the value-added approach. It is claimed that the value added approach, which describes those activities as outputs that have considerable value added characteristic is best for correctly assessing fluctuations in bank technology and productivity over time (Berger and Humphrey, 1992).

THE ASSET APPROACH

Observation approves that liabilities of banks have features of inputs, so these liabilities also work as raw material for investing resources. On the other hand, the assets of bank have characteristics of output because

eventually the resources create income for banks. In this method, banks perform as monetary mediators between liability repositories and the receivers of funds (Berger and Humphrey, 1992).

THE USER COST APPROACH

The user cost approach defines rather a financial item as an input or an output on the basis of its ultimate impact on the income of banks. If the monetary earning due to an asset surpasses the opportunity cost of asset or the monetary cost of a liability is less than the opportunity cost, the instrument then will be measured as a financial output. Otherwise, it is measured as a financial input (Berger and Humphrey, 1992).

THE VALUE ADDED APPROACH

The value-added approach is unlike other methods because it reflects all liability and asset groups to have some output feature. The value added method, used in many studies related to banking sector such as Berger, Hanweck and Humphrey (1987), categorize the major types of received deposits (time, savings and demand) and advances (commercial, installments, real estate) as main outputs. It is so because they are liable for value addition in the substantial extent. Purchased assets (foreign deposits, federal funds purchased, large CDs, other liabilities for borrowed money) are dealt in the intermediation process as financial inputs, because they involve very small amounts which are treated as physical inputs such as labour and capital (Berger and Humphrey, 1992). Further, they claimed that the value added for every financial institution should be measured on the basis of its operational cost and those financial products which have 'significant' characteristic of value-addition should be measured as output of the bank.

The suitable depiction of the bank production procedures and, in particular, the description of bank output is a debatable issue. However, in this research work, we have followed approach which is termed as 'value added approach', in which all the activities that create added value are measured as output of the bank.

SEEMINGLY UNRELATED REGRESSION ESTIMATION (SURE)

SURE is an application of generalized least squares (GLS) estimation to a group of seemingly unrelated equations. The equations are related through the nonzero covariances associated with error terms across different equations at a given point in time. We can generalize the seemingly unrelated model by writing the system of G equation as follows:

$$Y_i = X_i \beta_i + \mu_i \qquad i = 1, 2, 3, \ldots \qquad \text{(G)}$$

$$\text{Or} \quad \begin{bmatrix} Y_1 \\ Y_2 \\ .. \\ .. \\ Y_G \end{bmatrix} = \begin{bmatrix} X_1 & 0 & 0 & 0 & 0 \\ 0 & X_2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & X_G \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ .. \\ .. \\ \beta_G \end{bmatrix} + \begin{bmatrix} \mu_1 \\ \mu_2 \\ .. \\ .. \\ \mu_G \end{bmatrix}$$

Where $Y = GN \times 1$ matrix

$$X = GN \times \left(\sum_{i=1}^{G} K_i \right) \text{ matrix}$$

$$\beta = \left(\sum_{i=1}^{G} K_i \right) \times 1 \text{ matrix}$$

$$\mu = GN \times 1 \text{ matrix}$$

There is a cross-equation correlation as per the assumptions of the seemingly unrelated model:

$$E\left(\mu_i \mu_j'\right) = \begin{bmatrix} \sigma_{ij} & 0 & .. & 0 \\ 0 & \sigma_{ij} & .. & 0 \\ .. & .. & .. & .. \\ 0 & 0 & .. & \sigma_{ij} \end{bmatrix}$$

where I is a $G \times G$ identity matrix. This relationship applies to the covariances between the two arbitrary equations in the system of G equation. To generalized this result in matrix form, it can be write as follows:

$$\Omega = E\left(\mu\mu'\right) = \begin{bmatrix} E\left(\mu_1\mu_1'\right) & E\left(\mu_1\mu_2'\right) & .. & E\left(\mu_1\mu_G'\right) \\ E\left(\mu_2\mu_1'\right) & E\left(\mu_2\mu_2'\right) & .. & E\left(\mu_2\mu_G'\right) \\ .. & .. & .. & .. \\ E\left(\mu_G\mu_1'\right) & E\left(\mu_G\mu_2'\right) & .. & E\left(\mu_G\mu_G'\right) \end{bmatrix}$$

Substituting, we get:

$$\Omega = \begin{bmatrix} \sigma_{1_1} I & \sigma_{1_2} I & .. & \sigma_{1G} I \\ \sigma_{2_1} I & \sigma_{2_2} I & .. & \sigma_{2G} I \\ .. & .. & .. & .. \\ \sigma_{G_1} I & \sigma_{G_2} I & .. & \sigma_{GG} I \end{bmatrix}$$

$$\hat{\beta} = \left(X'\Omega^{-1}X\right)^{-1}\left(X'\Omega^{-1}Y\right)$$

$$E\left[\left(\hat{\beta}-\beta\right)\left(\hat{\beta}-\beta\right)'\right] = \left(X'\Omega^{-1}X\right)^{-1}$$

$$\hat{\sigma}_{ii} = \frac{\hat{\mu}_i\hat{\mu}_i'}{N-K_i}$$

$$\hat{\sigma}_{ii} = \frac{\hat{\mu}_i\hat{\mu}_j}{\sqrt{\left(N-K_i\right)\left(N-K_j\right)}}$$

$$\hat{\mu}_i = Y_i - X_i\hat{\beta}_i$$

ESTIMABLE MODEL

Production function defines a technical relation among the maximum output which is obtained from various combinations of probable factors of production. So the production function will be written as:

$$BY = f(L, K, ICT)$$

For the purpose of determining the proceeds from investments in ICT by segments, largely the production theoretical framework is used (Loveman, 1994; Lichtenberg, 1995; Parsad and Harker, 1997). Berdnt (1991) suggested production function methods as the most suitable method to know the effects of *ICT*. However, Berndt (1991) points out that the simplest method of determining the production is Cobb Douglas production function.

COBB-DOUGLAS PRODUCTION FUNCTION

The most commonly used production functions is the Cobb-Douglas and is suitably called as 'Workhorse production function' as well. This is shown in a logarithmic form and can be written as:

$$BY = \alpha L^{\beta_1} K^{\beta_2} ICT^{\beta_3}$$

and estimated as:

$$\ln\left(BY_{i,t}\right) = \alpha + \beta_1 \bullet \ln\left(L_{i,t}\right) + \beta_2 \bullet \left(K_{i,t}\right) + \beta_3 \bullet \ln\left(ICT_{i,t}\right) + \varepsilon_{i,t}$$

Where:

ln = Natural Logarithm

BY = Bank Deposits (Bank's Output)

K = Fixed Assets

L = Salaries and Wages

ICT = ATMs, POS, DD, CC and other ICT surrogates

Where α, β_1, β_2, β_3 are parameters to be estimated and ε is the regression disturbance. Subscripts '*i*' and '*t*' represent bank *i* at time *t*.

TRANSCENDENTAL LOGARITHMIC PRODUCTION FUNCTION

Translog production function is a more flexible production function, which was suggested by Christensen *et al.* (1973). The benefit of using transcendental logarithmic function is the elasticity as it can estimate almost any functional formula (Intriligator, 1978). The Translog production function is non-homogeneous and it belongs to the flexible functional class (Coelli, Rao and Battese, 1998). The Translog function is distinct flexible function due to presence of both linear and quadratic terms with the ability of using more than two factor inputs. It can be approximated by second order Taylor series (Christensen *et al.*, 1973). The 3-input Translog production function can be written in terms of logarithms as follows:

$$\ln(BY_{i,t}) = \alpha + \beta_L \bullet \ln(L_{i,t}) + \beta_K \bullet \ln(K_{i,t}) + \beta_{ICT} \bullet \ln(ICT_{i,t}) + \tfrac{1}{2}\beta_{LL} \bullet \ln(L_{i,t})^2 + \tfrac{1}{2}\beta_{KK} \bullet \ln(K_{i,t})^2 + \tfrac{1}{2}\beta_{ICTICT} \bullet \ln(ICT_{i,t})^2 + \beta_{LK}(\ln L_{i,t} \times \ln K_{i,t}) + \beta_{LICT}(\ln L_{i,t} \times \ln ICT_{i,t}) + \beta_{KICT}(\ln K_{i,t} \times \ln ICT_{i,t}) + \varepsilon_{i,t}$$

Where α and βs are the associated output elasticities. Stella (2010) mentions that in Translog-type model there are probably many parameters for estimation. Because with every added variable in the model it is required to involve a squared term and cross-product along with the already existing variables.

Conventionally, symmetry conditions are imposed on Translog function, *i.e.*

$$\beta_{LK} = \beta_{KL}$$

$$\beta_{LICT} = \beta_{ICTL}$$

$$\beta_{KICT} = \beta_{ICTK}$$

Moreover, constant returns to scale (CRS) requires following conditions to hold:

$$\beta_L + \beta_K + \beta_{ICT} = 1$$

$$\beta_{KK} + \beta_{LK} + \beta_{ICTK} = 0$$

$$\beta_{KL} + \beta_{LL} + \beta_{ICTL} = 0$$

$$\beta_{KICT} + \beta_{LICT} + \beta_{ICTICT} = 0$$

Thirdly, for reducing to Cobb-Douglas specification following restrictions can be imposed.

$$\beta_{KK} = \beta_{KL} = \beta_{KICT} = \beta_{LL} = \beta_{LICT} = \beta_{ICTICT} = 0$$

IV. EMPIRICAL RESULTS

To investigate whether ICT investment improve banks' productivity or not, we used OLS and SURE techniques to measure robustness of estimated parameters. Further we examined the difference between ordinary least square (OLS) and seemingly unrelated regression estimation (SURE) technique for Cobb-Douglas and Transcendental Logarithmic production function. In the first step, results are estimated using Cobb-Douglas specification of production function. In second step, the impact of ICT on banks' production is estimated by using Translog production function employing both OLS and SURE.

Table 1 shows the estimation results for the period of 2006 to 2013 for the banks' production by using Cobb-Douglas production function, whereas Table 2 and Table 3 show results for Translog production function employing OLS and SURE, respectively. The results obtained show positive and statistically significant coefficients for capital (fixed assets) and labour (salaries and wages of employees) in all the estimated models for OLS and SURE estimation techniques, while most of the ICT surrogates also show a positive relation with bank deposits. The estimation results are given in tables, Table 1 shows significantly positive influence of number of ATMs on banks production (total deposits) with the coefficient of 0.2959, this means that number of ATMs positively impacts banks productivity (if we increase the number of ATMs with 10% the deposits of banks will increase by 29%). The empirical literature on the adoption of technological innovation in the banking sector commonly focuses on the deployment of ATMs (*see* for example, Hannan and McDowell, 1984; Escuer *et al.*, 1991; Pennings and Harianto, 1992; Hester, Calcagnini and De Bonis, 2001). Thus, investment in ATMs upturns the value of bank deposit accounts, which is economical in terms of charges of funds than various other sources, like borrowing cash from other organizations, therefore dropping the total cost of funds.

TABLE 1

Dependent Variable:
Bank Deposits with Cobb-Douglas Production Function

Model No.	ICT Proxy	OLS			SURE		
		FA	SA	ICT	FA	SA	ICT
1	NOA	0.3091[a] (0.0515)	0.3208[a] (0.0798)	0.2959[a] (0.0708)	0.3091[a] (0.0511)	0.3208[a] (0.0791)	0.2959[a] (0.0702)
2	POS	0.3559[a] (0.0501)	0.5530[a] (0.0498)	–0.2044[a] (0.0335)	0.3559[a] (0.0497)	0.5530[a] (0.0494)	–0.2044[a] (0.0332)
3	CC	0.3548[a] (0.0500)	0.5705[a] (0.0496)	–0.2076[a] (0.0336)	0.3548[a] (0.0496)	0.5705[a] (0.0491)	–0.2076[a] (0.0333)
4	DC	0.3320[a] (0.0487)	0.2291[a] (0.0697)	0.4025[a] (0.0580)	0.3320[a] (0.0483)	0.2291[a] (0.0692)	0.4025[a] (0.0575)
5	NEBT	0.3179[a] (0.0502)	0.2559[a] (0.0765)	0.3674[a] (0.0663)	0.3179[a] (0.0498)	0.2559[a] (0.0759)	0.3674[a] (0.0657)
6	VEBT	0.3220[a] (0.0500)	0.2421[a] (0.0767)	0.3797[a] (0.0661)	0.3220[a] (0.0496)	0.2421[a] (0.0760)	0.3797[a] (0.0656)
7	NATMT	0.3188[a] (0.0506)	0.2893[a] (0.0750)	0.3325[a] (0.0643)	0.188[a] (0.0502)	0.2893[a] (0.0744)	0.3325[a] (0.0638)
8	VATMT	0.3219[a] (0.0498)	0.2513[a] (0.0740)	0.3746[a] (0.0632)	0.3219[a] (0.0494)	0.2513[a] (0.0734)	0.3746[a] (0.0627)
9	NPOS	0.3297[a] (0.0529)	0.6452[a] (0.0586)	–0.1250[a] (0.0464)	0.3297[a] (0.0525)	0.6452[a] (0.0581)	–0.1250[a] (0.0460)
10	VPOS	0.3282[a] (0.0536)	0.6568[a] (0.0689)	–0.1129[c] (0.0612)	0.3282[a] (0.0531)	0.6568[a] (0.0684)	–0.1129[c] (0.0607)
11	NEBCT	0.3272[a] (0.0491)	0.2307[a] (0.0719)	0.3984[a] (0.0607)	0.3272[a] (0.0487)	0.2307[a] (0.0713)	0.3984[a] (0.0602)
12	VEBCT	0.3360[a] (0.0486)	0.2297[a] (0.0690)	0.4013[a] (0.0569)	0.3360[a] (0.0482)	0.2297[a] (0.0685)	0.4013[a] (0.0565)
13	NOBT	0.3234[a] (0.0500)	0.2580[a] (0.0741)	0.3661[a] (0.0631)	0.3234[a] (0.0496)	0.2580[a] (0.0735)	0.3661[a] (0.0626)
14	VOBT	0.3185[a] (0.0503)	0.2590[a] (0.0762)	0.3642[a] (0.0658)	0.3185[a] (0.0498)	0.2590[a] (0.0755)	0.3642[a] (0.0653)

NOTE. Figures in parentheses are standard errors. Whereas [a] indicates significance at 1%, [b] at 5% and [c] at 10%.

The results of our study show significantly negative relation between POS and bank deposits. This mean if we increase the POS by 10% the deposits of banks will reduce by 20%. It shows that increased number of POS facilitates customers in their dealings which can reduce deposits of bank on the other side. Similarly, significantly negative relation was found between numbers of point of sale transactions (NPOS) and value of point of sale transactions (VPOS). Number of credit cards (CC) show a significant and negative effect on deposits of banks. It can be inferred that as the interest on credit cards increases, the bank gives more credit through credit cards from its deposits which in turn reduces its deposits.

Other ICT proxies such as number of debit cards (DC), NEBT, VEBT, NATMT, VATMT, NEBCT, VEBCT, NOBT and VOBT have positive and significant relation with bank deposits employing both estimation techniques. Increased use of these ICT surrogates can have the desirable effect of increasing banks' production (deposits).

On the basis of Scholnick *et al.* (2008) study one can argue that customers have rational behaviour and adopt that mechanism of payment which is less costly and more secure as compared to other payment mechanisms. If the customers use more of POS, then transactions of POS will increase which will in turn reduce the deposits of banks. So in the same way our study shows that number of point of sales (NPOS) transactions and value of point of sales transactions (VPOS) do not have any positive relation with bank deposits.

Concluding the Cobb-Douglas production function we found no startling difference between OLS and SURE results for determining production of banking sector in Pakistan by using different ICT proxies. Throughout the analysis most of the ICT surrogates remain positively related with deposits. This preliminary evidence provides our first insight into evidence of increase in production due to ICT.

Table 2 and Table 3 show the comparison between the OLS and SURE estimation techniques using Translog production function. The results remain consistent using OLS and SURE techniques. In Table 2, number of ATMs has a significant and positive impact on the deposits of banks. The squared term of number of ATMs also show a positive sign with statistical significance. It shows the presence of a non-linear quadratic relationship in addition to linear relationship. Pictorially, this relationship shall be a U-shaped parabola.[2] The results show that production of banks in Pakistan is

[2]U-shaped parabola is also referred as Happy Parabola.

quite responsive to number of ATMs, capital and labour expenses. Squared terms of FA, SA and interaction terms of independent variables did not show any significant result. The most significant technological improvement that brings this change has been the arrival of credit cards, automated teller machines (ATMs) and debit cards.

TABLE 2

Dependent Variable:
Bank Deposits with Translog Production Function

Model No.	ICT Proxy	OLS								
		FA	SA	ICT	FA^2	SA^2	ICT^2	FA×SA	SA×ICT	FA×ICT
1	NOA	0.3446[a] (0.0499)	0.3396[a] (0.0805)	0.3834[a] (0.0716)	0.0102 (0.0377)	–0.0003 (0.1211)	0.0847[a] (0.0836)	–0.1253 (0.1334)	–0.0334 (0.1578)	0.1084 (0.1282)
2	POS	0.3332[a] (0.0510)	0.4424[a] (0.0634)	–0.2680[a] (0.0510)	0.0103 (0.0381)	–0.0236 (0.0603)	0.2231[a] (0.0730)	–0.0357 (0.0674)	–0.2209[a] (0.0634)	0.0553 (0.0529)
3	CC	0.3556[a] (0.0494)	0.3481[a] (0.0660)	–0.3647[a] (0.0548)	0.0258 (0.0373)	–0.0099 (0.0603)	–0.2229[a] (0.0712)	–0.0205 (0.0662)	–0.1105[b] (0.0542)	–0.0373 (0.0510)
4	DC	0.3493[a] (0.0494)	0.2705[a] (0.0802)	0.3454[a] (0.0677)	0.0084 (0.0372)	–0.0200 (0.0926)	0.1355[c] (0.0791)	–0.0984 (0.1040)	0.0200 (0.1232)	0.1047 (0.1010)
5	NEBT	0.3520[a] (0.0492)	0.2856[a] (0.0797)	0.3845[a] (0.0670)	0.0028 (0.0371)	0.0255 (0.1088)	0.2747[a] (0.0831)	–0.1816 (0.1210)	–0.0958 (0.1444)	0.1819 (0.1169)
6	VEBT	0.3499[a] (0.0494)	0.2894[a] (0.0813)	0.3717[a] (0.0688)	0.0073 (0.0373)	–0.0569 (0.1137)	0.1928[a] (0.0800)	–0.0781 (0.1258)	0.0418 (0.1527)	0.0661 (0.1233)
7	NATMT	0.3452[a] (0.0504)	0.3476[a] (0.0799)	0.3058[a] (0.0678)	–0.0020 (0.0381)	0.0383 (0.1074)	0.1946[a] (0.0769)	–0.1353 (0.1190)	–0.0726 (0.1393)	0.1531 (0.1130)
8	VATMT	0.3545[a] (0.0491)	0.2873[a] (0.0794)	0.3566[a] (0.0652)	0.0050 (0.0370)	0.0115 (0.1010)	0.2693[a] (0.0807)	–0.1638 (0.1138)	–0.0734 (0.1332)	0.1664 (0.1088)
9	NPOS	0.3697[a] (0.0537)	0.6210[a] (0.0611)	–0.1061[c] (0.0617)	0.0366 (0.0406)	– 0.0206 (0.0886)	–0.0891 (0.0713)	0.1572[c] (0.0866)	0.1914[c] (0.1127)	–0.2076[a] (0.0781)
10	VPOS	0.3565[a] (0.0544)	0.6238[a] (0.0710)	0.0009 (0.0831)	0.0305 (0.0411)	–0.0983 (0.1218)	–0.0607 (0.0663)	0.2121[c] (0.1161)	0.2741[c] (0.1541)	–0.2247[c] (0.1101)
11	NEBCT	0.3517[a] (0.0494)	0.2862[a] (0.0799)	0.3427[a] (0.0665)	0.0109 (0.0371)	–0.0263 (0.0984)	0.1966[b] (0.0851)	–0.1077 (0.1100)	0.0070 (0.1326)	0.1015 (0.1077)
12	VEBCT	0.3542[a] (0.0489)	0.2577[a] (0.0787)	0.3501[a] (0.0649)	0.0057 (0.0369)	0.0142 (0.0903)	0.1687[b] (0.0788)	–0.1432 (0.1027)	–0.0423 (0.1198)	0.1630[c] (0.0978)
13	NOBT	0.3538[a] (0.0497)	0.3153[a] (0.0814)	0.3184[a] (0.0678)	0.0060 (0.0374)	–0.0247 (0.1023)	0.2139[a] (0.0749)	–0.0950 (0.1163)	–0.0044 (0.1354)	0.0947 (0.1108)
14	VOBT	0.3602[a] (0.0489)	0.2856[a] (0.0778)	0.4008[a] (0.0651)	0.0061 (0.0368)	0.0665 (0.1068)	0.3346[a] (0.0897)	–0.2260[b] (0.1189)	–0.1654 (0.1446)	0.2262[b] (0.1145)

NOTE. Figures in parentheses are standard errors. Whereas [a] indicates significance at 1%, [b] at 5% and [c] at 10%.

TABLE 3

Dependent Variable:
Bank Deposits Translog Production Function

Model No.	ICT Proxy	SURE								
		FA	SA	ICT	FA^2	SA^2	ICT^2	FA×SA	SA×ICT	FA×ICT
1	NOA	0.3446[a] (0.0489)	0.3396[a] (0.0788)	0.3834[a] (0.0701)	0.0051 (0.0369)	–.0178 (0.1185)	0.2912[a] (0.0818)	–0.1253 (0.1306)	–0.0334 (0.1545))	0.1084 (0.1255)
2	POS	0.3332[a] (0.0499)	0.4424[a] (0.0621)	–0.2680[a] (0.0499)	0.0103 (0.0373)	–0.0236 (0.0590)	0.2231[a] (0.0714)	–0.0357 (0.0660)	–0.2209[a] (0.0620)	0.0553 (0.0518)
3	CC	0.3556[a] (0.0484)	0.3481[a] (0.0646)	–0.3647[a] (0.0536)	0.0258 (0.0365)	–0.0099 (0.0590)	–0.2229[a] (0.0697)	–0.0205 (0.0648)	–0.1105[b] (0.0531)	–0.0373 (0.0499)
4	DC	0.3493[a] (0.0484)	0.2705[a] (0.0785)	0.3454[a] (0.0663)	0.0084 (0.0364)	–0.0200 (0.0907)	0.1355[c] (0.0774)	–0.0984 (0.1018)	0.0200 (0.1206)	0.1047 (0.0989)
5	NEBT	0.3520[a] (0.0481)	0.2856[a] (0.0780)	0.3845[a] (0.0656)	0.0028 (0.0363)	0.0255 (0.1066)	0.2747[a] (0.0814)	–0.1816 (0.1184)	–0.0958 (0.1414)	0.1819 (0.1145)
6	VEBT	0.3499[a] (0.0483)	0.2894[a] (0.0795)	0.3717[a] (0.0674)	0.0073 (0.0365)	–0.0569 (0.1113)	0.1928[a] (0.0783)	–0.0781 (0.1232)	0.0418 (0.1495)	0.0661 (0.1207)
7	NATMT	0.3452[a] (0.0493)	0.3476[a] (0.0782)	0.3058[a] (0.0664)	–0.0020 (0.0373)	0.0383 (0.1052)	0.1946[a] (0.0753)	–0.1353 (0.1165)	–0.0726 (0.1363)	0.1531 (0.1106)
8	VATMT	0.3545[a] (0.0481)	0.2873[a] (0.0777)	0.3566[a] (0.0638)	0.0050 (0.0362)	0.0115 (0.0989)	0.2693[a] (0.0790)	–0.1638 (0.1114)	–0.0734 (0.1304)	0.1664 (0.1065)
9	NPOS	0.3697[a] (0.0525)	0.6210[a] (0.0598)	–0.1061[c] (0.0604)	0.0366 (0.0398)	–0.0206 (0.0867)	–0.0891 (0.0698)	0.1572[c] (0.0848)	0.1914[c] (0.1103)	–0.2076[a] (0.0764)
10	VPOS	0.3565[a] (0.0533)	0.6238[a] (0.0695)	0.0009 (0.0814)	0.0305 (0.0402)	–0.0983 0.1192)	–0.0607 (0.0649)	0.2121[c] (0.1137)	0.2741[c] (0.1509)	–0.2247[c] (0.1077)
11	NEBCT	0.3517[a] (0.0484)	0.2862[a] (0.0783)	0.3427[a] (0.0651)	0.0109 (0.0363)	–0.0263 (0.0963)	0.1966[b] (0.0833)	–0.1077 (0.1077)	0.0070 (0.1298)	0.1015 (0.1054)
12	VEBCT	0.3542[a] (0.0479)	0.2577[a] (0.0771)	0.3501[a] (0.0635)	0.0057 (0.0361)	0.0142 (0.0884)	0.1687[b] (0.0771)	–0.1432 (0.1006)	–0.0423 (0.1172)	0.1630[c] (0.0958)
13	NOBT	0.3538[a] (0.0487)	0.3153[a] (0.0797)	0.3184[a] (0.0664)	0.0060 (0.0366)	–0.0247 (0.1002)	0.2139[a] (0.0733)	–0.0950 (0.1138)	–0.0044 (0.1326)	0.0947 (0.1085)
14	VOBT	0.3602[a] (0.0479)	0.2856[a] (0.0762)	0.4008[a] (0.0637)	0.0061 (0.0360)	0.0665 (0.1045)	0.3346[a] (0.0878)	–0.2260[b] (0.1164)	–0.1654 (0.1415)	0.2262[b] (0.1121)

NOTE. Figures in parentheses are standard errors. Whereas [a] indicates significance at 1%, [b] at 5% and [c] at 10%.

Estimates for POS, CC and NPOS show significantly negative relation with bank deposits. According to the study of Ishii (2005), the high interest rates and heavy surcharges by banks on credit card (CC) can affect bank deposits negatively. In the same way, this study also found a significantly negative relation between bank CC and deposits. As more credit cards used

and surcharges paid by customer it will reduce to the deposits of bank. Square of number of CC is also significantly negative and should yield an inverted U-shaped parabola.[3] The interaction terms of other independent variables in models, except for SA × CC, do not show any significant result in contributing to bank deposits.

Table 3 gives the results using SURE technique. DC affects the production of banks in a positive manner. Its coefficient is positive and statistically significant. The total number of e-banking transactions (NEBT) have positive effect on bank deposits with statistical significance level of 1%. Whereas we found that value of e-banking transactions (VEBT) and its squared term also affect the banks' deposits positively with 1% significance level. The squared terms of FA, SA and interaction terms did not show any significant result in the model.

Findings as in Saloner and Shepard (1995) and Ishii (2005) indicate that ATMs facilitates bank customers which will in turn increase the deposits of bank and impact positively and significantly to bank deposits. In similar veins, number and value of ATMs transactions (NATMT & VATMT) positively contribute to banks' deposits. Hence it is visible in Table 2 and Table 3 that both NATMT and VATMT contributing to banks' deposits using Translog production function. It can be inferred that banks' adoption of ICT channels, that facilitate to bank customers, can increase the deposits of banks.

In empirical results of this paper, number and value of other e-banking channels (NEBCT and VEBCT) show a positive impact on deposits of banks. This study other e-banking channels include Internet, Call Centre and Mobile Banking. Whereas Dar (2012) delimits his approach by suggesting e-banking as a vital segment of banking industry. Positive relationship also holds for squared terms of NEBCT and VEBCT. However, the interaction terms did not show any significant result except for model with term FA × NEBCT. Number and value of real time online branches transactions (NOBT & VOBT) and their squared terms shows positive relationship with banks' deposits.

On the basis of this interpretation, a positive relationship between ICT proxies and banks deposits in Pakistan's banking industry is contrary to Solow's Paradox. These findings are in contrast to that of Iqbal, Mehmood and Ahmed (2015).

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[3]Inverted U-shaped parabola is also referred as Sad Parabola.

OLS VS SURE

Stucka (2002) in his study concluded that tourism proceeds have a great impact on the Croatian economy. He used two estimation techniques which are OLS and SURE for comparing demand models. He further concluded that SURE model results are more accurate estimates. The same way the results of Cadavez and Henningsen (2012) on carcass composition of lambs showed that the SURE estimation technique performed better than the OLS estimator. They argue that the parameters obtained by SURE are characterized by lower standard errors, proving SURE as a better technique than OLS. We also find the same results in our study of determining impact of ICT on bank's deposits of Pakistan that standard errors of parameters in SURE technique are lower as compare to OLS. Resultantly, it is better to confide in the results produced via SURE.

V. CONCLUSION

The increased demand for ICT in banking industry has become inevitable. The statistical concern of over-estimated standard errors is also resolved by using SURE. It is in line with the study of Cadavez and Henningsen (2012). We concluded that SURE is a better estimation technique than OLS. Using Translog production function in addition to Cobb-Douglas production function has rendered rigor to our results. Further the results of study show that ICT have a positive impact on the output of Pakistan's banking industry. For the majority of ICT proxy variables and bank deposits the positive relation is found. This study adds to Mustafa and Mehmood (2015) by quantifying the impact of ICT whereas authors ranked banks on the basis of technical efficiency before and after digital restructuring in Pakistan.

The results of this study induce banks to increase investment in those ICT surrogates that results in increase in bank deposits in Pakistan. Further, it is suggested that banks should improve their services, increase public awareness and ensure secure banking system to increase its deposits. Further research work can be commenced in different departments of banking sector to know about the impact of ICT in that specific departments to get insight into validity of these results. Moreover, primary data and bank specific studies including the impact of education of banking staff and digital literacy can also be included in future studies.

In this study, Solow's Paradox has been ruled out in the banking sector of Pakistan, which in recent times, seems to be fading away as found in other studies as well (Abbas *et al.*, 2015; Iqbal, Mehmood, and Ahmed, 2015;

Khan, Mehmood and Sair, 2015; Mehmood, Azim and Asghar, 2013; Mehmood, Shafique and Rafaqat, 2014; Mustafa and Mehmood, 2015; among others). Perhaps it has become safer to say that, you could see the ICT everywhere and 'now' also in the productivity statistics and hence technology matters.

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CHOICE OF FUNCTIONAL FORM IN THE NONLINEAR TAYLOR RULE
The Case of Pakistan

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Abstract. Linear Taylor rule prescribes symmetric response to inflation rate and output gap in good and bad times. Central banks in the world, however, are more concerned about inflation when economy is in high inflationary regime. Similarly they are more reactionary to output fluctuations when economy is experiencing slowdown in the economic activity. Thus, most of the researchers in the area of monetary policy construct a nonlinear monetary policy reaction function. In the literature related to monetary policy of Pakistan, this reaction function has been modeled as threshold regression (TR), Markov regime switching regression, and Logistic smooth transition regression (LSTR). This study compares these three choices for the case of Pakistan and tries to find out which functional form of nonlinear Taylor rule fits the Pakistani data well. Using quarterly data for the period 1993:1-2011:4, we find strong evidence that the monetary policy followed by the State Bank of Pakistan (SBP) exhibits nonlinearity. The results of this study show that threshold level of inflation rate is 6.37% and that of output gap is 2.5%. Moreover, threshold regression, with inflation rate as threshold variable, is found the best among the three specifications as it satisfies maximum number of criteria for comparison. However, LSTR model performs well if forecasting performance of the models is compared.

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JEL classification: E52, E58

I. INTRODUCTION

Monetary policy objective is to maximize society's welfare by maintaining price stability along with keeping unemployment at its natural rate. A great deal of research has been done, since the early 1990's, on monetary policy reaction functions of central banks. In particular, Taylor rule (Taylor, 1993) has received considerable attention. The rule specifies relationship between policy instrument (short term interest rate) and the target variables (inflation rate and output gap). According to this rule, central bank increases the interest rate in times of high inflation, or when output is above its potential level (unemployment is below the natural rate of unemployment), and *vice versa*. Therefore, the rule prescribes symmetric policy action in high and low inflationary regimes.

The theoretical basis of linear Taylor rule rests on two key assumptions, namely that central banks have quadratic loss function and that the Phillips curve is linear. Recently however, both of these assumptions have been criticized. For instance, Bec *et al.* (2002), Kim, Osborn and Sensier (2002), Martin and Milas (2004), Brüggemann and Riedel (2011), Cukierman and Muscatelli (2008), Castro (2008), and Ncube and Tshuma (2010) highlight asymmetric preferences of central banks regarding inflation and the output gap, which in turn lead to nonlinear policy reaction function. Moreover, Dolado *et al*. (2004), Corrado and Holly (2003), and Nobay and Peel (2003) specify the Phillips curve relationship as nonlinear which again lead to the nonlinear policy reaction function. Dolado *et al.* (2000) relax both the assumptions and have constructed a general model which departs from linear-quadratic framework. Hence, there are good theoretical reasons to hypothesize that central banks may not be following a linear Taylor rule; empirical evidence validates this hypothesis. The nonlinear Taylor rule spells out that weights assigned to negative vs. positive output gap and low vs. high inflation rate could be different. However, we do not directly observe non-quadratic loss function or nonlinear Phillips curve so there exists unbounded universe of possible alternative nonlinear specifications of the Taylor rule.

There is limited literature and empirical work available on the monetary policy reaction function of Pakistan. In this regard, the pioneering study estimating linear Taylor rule for Pakistan is of Malik and Ahmed (2010). The

study finds, using threshold regression, that State Bank of Pakistan (SBP) has never followed Taylor rule during the period 1991-2005. Ahmed and Malik (2011) find nonlinearity in the reaction function; SBP has asymmetry in the degree of leaning against the wind in high and low inflationary regimes. Saghir (2014) and Satti (2014) find instability of parameters in the monetary policy reaction function of SBP. Moreover, asymmetry is found in the response to high vs. low inflation and positive vs. negative output gap. Sattar (2014), using Markov Regime Switching framework, also depicts nonlinearity in the policy reaction function of SBP. Finally, Alam (2015) reaches the same conclusion using Logistic Smooth Transition model.

The nonlinearity in the policy reaction function, once established, becomes part of the macroeconomic models analyzing monetary policy issues. But question remains how nonlinearity should be modeled; threshold regression, Markov regime switching framework, or smooth transition regression model. We believe that it is important to investigate the type and nature of nonlinearity in SBP's reaction function while avoiding specific parametric assumptions. Once we are out of the realm of linear framework, the specification problem has to be addressed. Adopting an incorrect non-linear specification is more problematic than simply ignoring the nonlinearity altogether.

Our main contribution is to determine the most appropriate form of nonlinearity in the policy reaction function of SBP. In this regard, we compare the results of three models; Threshold regression model, smooth transition regression model and Markov regime-switching model. These three models differ on the basis of their mode of transition from one state to another. In threshold regression model, parameters abruptly change from one regime to another regime implying sharp threshold while smooth transition regression allows for the smooth and gradual transition of the parameters from one state to the other. In Markov regime switching model, there is exogenous regime switching having fixed probabilities.

In this study, we have first estimated the simple linear Taylor rule which did not fit the data well. Therefore, we have estimated nonlinear Taylor rule with the three potential nonlinear techniques, *i.e.* Threshold regression model, Smooth Transition regression model and Markov regime switching model. The objective of our study is to compare these models and to find the best fitted model for our data. The three models are compared on the basis of six criteria, *i.e.* Akaike information criterion, Shwartz information criterion, coefficient of determination, coefficient of correlation, root mean square error and mean absolute error.

The structure of rest of the study is as follows. The following section presents a review of the relevant literature. Section III describes in detail the nonlinear econometric models and their comparison techniques. Moreover, details of data and variables are also given in this section. Estimation results are then presented and discussed in section IV, and section V concludes the study.

II. LITERATURE REVIEW

Monetary policy is the demand side macroeconomic plan of action or strategy set by the nation's central bank in order to achieve the macroeconomic goals which are achieved by manipulating money and credit supplies or by changing interest rates. The idea of monetary policy originated in 1699 when the Bank of England printed notes backed by gold. Later on during 1870-1920, the developed or industrialized nations set up central body known as central bank for laying the monetary policy. The objectives of monetary policy may vary across countries but the main objectives do not change which are controlling inflation rate, exchange rate stability and stabilization of economic activity. For the monetary stability, there are policy tools like open market operations, discount window borrowing and reserve requirements. The operating target of monetary policy is set either by a prespecified rule or it remains discretionary choice of the central bankers.

Simons (1936) was the first to raise the issue regarding the rules vs. discretion of monetary policy and favoured policy rule for the economic stability. Discretion is authorization to enhance economic performance whereby actions are done solely on the basis of judgment whereas rule is considered a constraint. Monetary policy rule has been advocated against discretion by the prominent economists including Kydland and Prescott (1977), Fischer (1980), Barro and Gordon (1983), McCallum (1988) and Taylor (1993).

The idea of rule as a practical guide for monetary policy was popularized by McCallum (1988) and Taylor (1993). McCallum proposed changes in money growth rate in response to changes in inflation rate and GDP growth rate. Taylor rule prescribes changes in short term interest rate in response to changes in inflation rate and output gap; the relationship is assumed to be linear. The assumptions of quadratic loss function and linear Phillips curve lead to linear and symmetric response of central bank to inflation deviation from the target and output deviations from potential level.

Linear Taylor rule has been criticized by many intellectuals on the basis of its assumptions and once any of these assumptions is relaxed monetary

policy response function becomes nonlinear. Central bankers' preferences regarding stabilization of economic activity and inflation rate are modeled symmetric, perhaps due to mathematical convenience, but actually these preferences might be asymmetric either due to the bankers' own choice or due to political pressure (Blinder, 1999). Policy makers tend to take more serious actions when output is below its potential (unemployment is higher) and/or inflation rate is above its target. The response to deviations is less severe when output is above its potential (unemployment is lower) and/or inflation rate is below its target. This kind of behaviour is quite close to the human psychology as human beings try to avert loss while welcome bliss, expansion and benefits. Moreover, the shape of Phillips curve is found convex instead of linear,[1] which shows that at any point on the curve the increase in inflation rate is more in order to decrease the unemployment than decrease in inflation rate when unemployment of same magnitude gets increased. Inflation responds strongly to excess demand in expansion while it gets insensitive to the output during recession (Laxton *et al.*, 1999). The convexity of Phillips curve is also supported by the downward wage rigidity. Optimal monetary policy response also gets nonlinear when Phillips curve is nonlinear. For instance, Dolado *et al.* (2005) empirically tested the convexity of Phillips curve for four European countries where labour market rigidities were severe and derived the nonlinear policy rule. Tambakis (1998) and Corrado and Holly (2003) find that, in the presence of nonlinear Phillips curve, positive inflation bias (average inflation exceeds the target) has been observed if linear rule is specified. On the other hand, Nobay and Peel (2003) find deflation bias in output gap and do not find any significant signs of inflation bias while deriving optimal monetary policy reaction function. Due to these two reasons monetary policy reaction function is modeled and estimated as nonlinear (*see* for instance, Bec *et al.*, 2002; Kim, Osborn and Sensier, 2002; Martin and Milas, 2004; Brüggemann and Riedel, 2011; Cukierman and Muscatelli, 2008; Castro, 2008; Ncube and Tshuma, 2010). Moreover, type of asymmetric preferences lead to different nonlinear shapes of the reaction function; when there is recession avoidance preference, the reaction function happens to be the concave with respect to the output gap while inflation avoidance preference leads to the convex reaction function with respect to the inflation gap (Cukierman and Muscatelli, 2008).

Linear estimation techniques cannot be applied to analyze the features of nonlinear behaviour. Thus, nonlinear behaviour should be handled with nonlinear specification and the model should be estimated using nonlinear

[1]Stiglitz (1997) however, talked about concavity of the Phillips curve.

estimation techniques. The idea behind the nonlinear models is "regime shifts or regime switching" and these models were first introduced by Goldfeld and Quandt (1972). There are three types of nonlinear specifications of the regression models. First is the threshold regression model, developed by Tong (1983), in which change of behaviour of a variable has been observed above and below the certain value or set of values of a threshold. Regime shift in this model is assumed to be discrete and can be determined endogenously from the data. This model can be easily estimated by Ordinary Least Square Technique (*see* for instance, Komlan, 2013; Koustas and Lamarche, 2012; Rodríguez, 2008). Second, the smooth transition regression models which let the parameters to change smoothly and slowly from one regime to another and allows for endogenous regime switches. Smooth transition autoregressive (STAR) models have two useful types; logistic version of star model (LSTAR) and exponential form of the model (ESTAR). Castro (2008) and Peterson (2007) argue in the favour of using this type of models as these provide better structural framework and economic intuition for the central banks' nonlinear policy behaviour.[2] Third, Markov switching model developed by Hamilton (1989) captures the nonlinear behaviour of monetary policy assuming regime switching a Markov process. Several authors have followed this approach. Tan and Habibullah (2007) empirically assessed the asymmetric behaviour of monetary policy with the business cycles using this technique. Yi (2012) argues in favour of using this technique to the 'crisis mentality' of Asian emerging economies. Owyang and Ramey (2001) point to the presence of 'dove' and 'hawk' regimes in the monetary policy of US, using this methodology.

Before deciding for the appropriate form of the nonlinearity, detection of the nonlinear behaviour is a pre-requisite. If nonlinearity is not detected, applying a nonlinear model can lead to over fitting the data. This can be done with number of tests like the McLeod test, RESET test, LM test, and other portmanteau test. McLeod-Li (1983) test is done to determine if there is presence of significant autocorrelations in the squared residuals from linear equation. Ljung-Box statistic is used to determine serial correlation in the squared residuals. If the null hypothesis is rejected, this shows that the model is nonlinear. This test can detect various forms of nonlinearity but cannot specify the actual nature and form of the nonlinearity present in the data. Regression Error Specification Test is used to test the linearity of the model.

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[2]Using the LSTAR specification, Huh, Lee and Lee (2009) models the nonlinear Phillips curve of US to inquire optimal policy rule and Brüggemann and Riedel (2011) models quarterly data of UK which according to them was most plausible and viable technique.

Thus, null hypothesis is linearity and the alternative hypothesis is nonlinear specification of the model. The concept of doing this test relies on the fact that for the linearity to hold, the residuals of the estimated linear model should be uncorrelated to the regressors used in the estimating equation or with the fitted values. The advantage of using this test is that it's easy to apply and detect nonlinearity. Other portmanteau tests are residual-based while having no specific alternative hypothesis. One of these tests is BDS (Broock *et al.*, 1996) test for independence. Distance between different pairs of residuals has been examined in this test for the detection of serial correlation, nonlinearity, and structural breaks. McLeod-Li Test, the RESET and other Portmanteau tests provide little help in determining the nature of the nonlinearity as these tests have general alternative hypothesis of nonlinearity. To tackle this issue, Lagrange Multiplier Test is used since it has specific alternative hypothesis. This test can be done in three steps where residuals of the estimated linear portion model are regressed on the partial derivatives estimated under the null hypothesis of linearity and then on the basis of the value of TR^2, which has χ^2 distribution, is used to accept or reject the null hypothesis of linearity.

The focus of our study is nonlinear Taylor rule with reference to State Bank of Pakistan. By reviewing the literature related to Pakistan's monetary policy (given in introduction), it is found that monetary policy reaction function in Pakistan is asymmetric. The asymmetric response in Pakistan is modeled, in different studies, as threshold regression, Logistic smooth transition regression and Markov regime switching models. However, we have analyzed with the help of literature that these techniques vary on the basis of the type of the 'regime switching'. Our objective in this study is to find the most appropriate specification of the nonlinear Taylor rule in Pakistan.

III. ECONOMETRIC METHODOLOGY

The purpose of our study is to find out the appropriate specification of monetary policy reaction function of SBP to capture nonlinearity. Initially linear Taylor rule is estimated and then different nonlinear specifications are tested.

LINEAR MODEL

The linear static Taylor rule can be specified as the following equation:

$$i_t = \alpha_0 + \alpha_1 \pi_t + \alpha_2 y_t + u_t \tag{1}$$

Here, i is the short term nominal interest rate, π is the inflation rate and y is output gap. Coefficients α_0 depends on the inflation target and equilibrium real interest rate, α_1 is assumed to be positive and greater than 1 (1.5 in Taylor's specification) and α_2 is assumed to be positive for policy to be counter-cyclical. u_t is the error term which is identically distributed but may be serially correlated.

The serial correlation of the error term is indicative of the interest rate smoothing objective which is one of the objectives of SBP (Malik, 2007). In this case, the above specification of Taylor rule is inappropriate. If we correct the above specification for serial correlation then it becomes dynamic version of the linear Taylor rule.

$$i_t = \rho i_{t-1} + (1-\rho)(\alpha_0 + \alpha_1 \pi_t + \alpha_2 y_t) + e_t \tag{2}$$

In this case ρ is the first order autocorrelation coefficient and e is assumed to be serially uncorrelated error term.

NONLINEAR MODELS

Nonlinear econometric models are based on the concept of regime switching where behaviour of the variable depends on the state of the economy. There are different kinds of regime switching models which are discussed in this sub-section.

1. Threshold Regression Model

In this type of model response of a variable changes above and below the certain threshold value or set of values. Threshold regression model, developed by Tong (1983) and Chan and Tong (1986), is quite useful in the field of economics for the analysis of the nonlinear models. This model can be easily estimated by Ordinary Least Square Technique (OLS). In order to capture the nonlinearity and asymmetry in the Taylor rule, we used the following TR model:

$$i_t = \rho_1 i_{t-1} + (1-\rho_1)(\alpha_{01} + \alpha_{11}\pi_t + \alpha_{21} y_t) + e_{1t} \quad \text{if } \pi > \tau \quad \text{and}$$

$$i_t = \rho_2 i_{t-1} + (1-\rho_2)(\alpha_{02} + \alpha_{21}\pi_t + \alpha_{22} y_t) + e_{2t} \quad \text{if } \pi \leq \tau \tag{3}$$

The above equation represents threshold model with two regimes defined by the value of inflation where threshold inflation rate is τ, above and below which parameters' values are different. The process is linear in each regime but the possibility of switching from regime 1 to regime 2 renders Taylor rule a nonlinear process. Estimation of threshold model is performed by OLS technique and it is easier to estimate if threshold τ is known. The

threshold value, if unknown, can be estimated using Chan (1993) methodology. In our case, we have 72 observations, the maximum and minimum 13% of the values are trimmed to ensure enough values on each side of the threshold value. Exclusion of 26% from both the sides leaves us with 52 values. The above equation (3) has been estimated 52 times considering each of the remaining observations as potential threshold value. The regression with the smallest sum of square of residuals contains the estimate of threshold. With similar methodology threshold for output gap is also determined in this study.

2. Smooth Transition Regression Model

Parameters change slowly from one regime to another in STR model capturing smoothness of the regime switching in monetary policy reaction function. Following Teräsvirta (1994; 1996), STR model for nonlinear monetary policy reaction function can be defined as follows:

$$i_t = \alpha' z_t + \gamma' z_t G(\gamma, c, s_t) + \varepsilon_t \tag{4}$$

Where z_t represents the vector of the explanatory variable which includes i_{t-1}, π_t, and y_t. Vectors ε' and γ' include the parameters associated to the linear and nonlinear parts of the equation respectively. The error term ε_t is assumed to be normally distributed with zero mean and constant variance. $G(\gamma, c, s_t)$ is known as transition function which is continuous and bounded between zero and one depending on the smoothness parameter γ, location parameter c and transition variable s_t, which may be an independent variable or a linear combination of the elements of z_t.

There are two basic transition functions in this case; the Logistic Smooth Transition Regression model and the Exponential Smooth Transition Regression model.

(LSTR) model has the following transition function:

$$G(\gamma, c, s_t) = \left[1 + \exp\left\{-\gamma(s_t - c)\right\}\right]^{-1} \quad \gamma > 0 \tag{5}$$

This function is monotonically increasing function of transition variable s_t. γ is the smoothness parameter indicating how smoothly the transition occurs between the regimes while c is the location parameter indicating where transition has actually taken place.

ESTR model has the following exponential transition function:

$$G(\gamma, c, s_t) = 1 - \exp\left[-\gamma(s_t - c)^2\right], \quad \gamma > 0 \tag{6}$$

3. Markov Regime Switching Technique

Markov regime switching model developed by Hamilton (1989) posits that regime switches are exogenous Markov processes. Our model is specified in a fashion that there exists two possible regimes for each target variable .The Taylor rule specification for Markov switching process is as follows:

$$i_t = \alpha_0\left(S_t^m\right) + \alpha_n\left(S_t^m\right)\pi_t + \alpha_{i_{t-1}}\left(S_t^m\right)i_{t-1} + \alpha_y\left(S_t^m\right)y_t + \sigma_i\left(S_t^m\right)\varepsilon_t^i \qquad (7)$$

S_t^m is the monetary policy regime and $\varepsilon_t \sim N(0,\sigma^2)$. There exist fixed probabilities of regime changes. If p_{11} denotes the probability that the system remains in regime one then $(1 - p_{11})$ denotes the probability that the system switches from regime 1 to regime 2. Similarly p_{22} denotes the probability that the system remains in regime two and $(1 - p_{22})$ denotes the probability that system switches from regime 2 to regime 1. S_t is unobservable in the data so we can only make inferences about the state based on the Markov transition probabilities. The coefficients of the two regimes and their transition probabilities are estimated through Maximum Likelihood Estimation (MLE) method. The transition probabilities are conditional probabilities and they are unknown, so they have to be estimated along with the coefficients of the model.

MODEL SELECTION CRITERIA

Our aim is to find the most appropriate model by comparing results from different models on the basis of following criteria:

1. The Information Criteria

We used information criteria, such as Akaike Information Criterion (AIC) and Shwartz Information Criterion (SIC) for selecting the appropriate model. An advantage of these information criteria is that they can be used to compare non-nested models. AIC provides a relative estimate of the information loss when a certain model performs a data generating process. There is always possibility of some information loss as one of the candidate models is used to represent the "true" model.

Generally, AIC is estimated as:

$$AIC = 2k - 2\ln(L) \qquad (8)$$

Here, k represents the number of parameters and L is the maximized value of the likelihood function of the estimated model. That model is preferred from a set of models which has the minimum AIC value.

SIC is also based on the likelihood function. The general formula for SBC is as follows:

$$SIC = -2.\ln \hat{L} + k.\ln(n) \tag{9}$$

Where $\hat{L}$ represents the estimated log likelihood value, k is the number of parameters and n is the sample size. The model with lower SBC is the one to be preferred. This criterion has lower probability of over-fitting the data than AIC.

2. Coefficient of Determination (R-square)

The most general definition of coefficient of determination is

$$R^2 = 1 - \frac{SSR}{SST} \tag{10}$$

Where SSR and SST are the residual sum of squares and total sum of squares respectively. It is useful for model selection when the specifications differ on the basis of addition or deletion of the explanatory variables (Johnston and Dinardo, 1997).

3. Forecasting

Forecasting helps to predict about the economic conditions, so it is important to find how well the four models under study perform in forecasting. For forecasting accuracy, the following statistical tools are used in this study.

Root Mean Square Error

It is the measure of the difference between the values predicted by the estimated model and the values actually observed. It compares the forecasting errors of different models. It can only have positive values; the model with a smaller value of RMSE is the better one to diagnose the variation in the errors in a set of forecast. Formula to calculate RMSE is as follows:

$$RMSE = \sqrt{\frac{\sum_{t=1}^{n} (y_t - \hat{y}_t)^2}{n}} \tag{11}$$

Where y_t and $\hat{y}_t$ represent actual and predicted values and *n* is the number of observations.

Mean Absolute Error

This measure of forecast error indicates how close forecasts are to eventual outcomes. MAE is given by:

$$\frac{1}{n}\sum_{i=1}^{n}|e_i| \tag{12}$$

Where e_i is the residual obtained from the estimation and n is the number of observations.

Coefficient of Correlation

The coefficient of correlation between the actual and the fitted values indicates the degree of linear association between these two series. The high value indicates the better fit of the model from which forecasts are generated.

DATA AND VARIABLES

For estimation of the monetary policy reaction function of SBP we have used quarterly data over the period 1993Q1-2011Q4. Before this time period State Bank of Pakistan was not given the autonomy to set operating target. Therefore the time span chosen starts from 1993. SBP achieves its objectives by targeting KIBOR (Karachi Interbank Offered Rate) at midpoint of the *repo* rate corridor. Though State Bank of Pakistan uses KIBOR as a policy instrument but due to unavailability of its data over the period under consideration we have used Call Money Rate as its proxy. Output gap is the difference between the actual output of the economy and the potential output. For the construction of this variable, data on GDP (constructed using the methodology of Arby (2008)) was seasonally adjusted by four quarters moving average method. The annual data on GDP have been collected from Pakistan Economic Survey. In Pakistan data on GDP are revised twice after release of provisional data, therefore, only provisional data are available for the last two years. The seasonally adjusted quarterly GDP is then regressed on time and time square; the resulting fitted values are used as proxy of the potential GDP. The output gap is estimated as the percentage difference of seasonally adjusted GDP and the potential level of GDP. Inflation rate is calculated as year on year growth rate of quarterly values of consumer price index (CPI), data on which are obtained from International Financial Statistics (IFS).

IV. ESTIMATION RESULTS

In the first step linear model has been estimated to find whether or not SBP follows linear Taylor rule. After getting the evidence of nonlinearity, all the

three regime switching nonlinear techniques have been applied. Later on comparison is made among the models to find which one is the most appropriate description of nonlinear behaviour of monetary policy reaction function of Pakistan.

LINEAR TAYLOR RULE

Table 1 reports the estimation results of our static and dynamic versions of linear Taylor rule. The results clearly show that SBP has not been following linear Taylor rule as our coefficients' estimates are different to what have been taken by Taylor. It is worth noticing that all the coefficients are statistically significant and residual series of the estimated rule is found stationary. However, the values of Durbin Watson (DW) stat and adjusted R-square are low which indicate other objectives of monetary authority in Pakistan. To capture the effect of another objective – interest rate smoothing – lagged interest rate is introduced on right hand side of the Taylor rule. Dynamic version of Taylor rule also tackles the problem of autocorrelation.

TABLE 1

Estimation Results of Linear Taylor Rule

Variables	Static Taylor Rule		Dynamic Taylor Rule	
	Coefficient Estimates	P-values	Coefficient Estimates	P-values
Constant	6.02	0.0000	2.15	0.003
Output Gap	28.77	0.0092	19.84	0.01
Inflation Rate	0.33	0.0000	0.137	0.01
Lagged Interest Rate			0.62	0.000
Adjusted R-Square	0.4		0.688	
DW-stats	0.58		2.06	
F-stats	24.18	0.000	53.28	0.000

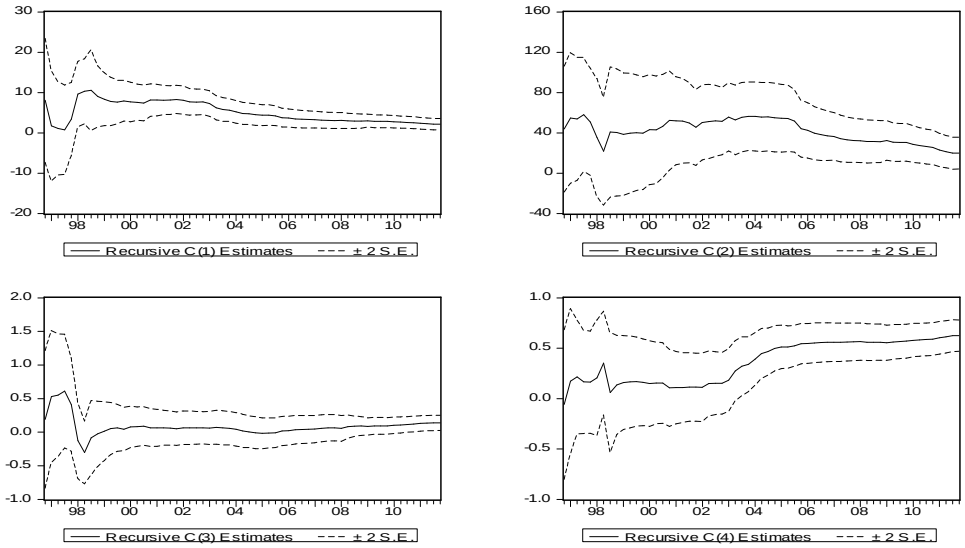
NOTE: F-stats are estimated for the null hypothesis that all coefficients except constant are zero.

It is worth noticing that coefficient of the lagged interest rate is statistically significant and high in magnitude indicating interest rate smoothing objective of the SBP. Output stabilization is another objective of monetary policy in Pakistan but coefficient of inflation rate is less than 1 in

both specifications. We have also found recursive estimates of the coefficients in dynamic version of the Taylor rule to have an idea of the stability of the parameters. The estimates of coefficients of output gap [C(2)] are unstable changing in 2007 when economy went into the problem of stagflation. At that time coefficient of inflation rate [C(3)] was also increasing but this increase was less than the increase in inflation rate. The coefficient of lagged interest rate [C(4)] significantly increased after 2007 as SBP continuously increased discount rate after this time period.

FIGURE 1

Recursive Estimates of Coefficients in Dynamic Taylor Rule



NONLINEAR TAYLOR RULE

1. Threshold Regression Model

In the first step, threshold values of inflation and output gap are estimated. For this Chan's (1993) method has been used. The values of sum of the squared residual obtained from the 52 regressions of the threshold model are plotted against successive values of threshold variable. The graph shown in Figure 2(a) clearly demonstrates that there is a sharp trough at fourteenth observation, which indicates viability of the threshold regression model. Threshold inflation rate has been found to be 6.37%. Same procedure is repeated for output gap; the threshold value of output gap is found 0.025 (2.5%). Hence, there is possibility that SBP's response to deviations of inflation from target change when inflation rate crosses the threshold value

of 6.37%. Similarly, the response may be different above and below 0.025 value of output gap.

FIGURE 2(a)

Residual Sum of Squares to Find Threshold Inflation Rate

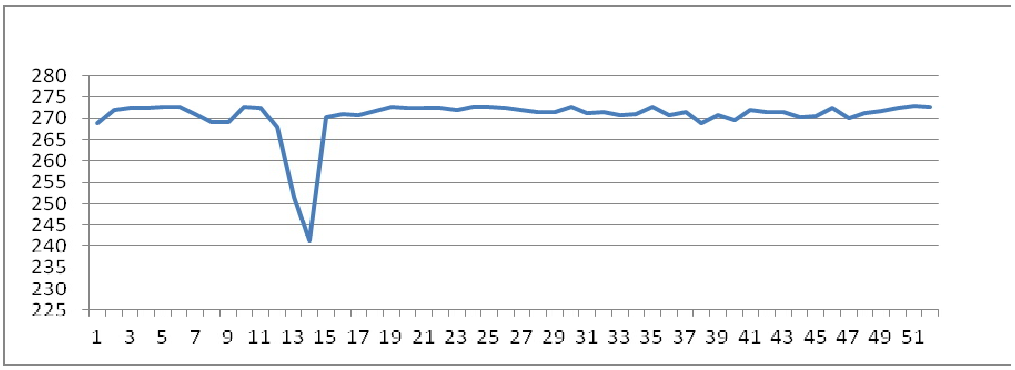
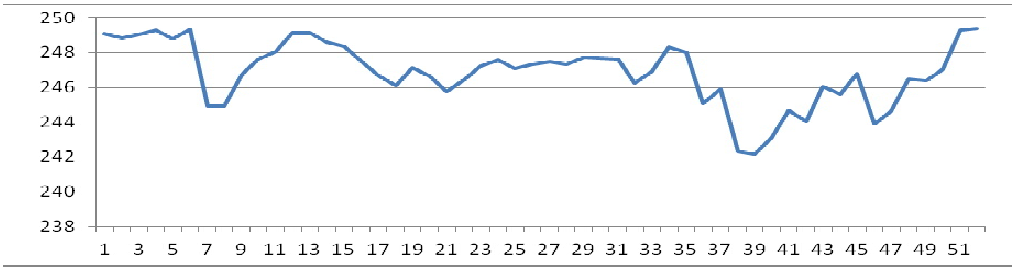


FIGURE 2(b)

Residual Sum of Squares to Find Threshold Output Gap



The next step is to estimate threshold regression for monetary policy analysis. Results from Table 2 show that all the coefficients are statistically significant (except for constant) when threshold inflation rate is used to construct dummy variable, which is then multiplied with the inflation rate. The fit of the model improved a lot as adjusted R-square is found 0.73 and Durbin-Watson stats is also close to 2. The magnitude of coefficient of output gap is still high and that of lagged interest rate is almost same as found in linear Taylor rule. The coefficient of inflation rate is different to what has been found in case of linear Taylor rule. Moreover, the coefficient of inflation rate is different in high and low inflationary regimes. This coefficient is greater than 1 (after adjusting for the coefficient of lagged interest rate) only when inflation rate is less than threshold inflation rate. Wald test shows that coefficients of inflation rate in two regimes are statistically different from each other. This shows that SBP is able to effectively respond to inflation rate only when economy is in low

inflationary regime. Similarly in case, when regimes are defined with respect to output gap, coefficient of output gap is higher and statistically significant when output gap is below its threshold value. It means response to output gap movements are also effective only when the economy is under performing. This behaviour is also confirmed when interaction dummy variables are used; SBP effectively responds to output gap only when output gap is negative and inflation rate is below threshold (Results are given in Appendix).

TABLE 2

Estimation Results of Threshold Regression

Variables	Regimes with respect to Inflation Rate		Regimes with respect to Output Gap	
	Coefficient Estimates	P-values	Coefficient Estimates	P-values
Constant	0.60	0.44	2.6	0.001
Output Gap	24.8	0.001		
Inflation Rate			0.14	0.015
Lagged Interest Rate	0.61	0.000	0.6	0.000
Inf * Dum_Inf	0.24	0.000		
Inf * (1–Dum_Inf)	0.71	0.000		
Gap * Dum_gap			6.5	0.58
Gap * (1-Dum_gap)			33.6	0.008
Threshold Inflation Rate	6.37		0.025	
Threshold Output Gap				
Adjusted R-square	0.73		0.69	
DW stat	1.87		2.02	
F-stat	49.00	0.000	41.02	0.000
Wald Stat	11.49	0.000		

F-stat is estimated for the null hypothesis that all coefficients except constant are zero.

2. Results of Markov Regime Switching Model

In order to estimate nonlinear Taylor rule, five specifications are used in Markov regime switching model. In the first specification, all policy

parameters including intercept and error variance are regime variant. In second specification only coefficient of inflation is regime variant keeping all other parameters constant across the regimes. Contrary to this, in third specification, only coefficient of inflation is regime invariant keeping all other parameters as regime variant, while in the fourth specification coefficient of gap is switching keeping all other parameters as regime invariant. In the last specification, coefficient of lagged interest rate is variant while keeping all other parameters as non-switching and invariant to regime change. The results are shown in Table 3.

TABLE 3

Estimation Result of Markov Regime Switching Model

Parameters	Specification 1		Specification 2		Specification 3		Specification 4		Specification 5	
	State 1	State 2	State 1	State 2	State 1	State 2	State 1	State 2	State 1	State 2
α_0	1.05 (1.00)	7.05 (1.00)	0.00 (1.00)		7.89 (1.00)	1.05 (0.00)	0.00 (1.00)		0.00 (0.00)	
α_{it-1}	0.77 (0.00)	2.39 (1.00)	0.60 (1.00)		0.1 (1.00)	0.76 (0.00)	0.78 (1.00)		0.82 (0.00)	–0.4 (0.00)
α_π	0.12 (1.00)	0.03 (1.00)	0.87 (0.00)	–0.87 (1.00)	0.11 (0.00)		0.1860 (1.00)		0.15 (0.00)	
α_y	9.93 (1.00)	47.52 (1.00)	24.24 (1.00)		36.23 (0.00)	12.8 (1.00)	11.75 (0.00)	139.56 (1.00)	8.11 (0.00)	
σ_i^2	0.6 (1.00)	6.24 (1.00)	11.53 (1.00)		5.82 (0.00)	0.89 (1.00)	3.73 (0.00)		4.47 (0.00)	
Expected regime duration	8.18	4.17	10	10	12.11	44.47	5.82		1.00	
Log Likelihood	–140.81		–282.19		–138.82		–157.73		–162.62	

The first specification is standard for the monetary policy rule as used by Davig and Leeper (2006); results demonstrate that SBP does not follow Taylor rule as coefficient of inflation is 0.12 in low variance state and 0.03 in high variance state. These results are consistent with Malik and Ahmed (2010) who find that Taylor rule has never been followed by SBP. In the second specification, only coefficient of inflation rate is significant (when economy is in low variance state). In the third specification, coefficient of inflation rate is significant but its magnitude is low while coefficient of output gap is significant only in high variance state. All specifications show

that State bank of Pakistan has never followed Taylor rule in both volatile and docile periods as coefficient of inflation rate is less than one in all the cases. Monetary policy is active (in Leeper's terminology) when it satisfies the Taylor principle, that is, estimated coefficient of inflation is greater than one, and in periods when it is passive, the same coefficient is less than one. Our results show that SBP has passive policy stance.

TABLE 4

Results of LSTR Model (with i_{t-2} as Transition Variable)

Parameters	Linear Part		Nonlinear Part	
	Coefficient Estimates	P-values	Coefficient Estimates	P-values
Constant	2.32	0.03	3.97	0.02
Output Gap	30.70	0.01	–29.30	0.06
Inflation Rate	0.06	0.54	0.10	0.42
Lagged Interest Rate	0.54	0.00	–0.27	0.11
Alpha			8.40	0.00
Gamma			4.74	0.35
DW stats	1.85			
R-square	0.77			

3. Results of Smooth Transition Regression

First of all, we have tested linearity against STR model using residual based LM test which is discussed in Teräsvirta (1996). Linear Taylor rule is estimated and then the residuals from this linear model are used to estimate following auxiliary equation:

$$\hat{\varepsilon}_t = \delta_0' w_t + \delta_1' w_t s_t + \delta_2' w_t (s_t)^2 + \delta_3' w_t (s_t)^3$$

w_t denotes the vector of explanatory variable while s_t denotes the transition variable. The null hypothesis of linearity is H_0: $\delta_1 = \delta_2 = \delta_3 = 0$. Linearity is tested for several transition variables including lags of the explanatory variables and second lag of interest rate is chosen on the basis of its lowest p-value of χ^2 which is 0.005 for the rejection of the linear model. Moreover, further testing of the cubic expressions of the above equation shows that LSTR model, in comparison with the ESTR model, is more appropriate for

the monetary policy reaction function of SBP. Results of LSTR model indicate that coefficient of inflation rate is insignificant in linear as well as in nonlinear part of the model. Moreover, it is found that SBP is concerned with output stabilization rather than price stabilization. Output gap has the positive sign in the linear part but opposite sign in the nonlinear part implying that the coefficient's value is decreasing with the increase in interest rate (in high inflationary regime). The coefficient of lagged interest rate is significant only in the linear part but not in nonlinear part indicating that the inertia coefficient decreases with increase in the lagged interest rate. Location parameter, alpha is significant while smoothness parameter gamma is insignificant in our results.

TABLE 5

Comparing Different Specifications of Nonlinear Taylor Rule

Model	AIC	SBC	R^2	RMSE	MAE	r
Linear rule	4.14	4.31	0.70	2.30	1.92	0.83
TR(inf)	4.06	4.21	0.74	2.22	1.80	0.86
TR(gap)	4.18	4.34	0.71	2.26	1.87	0.84
LSTR	10.1	32.9	0.22	1.60	1.15	0.47
MS(spec1)	18.1	49.9	0.40	1.75	1.27	0.63
MS(spec2)	8.71	31.4	0.05	4.31	3.49	0.22
MS(spec3)	16.1	45.7	0.38	1.71	1.22	0.61
MS(spec4)	9.87	32.6	0.07	1.97	1.38	0.28
MS(spec5)	9.81	32.5	0.08	1.99	1.35	0.29

RESULTS OF MODEL SELECTION CRITERIA

The selection of the most suitable model is based on the different criteria which are shown in Table 5. Results demonstrate that threshold regression model with inflation as a threshold variable has the minimum value of AIC and SBC while the Markov regime switching specification having all the parameters as regime variant has highest values of these criteria. Coefficient of determination, R^2 has the highest value in threshold regression model with inflation rate as threshold variable and Markov switching model with only inflation's coefficient as regime variant has its lowest value. LSTR model has the lowest standard deviation of the unexplained variance and closest

fitted values to the actual outcomes as shown by the lowest values of RMSE and MAE. The coefficient of correlation between the actual and the predicted values is highest for the TR model with inflation as transition variable. These results imply that on the basis of information criteria, R^2 and correlation coefficient between predicted and actual values, TR model with inflation as the threshold variable is the best model but if one is only interested in forecasting performance of the model then LSTR gives the minimum RMSE and MAE. The choice between these two models, *i.e.* TR model with inflation as threshold variable and LSTR model depends on the researcher's objectives.

V. CONCLUSION

According to Linear Taylor rule, monetary policy reaction function of Pakistan would set its interest rate as a policy instrument in response to inflation and output gap. This shows that whatever the inflation rate or the output gap is in the economy, policy makers would behave symmetrically to bring these economic indicators to their respective target levels. Doesn't it sound unrealistic? Human psychology and real life aggregate supply function lead to asymmetric response of policy makers. Would a policy maker treat positive and negative output gap and high and low inflation the same way? No, it rarely happens in the real world where loss aversion is the prevailing characteristic. Our estimation results of static linear Taylor rule and dynamic version of linear Taylor rule clearly indicate that SBP has never followed a linear Taylor rule. This convinces us to widen our research out of the realm of linearity.

After getting to know that response function is nonlinear, its proper specification is the major area of concern as misspecification of nonlinearity is a bigger problem than ignoring it altogether. "What is the type and nature of nonlinearity in the Taylor rule of Pakistan?" To find the answer, we estimated the reaction function using three different nonlinear models namely the Threshold regression model, logistic smooth transition regression model and Markov regime switching model. These three models have 'regime switching behaviour' but they differ on the basis of the mode of switching of parameters between the regimes. This characteristic makes each model unique in its specification and tells about the nature of nonlinearity. Later on, to find the answer of our research question, we have to choose between the models to know the nature of the nonlinearity in the reaction function of Pakistan. This can be done by comparing the estimated models on the basis of best-fitted criteria. The model satisfying the maximum criteria is the one to be used to estimate reaction function of Pakistan.

First of all we estimated Threshold regression model and found that threshold level of inflation rate and output gap were 6.37% and 2.5% respectively. These thresholds act as pivots leading to low and high inflationary regimes and good and bad times. Results of this study show that SBP responds to output gap in all specifications but reaction to inflation rate is significant and coefficient of inflation rate is greater than 1 only in low inflationary regime. We also estimated logistic smooth transition regression model and found that SBP does not target inflation rate in Pakistan rather it is concerned with output stabilization and interest rate smoothing. In the Markov regime switching model we find that SBP has never followed Taylor rule and Taylor principle is not satisfied (hence, monetary policy is passive). All these models have common finding that SBP desires to smooth interest rate changes over time. We conclude from the comparison of results from different models that best fitted model is threshold regression model with inflation as threshold variable according to which SBP reacts asymmetrically above and below threshold inflation rate of 6.37%. We can conclude from this result that high inflation usually accompanies high level of output therefore SBP does not raise interest rate to high levels to curb the output and inflation deviations from their respective targets. It can also be related to the fact that SBP faces political pressure when it raises interest rate during expansions.

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APPENDIX

TABLE A1

Categorization of Dummy Variables of Output and Inflation Rate

DBHINF	DBLINF	DRHINF	DRLINF
Good Time and high inflation = 1, otherwise 0.	Good Time and low inflation = 1, otherwise 0.	Bad Time and high inflation = 1, otherwise 0.	Bad Time and low inflation = 1, otherwise 0.

TABLE A2

Regression Results (With Dummy Variables Representing Four States of the Economy)

Constant	2.91 (0.0079)*
Gap*DBHINF	12.8 (0.53)
Gap*DBLINF	51.22 (0.29)
Gap*DRHINF	–33.7 (0.39)
Gap*DRLINF	52.78 (0.009)*
Infl*DBHINF	0.102 (0.22)
Infl*DBLINF	–0.104 (0.7)
Infl*DRHINF	0.033 (0.71)
Infl*DRLINF	0.192 (0.36)
Cmr(–1)	0.6 (0.000)*
Threshold Output gap	2.5%
Threshold inflation rate	6.37%
Adjusted R-square	0.68
DW stat	1.96
F-stat	18.35 (0.000)*

NOTE: The values in the parenthesis are p-values. The * indicates significance at 1%. Dependent variable = Call Money Rate

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MONETARY POLICY AND ITS INFLATIONARY PRESSURE IN PAKISTAN

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Abstract. Inflation has always been a central issue of socio-economic policy framework. The mechanism, through which it comes out, is of vital importance to explore for prudent policy formulation. The present study aims at investigating the impact of money supply growth on the rate of inflation in Pakistan. Annually time series data ranges form 1973-2013 is employed for the analysis. The model of the study works out the short-run and the long-run impact of money growth on the rate of inflation in Pakistan. ARDL technique is used, depending upon the time series properties of data that confer mixed order of integration. Diagnostic and stability tests confirm that models are econometrically sound and stable. The results go over the main points; interest rate and money supply are important policy variables for controlling inflation in the long-run while it is the national output level which put downward pressure on inflation rate in the short-run.

Keywords: Monetary policy, Price level, ARDL, Cointegration, Pakistan

JEL classification: E31, C50, C22

I. INTRODUCTION

Money supply and inflation, and their mutual relationships are the most prominent indicators of strength, potential and the prosperity of a country.

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The nature of monetary policy as well as the determination and maintenance of the price level always remain in the primary focus of social and economic planners. Moreover, it is most often observed and argued by the monetarists that money supply and rate of inflation are intricately related to each other. However, it is also observed that substantial increase in the quantity of money supply may either positively or adversely affect the overall economic progress. That is why, the two aspects, *i.e.* money supply and their interdependence, are always the subject matter of hot debates prevailing on the macroeconomic scene at various grades of the economic circle.

Contrary to traditional view of the economists that inflation can be eliminated completely, it is an ever existing and continuous phenomenon, *i.e.* inflation is always present in an economy. It is the rate of inflation which undergoes fluctuation from time to time and with respect to the prevailing circumstances. That is why the primary concern of the macro-economic policy makers is to control the rate of inflation and maintain it as certain optimum level which is largely dependent on the nature of monetary and fiscal policies, and the availability of natural economic potential.

Above discussion gives the impression of great importance to analyze the impact of monetary policy on inflation rate in different time horizons for Pakistan. After the introduction in the first section, Section II provides a profile about the money supply and inflation trends in Pakistan. Section III consists of a brief review of the existing literature. Methodological issues and sources of data are elaborated in Section IV. The empirical estimation of different models of money supply and inflation are brought into the analysis in Section V. Finally, conclusion of study along with possible policy recommendations are set forth in Section VI.

II. MONETARY AGGREGATES AND PRICE LEVEL

Monetary aggregates have become most important sector over the last few years, specially, in order to control inflation rate and to enhance growth. The annual changes in different definitions of money supply (M1, M2, and M3) are shown in the following Table 1. It presents yearly change in the amount of monetary aggregates (M1, M2, and M3) as well as in percentage change.

Figure 1 presents that money supply (M1) consists of the outstanding stock of currency in circulation, the demand deposit of scheduled bank and the other deposits with the State Bank of Pakistan. Increase in the share of M1 indicates that it has positive contribution to inflationary pressure on the economy of Pakistan. Figure 1 shows an upward trend in money supply

TABLE 1

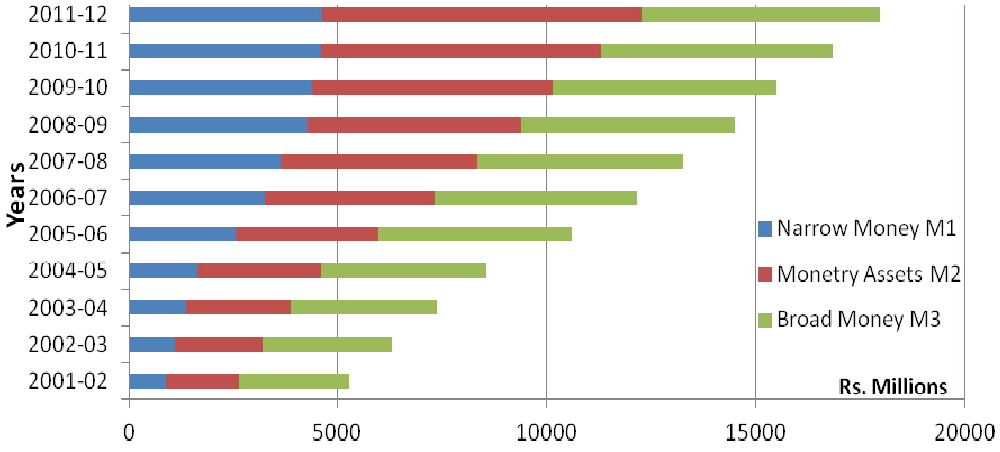
Money Supply in Pakistan (Rupees in millions)

End year stock	Narrow Money M1	Percentage change	Monetary Assets M2	Percentage Change	Broad Money M3	Percentage Change
2001-02	876.84	15.1	1,761.37	15.4	2,640.94	14.1
2002-03	1,106.25	26.2	2,078.71	18.0	3,102.00	17.5
2003-04	1,371.64	24.0	2,486.56	19.6	3,517.60	13.4
2004-05	1,624.12	18.4	2,966.39	19.3	3,975.50	13.0
2005-06	2,564.60	19.7	3,406.50	15.2	4,623.40	12.3
2006-07	3,256.72	76.9	4,065.16	11.0	4,837.50	9.4
2007-08	3,639.50	18.8	4,689.14	12.0	4,942.40	11.4
2008-09	4,262.22	19.3	5,137.21	15.0	5,099.50	15.2
2009-10	4,372.50	20.4	5,777.23	19.0	5,345.60	16.3
2010-11	4,599.50	23.2	6,695.20	22.0	5,560.90	18.2
2011-12	4,619.10	24.1	7,641.79	23.0	5,710.40	19.1

Source: *Pakistan Economic Survey* (various issues)

FIGURE 1

Monetary Aggregates of Pakistan



Source: *Pakistan Economic Survey* (various issues)

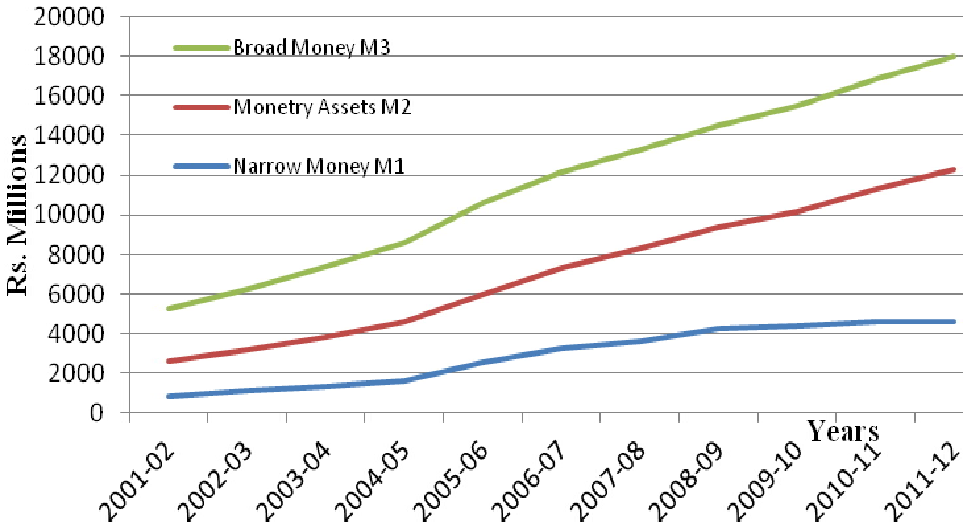
(M2). Money supply (M2), during 2006-07, expanded by Rs. 47.8 billion or 14 percent higher than the corresponding period the previous year. The main reason of this high monetary growth, during this period, was sharp rise in the net foreign assets (NFA) of the banking system and the growth in the net domestic assets (NDA) of the banking system accelerated at a lesser pace.

The overall money supply (M2) increased by 14 percent as against 12.1 percent in the same period last year. The monetary expansion was kept marginally below the projected nominal GDP growth over 14 percent in view of monetary overhang that had built up from excessive yearly monetary expansion since 2002-03.

Figure 2 presents the upward increasing trend in money supply (M3) during 1990 to 2011. During the 1990s, money supply increased at large level not only in public sector but also in private sector.

FIGURE 2

Trends in Monetary Aggregates



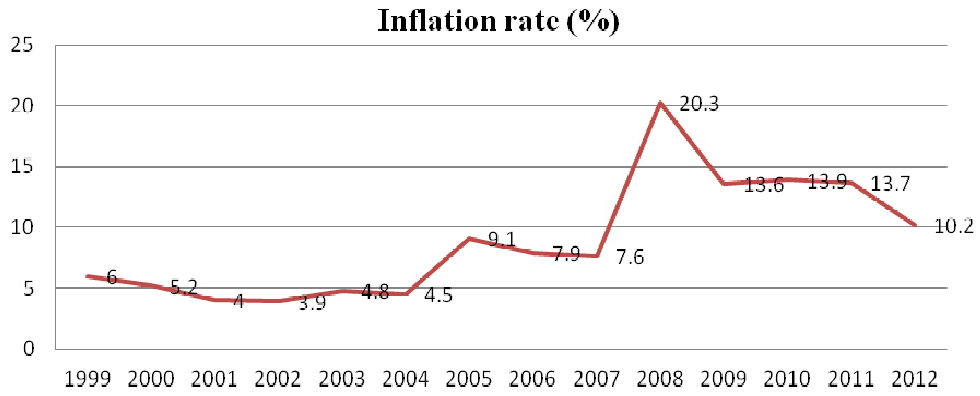
Source: *Pakistan Economic Survey*

In Pakistan, inflation rate was recorded as 3.3 percent during 1960s on an average and it geared up to 11.9 percent in the 1970s. The inflation rate fell again to an average of only 7.5 percent in 1980s. Since the early 1990s, inflation rate has been creating a serious matter for economists. A number of

reasons for this double-digit inflation rate are observed in 1990s which include supply shocks, monetary policy, tax policy, external shocks, pricing policy (*i.e.* procurement prices for agriculture products). While, expectations of people are the main factors that explain the inflationary pressures. The inflationary trends are explained with the help of Figure 3.

FIGURE 3

Trends in Inflation Rate



Source: *Pakistan Economic Survey* (various issues)

Analyzing the trends of inflation rate in Pakistan, there can easily be observed a fluctuating trend over the last 18 years. The pressure on prices increased due to inflation which shoots up to 13 percent mainly due to extremely high food inflation of 16.5 percent. The price pressure started to release from 1997-98 onwards due to an improved supply, strict budgetary measures and low international market prices. The inflation rate was at its lowest level in 2002-03, *i.e.* 3.9 percent. Owing to rise in the support price of wheat, shortage of wheat and increase in international prices (including the oil price), inflation reached at 9.3 percent in June 2005. The CPI based inflation during July-April 2007-08 was 10.3 percent on an average, as against 7.9 percent in the same period the previous year. Food inflation which is the largest component of the CPI, showed an increase of 15.0 percent. In the early period of 2008, inflation rate as measured by the changes in CPI reached at peak, *i.e.* 20.3 percent but in the late 2008, it started declining. This scenario changed in 2009 and inflation rate came down, *i.e.* 13.6 and in 2010, it was 13.9. Now in 2012, the inflation rate has been recorded as 10.2%.

III. LITERATURE REVIEW

The idea that persistent changes in price level are associated with change in money supply growth is one of the oldest and most established propositions in economics. The relationship between money growth and inflation rate is, ultimately, based on demand for money and supply of money**.** In low inflation countries there is positive association between money supply growth and inflation relative to real income in high inflation countries. Substantial changes in inflation rate in a country are certainly associated with money supply growth relative to real income. Money supply and its impact on inflation rate have been investigated by a number of researchers. Following is a comprehensive glimpse of an international literature on this issue.

Friedman (1963) argues that tight monetary policy maintained for a long time could check the inflation. The main emphasis of Friedman is on monetary description of inflation as his famous quotation is: "Inflation is always and everywhere a monetary phenomenon."

Friedman (1968; 1970; 1971) and Schwartz (1973) point out in the Monetarists Model that the past behaviour of money supply to output ratio will explain the prevailing rate of secular price changes.

Hossain (1986) constructed a simple monetary model of inflation. The basic assumption of that model was that any disturbance in real money stock (market) adjusted itself through change in price level. This study concluded that both exogenous and endogenous variables were observed that caused inflation in Pakistan.

Chaudhary and Ahmed (1995) analyzed the endogenous and exogenous nature of money supply. The results suggested that domestic finance of budget deficit, particularly, from banking system became inflationary in long-run in an economy. This explored the one to one strong relationship between money supply and inflation rate in an economy.

Moroney (2002) explored the quantity theory of money growth, inflation rate and GDP in long-run. Study showed that for the countries having high rate of money supply growth and inflation rate, the estimated M2 growth coefficient was close to one which strongly justified quantity theory of money and *vice versa*.

Abulrazag *et al.* (2003) presented an empirical investigation on money supply in the case of Qatar (UAE). Study used yearly data for the period of 1973 to 1998 and concluded that, in long-run, money supply was the

function of price level, real income, international reserves and government expenditure.

Brumm (2005) examined the relationship among money stock growth, output growth and inflation. The results showed that there was positive and significant relationship between money stock growth and inflation rate, and negative association between inflation and aggregate output growth. Empirical evidences strongly favour the Friedman's view that inflation is always and everywhere a monetary phenomenon.

Grauwe and Polan (2005) investigated quantity theory association between supply of money and inflation rate. It examined the two aggregates of money supply, *i.e.* M1, M2 (two proportions of quantity theory of money). Study showed positive and significant association between the long-run money supply growth rate and inflation rate. Same conclusions are drawn by Christensen (2001).

Qayyum (2006) explored the relationship between excess money supply growth and inflation rate for the economy of Pakistan and verified the Monetarists' views that "inflation is everywhere a monetary phenomenon." Study used time series data from 1960 to 2005 for the economy of Pakistan. Findings indicated that there was stable and one to one correlation between money supply growth and inflation rate.

Khan and Schimmelpfenning (2006) analyzed the main factors that might translate into inflation rate in Pakistan. Study employed the standard monetary variables such as money supply, credit to private sector as an active variable, exchange rate and interest rate in the model and used structural model of inflation which stressed on supply side factors as determinants of inflation. The outcome of the study was that monetary factors caused inflation in Pakistan. The same conclusions were drawn by Qayyum (2008).

Bakare (2011) investigated the determinants of money supply growth and its effect on inflation in Nigeria. It is found that 1% rise in money supply caused 5.6% increase in depicted inflation rate. Result referred to the strong supervision of money supply and money circulation (velocity) which caused high inflation in Nigeria.

Simwaka *et al.* (2011) presented an econometric investigation regarding the supply of money growth and inflation rate in Malawi. This study explored the factors of monetary aggregates that caused rise in inflation rate in Malawi.

Chaudhry *et al.* (2012) analyzed the nexus of monetary policy, inflation and growth in Pakistan using time series data properties from 1972-2010. The results indicate that credit to private sector, the variable of financial depth, real exchange rate and budget deficit are found elastic and significant variables to influence the real GDP in Pakistan. The pair-wise Granger causality results suggest that real GDP and real exchange rate are causing to each other bi-directionally. The real GDP also do cause financial depth, domestic credit and budget deficit uni-directionally. The real exchange rate is also causing the financial depth and budget deficit variables.

In this section, discussion regarding money supply and its impact on inflation rate is documented in detail. After a comprehensive literature review, conclusion is derived that increase in money supply has an inflationary effect on the economy. Different studies discussed the cause of inflation as growth in supply of money (Ogun and Adenikinju, 1995; Bakare, 2011; Qayyum, 2006; Khan and Schimmelpfenning, 2006). Therefore, inflation targeting policies are recommended by Fitzgerald (1991). Almost all studies are in the favour of positive and significant effect of money supply on inflation rate (Dwyer and Hafer, 1999; Moroney, 2002; Brumm, 2005; Grauwe and Polan, 2005; Qayyum, 2008; Bakare, 2011). Studies go with Monetarist view that inflation is always and everywhere a monetary phenomenon (Brumm, 2005; Qayyum, 2006; Okpara and Nwaoha, 2010; Bakare, 2011).

One of the interesting points which are common in all studies is that money supply is endogenously determined in short-run while in the case of long-run money supply is exogenously determined (Chaudary and Ahmed, 1995; Ahmed and Ahmed, 2006; Muhammad, 2010).

IV. DATA AND METHODOLOGY

This section consists of data and methodology to assess the effect of money supply on inflation rate. To analyze this relationship, ARDL techniques have been used for the estimation of results.

DATA

The data for this study are taken from Pakistan Economic Survey (Various Issues), Ministry of Finance, Fifty Year Economy of Pakistan (SBP) and World Bank (World Development Indicators). The data ranges from 1972-73 to 2011-13 is used for the analysis. Study uses inflation rate (IR) as dependent variable while Money supply (M2), interest rate (*i*), Gross

domestic product (GDP) are taken as explanatory variables. Variables are used into their log form to find out the elasticities.

TIME SERIES PROPERTIES OF DATA

At the formal level, stationarity can be checked by finding out if the time series data contains a unit root. The Dickey-Fuller (DF) and ADF tests can be used for this purpose. If the time series data is non-stationary but becomes stationary after differencing, then it is said to be integrated order one, *i.e.* I(1).

MODEL SPECIFICATION

The following model is formulated for the estimations of the results of money supply and inflation. This model finds the short-run and long-run impacts of money supply on inflation in Pakistan as follows:

$$IR_t = \beta_1 + \beta_2 (\text{M2}) + \beta_3(\text{GDP}) + \beta_4(i) + \mu_t$$

Where, μ_i = Disturbance term; β_0 = intercept term; β_1, β_2, β_3, β_4 = stimulus coefficients that measuring percentage change in response.

Whereas, the unrestricted vector error correction model is presented as below:

$$\Delta(IR)_t = \alpha_0 + \sum_{i=1}^{a} \alpha_{1i}\Delta(IR)_{t-i} + \sum_{i=0}^{b} \alpha_{2i}\Delta(M_2)_{t-i} + \sum_{i=0}^{c} \alpha_{3i}\Delta(GDP)_{t-i}$$
$$+ \sum_{i=0}^{e} \alpha_{4i}\Delta(i)_{t-i} + \alpha_5(\text{IR})_{t-1} + \alpha_6(\text{M}_2)_{t-1} + \alpha_7(\text{GDP})_{t-1} + \alpha_8(\text{i})_{t-1} + \mu_t$$

Above ARDL equation shows the short-run and long-run relationship between inflation, money supply, GDP and interest rate. $\alpha 0$ is the intercept term, while α_1, α_1, α_2, α_3, α_4 are the short-term coefficients of variables and α_6, α_7, α_8 are the long-term coefficients of the variables. Whereas, μ is the disturbance term and it includes all the ignored variables in the equation.

WALD-TEST (F-STATISTIC)

After regressing ARDL equation, we apply the Wald test (F-Statistic). The Wald test (F-Statistic) is used to establish the long-run relationship between dependent and independent variables.

The Null Hypothesis is given as follows:

$$\alpha_6 + \alpha_7 + \alpha_8 = 0 \qquad \text{(No long-run relationship exist)}$$

And Alternative Hypothesis as:

$$\alpha_6 + \alpha_7 + \alpha_8 \neq 0 \qquad \text{(A long-run relationship exist)}$$

If the calculated value of F-statistic is greater than the tabulated value then the null hypothesis is rejected and consequently alternative hypothesis is accepted and *vice versa*.

The long-run relation between dependent and independent variables is shown by the following equation:

$$(IR)_t = \beta_0 + \sum_{i=1}^{c1} \beta_{1i}(IR)_{t-i} + \sum_{i=0}^{c2} \beta_{2i}(M_2)_{t-i} + \sum_{i=0}^{c3} \beta_{3i}(GDP)_{t-i} + \sum_{i=0}^{c5} \beta_{4i}(i)_{t-i} + \mu_t$$

Equation shows the short-run relationship between dependent and independent variables as follows:

$$\Delta(IR)_t = \gamma_0 + \sum_{i=1}^{j1} \gamma_{1i}\Delta(IR)_{t-i} + \sum_{i=0}^{j2} \gamma_{2i}\Delta(M_2)_{t-i} + \sum_{i=0}^{j3} \gamma_{3i}\Delta(GDP)_{t-i} + \sum_{i=0}^{j5} \gamma_{4i}\Delta(i)_{t-i} + \lambda(\text{ECM})_{t-1} + \mu_t$$

In short-run equation the error correction term lagged $(\text{ECM})_{t-1}$ is added to adjust the results.

Error correction model (ECM_{t-1}) is the speed of adjustment from short-run to long-run equilibrium. In this equation, λ shows the speed of adjustment. The error correction shows the disequilibrium value.

V. RESULTS AND DISCUSSIONS

After the data and methodological issues, the study estimates the short-run and long-run impacts of monetary policy on inflation rate in Pakistan.

DESCRIPTIVE STATISTICS OF DATA

The descriptive statistics are represented in Table 2. Average values are measured with means and median. The Jarque-Bera (JB) test of normality provides combined results of skewness and kurtosis. Jarque-Bera (JB) test of normality shows that variables are normally distributed.

TABLE 2

Descriptive Statistics

Variables	GDP	I	IR	M2	RM
Mean	3006686	8.642564	10.64679	1351264.	135586.3
Median	1077943	8.800000	9.094895	544732.0	43910.17
Jarque-Bera	35.01189	1.434803	9.699595	16.91541	81.88817
Probability	0.000000	0.488019	0.007830	0.000212	0.000000
Observations	40	40	40	40	40

Source: Authors' calculations

STATIONARITY OF DATA

The stationary can be checked with the help of ADF test. Table 3 shows the calculation for ADF Test at the critical level of five percent. The results of the data show mixed order of integration.

TABLE 3

ADF Unit Root Test

Variable	At level	At 1st Difference	Conclusion
GDP	–0.914946	–5.9399	I (1)
IR	–7.712870	–8.9422	I (0)
M2	–1.011641	–4.9399	I (1)
I	–3.097144	–4.9422	I (0)

Source: Authors' calculations based on E-Views 7.0.

Table 3 is the representation of the Augmented Dickey Fuller test, *i.e.* ADF test. The ADF statistics calculated for checking the stationarity of variables time series variables.

BOUNDS TEST FOR COINTEGRATION

In the first step the existence of the long-run relationship among the variables is needed. We have used Bound Testing Approach in order to examine the long-run relationship. Table 4 interprets the findings of Wald-Test (F-

Statistics) for long-run relationship. The value of F-statistics based on Wald test is given in second column. The upper bound values are reported in third column of Table 4. The results of the test indicate that there exits long-run relationship among the variables in the model.

TABLE 4

Bound Testing for Cointegration

Equation	F-Statistic	Upper Bound Critical Value	Conclusion
IR / GDP, M2, *i*	13.73 [0.00]	5.96 (1%)	Integration exists

Source: Authors' calculations.

NOTE: f-statistic: 13.73 (Significant at 1% marginal values). Critical Values at $k = 5 - 1 = 4$ is cited from Narayan (2005), Case v: unrestricted intercept and unrestricted trend. The numbers in parenthesis shows the probabilities of F-statistic.

LONG-RUN AND SHORT-RUN IMPACT OF MONEY SUPPLY ON INFLATION RATE

The short-run and long-run estimates of money supply impact on rate of inflation are reported in Table 5. Results show a positive impact of money supply on the rate of inflation that is statistically significant. This finding of the study is consistent with the theoretical and empirical evidences that argue that money supply is always a monetary phenomenon (Friedman, 1963; Kemal *et al.*, 1980; Hossain, 1986; Chaudhary and Ahmed, 1995; Qayyum, 2006).

TABLE 5

Long-Run Impact of Monetary Policy on Inflation
Dependent variable: INF

Regressor	Coefficient	Standard Error	T-Ratio
i	–0.112	0.80611	1.6947
M2	5.933	13.76	2.4310
GDP	–6.063	14.30	–0.42399
C	5.226	21.42	0.24393

Source: Authors' calculations

TABLE 6

Short-Run Impact of Monetary Policy on Inflation Rate
Dependent variable is INF

Regressor	Coefficient	Standard Error	T-Ratio
di	0.033239	0.25455	0.13058
dM2	1.7542	4.0498	0.43316
dGDP	19.6047	8.2844	2.3664
dC	1.5451	6.4694	0.23883
ecm(–1)	–0.29565	0.18399	–1.6069

Source: Authors' calculations

With an increase in inertest rate which is the cost of holding money, stimulates the money demand for holding to decease that results in low level of prices of goods and services (Khan and Schimmelpfenning, 2006). The effect money demand is captured by real GDP. Whereas the factors that determine the real income level are different from the factors that determine money demand. So the price level remains unrelated with the level of real income (Qayyuam, 2006) as results show a negative relation but that is insignificant. The results are also in line with the finding of Khan and Qasim (1996).

The error correction estimates indicate the time required for inflation to converge to its long-run equilibrium. The short-run results indicate that income has only significant short-run results.

TABLE 7

Diagnostic Test

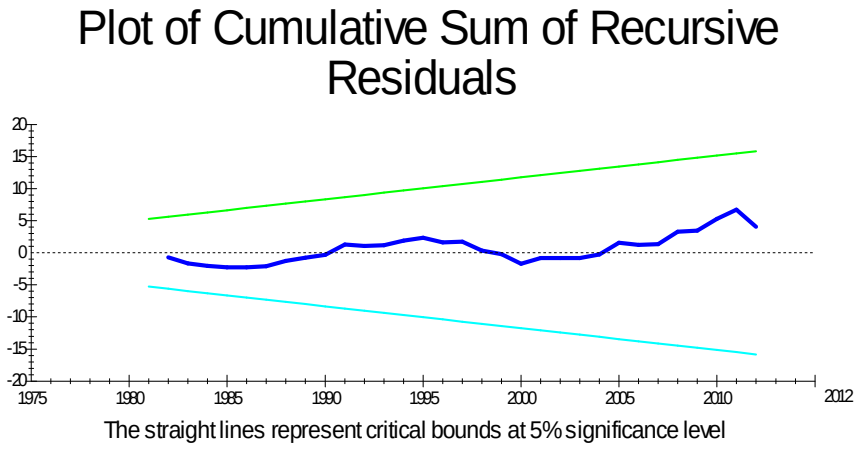
* Test Statistics *	* LM Version *	* F Version *
* A: Serial Correlation	*CHSQ(1) = 0.31032 [0.577]*	F(1, 31) = 0.25524 [0.617]
* B: Functional Form	*CHSQ(1) = 0.057099 [0.811]*	F(1, 31) = 0.046651 [0.830]
* C: Normality	*CHSQ(2) = 1.2093 [0.546]*	– Not applicable –
* D: Heteroscedasticity	*CHSQ(1) = 2.6221 [0.105]*	F(1, 36) = 2.6682 [0.111]

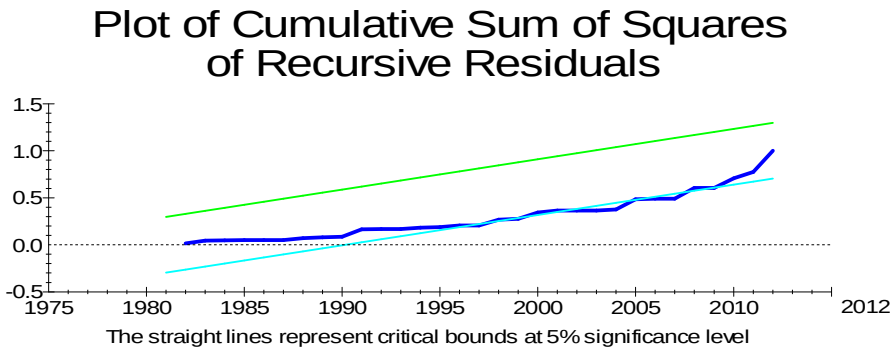
Source: Authors' calculations

DIAGNOSTIC AND STABILITY TESTS

The diagnostic and stability test are performed to check the econometrics soundness of the model. Our model passes the entire tests and is free from any biasness.

STABILITY TEST





VI. CONCLUSION

The present study is designed to investigate the short-run and long-run impact of monetary policy on inflation rate in Pakistan by using the time series data and employs ARDL techniques for the estimation of the results. The study figures out important policy variables that would be helpful in prudent policy formulation for controlling inflation in Pakistan. Results of

the study go in favour of monetarist approach that money supply is the main cause of inflation while any increase in interest rate is responsible for reducing inflationary pressure in Pakistan. While increase in national income fulfills peoples demand for the commodities and slows down the inflationary pressure, the results reveal. This leaves a clear message for economic planners that inflation targeting policies may be helpful through controlling the interest rate, money supply and country output level.

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PASS-THROUGH OF WORLD OIL PRICES TO INFLATION: A TIME SERIES ANALYSIS OF PAKISTAN

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Abstract. Inflation plays vibrant role in economic stability and is considered to be an integral component of sound macroeconomic policies. Consumer prices are very much linked with the oil prices. A change in oil prices is assumed to be passing through to other goods prices directly or indirectly. The main objective of this study is to investigate long-run pass-through of world oil prices to domestic inflation in Pakistan using monthly data from January 2000 to December 2014. The standard Augmented Dickey-Fuller (ADF) unit root test is applied to test the order of integration of selected variables. The Autoregressive Distributed Lag (ARDL) bounds testing approach is applied to investigate long-run pass-through of world oil prices to domestic inflation in Pakistan in the presence of control variable, *i.e.* exchange rate. The results of the study clearly explain that in the long-run international oil prices and exchange rate significantly affect the inflation rate in Pakistan. Furthermore, oil price (LOILP) has positive relationship with inflation and Nominal Exchange Rate (LER) has negative relationship with inflation rate in Pakistan. The findings of the Granger causality test reveal that there is unidirectional causality that runs from world oil prices to inflation rate, from inflation to exchange rate, and from world oil prices to exchange rate in Pakistan.

Keywords: Pass-through, Oil price, Inflation, Exchange rate

JEL classification: C22, E42, P24

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I. INTRODUCTION

Inflation plays an important role in economic stability of an economy and is considered to be integral component of sound macroeconomic policies. Low inflation could impact growth negatively while high inflation can affect poor more severely than rich. After 1973, when Pakistan experienced highest inflation rate (38 percent), in 2008-09 severity again has been observed when inflation rate augmented by 17 and economic growth declined to 0.4 percent (*Pakistan Economic Survey*, 2008-09, 2013-14). This high inflation is due to internal and external factors. In foreign factors exchange rate, global inflation, food prices, and, more importantly, world oil prices are factors affecting domestic price stability in developing countries like Pakistan.

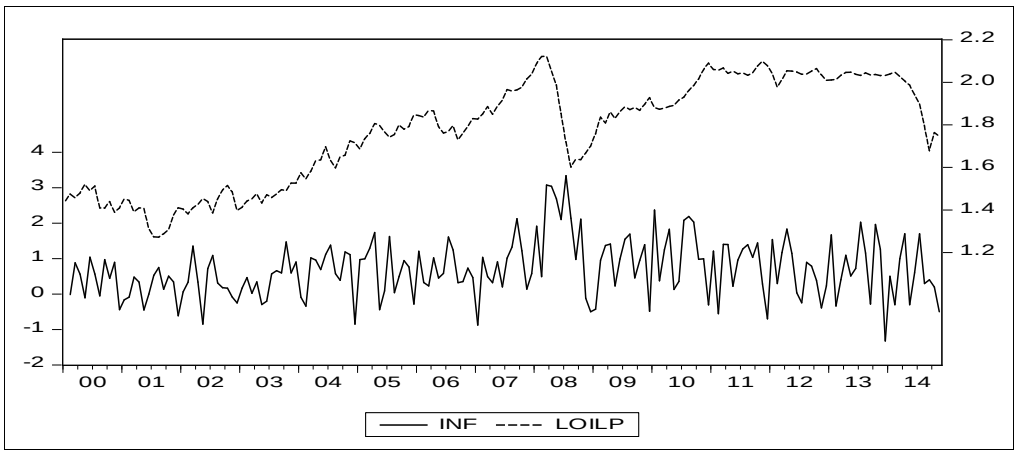
In general, consumer prices are very much linked with the oil prices, because oil products are not only used as a final product but are also used as an input in many of the production processes and economic activities. A change in the oil prices is assumed to be passing through to other goods prices directly or indirectly. Oil prices affect the consumption of consumers in many fields. The increase in the oil prices is reflected into increase in the producer prices that are finally pass-through to the consumer prices. Furthermore, it has been observed that an increase in oil prices have a significant impact on exchange rate and it also exerts pass-through adverse impact on the development process. The pass-through effect of global oil prices on domestic inflation deteriorates the living standard, causes political unrest and increases unemployment in developing countries like Pakistan.

During the last five decades, the global economy has faced several big oil shocks. In 1973, world has faced first oil shock, when OPEC economies reduced oil exports due to Arab War against Israel. Resultantly, world oil prices moved up from $ 4.15 in 1973 to $ 9.07 in 1974. Second oil shock occurred in 1979, when Iran faced severe political instability that caused a massive reduction in oil production in Iran, resultantly oil prices shifted from $ 12.46 in 1978 to $ 35.24 in 1981.

From 2000 to 2008 world oil prices created new records that severely affected the economy of every country of the world. In 2007-08, world oil prices have approached to ever highest $ 145 per barrel. But in the second quarter of 2014-15, oil price moved down to $ 44 per barrel, which is lowest in last 10 years. These oil price shocks affect economic growth, foreign trade, balance of payments, inflation and other economic variables adversely. Furthermore, an increase in oil prices may lead to slow economic growth, which results in an increase in domestic consumer prices and in turn affects the process of economic growth badly.

FIGURE 1

World Oil Prices and Inflation Rate of Pakistan
(Monthly data from 2000M1-2014M12)



Source: Thomson Reuters and IFS 2014

The world oil shocks during 1970s and 2008 have attracted a lot of attention of researchers to investigate the impact of oil prices on macroeconomic indicators. Many empirical studies suggest a strong pass-through effect of oil prices on consumer prices. Gisser and Goodwin (1986) point out that macroeconomic variables are significantly affected by oil prices in United States. Both, 1973 and 1979 oil shocks have contributed significantly in an increase in price level in developing countries (Burbidge and Harrison, 1984). Whereas, Hooker (2002) investigates the pass-through effect of oil prices by estimating Phillips curve model. The study reveals that oil price pass-through effect appears to be negligible after 1980 in USA. Moreover, LeBlanc and Chinn (2004) find that crude oil prices have very small effects on consumer prices in developed economies. Different studies suggest that affects of oil prices on consumer prices and other economic activities vary for the different investigation periods and across the countries. This study is an attempt to extend the empirical literature on pass-through impact of global oil prices on domestic inflation for Pakistan using monthly data from January 2000 to December 2014.

II. LITERATURE REVIEW

Several theoretical and empirical studies have been conducted to investigate the effect of exchange rate, global inflation, energy prices, international food inflation and international crude oil prices on domestic inflation, and growth

of different countries. Two consecutive oil crises and stagflation in the different countries during the 1970s has received considerable attraction of researchers and academicians to analyze the relationship between international oil prices and domestic economic activities. The review of literature indicates that there is a strong relationship between world oil prices and inflation.

Chou and Tseng (2011) estimate the short-run and long-run pass-through effects of international oil prices on CPI index in Taiwan using data from 1982 to 2010. The results of the study show that oil prices have significant and long-run pass-through effect on domestic price level of Taiwan. The results indicate that short-run pass-through effect of oil prices on inflation rate in Taiwan is not significant.

Shioji and Uchino (2010) explore the effect of world oil prices on domestic inflation in Japan by employing Vector Autoregressive (VAR) approach on data for the period 1980 to 2000. The results of the study reveal that pass-through effects of international crude oil prices on domestic prices have declined at aggregate level as well as at sectoral level. L'Oeillet and Licheron (2008) observe the relationship between international oil prices and inflation rate by estimating Phillips curve on European zone data for the time period 1970-2007. The study finds a declining pass-through of international oil prices to domestic consumer prices.

As far as Pakistan is concerned, Tufail and Batool (2013) investigate the effect of gold and stock prices on consumer prices in Pakistan using cointegration and vector error correction models for the data from 1960 to 2010. The results of the study show that gold prices significantly affect inflation in Pakistan. The results of the study suggest that along with effective monetary policy government should monitor and regulate the gold market to control inflation in Pakistan. Jaffri *et al.* (2013) have analyzed global inflation pass-through to domestic inflation of Pakistan using quarterly data for the period 1993-2012. The results of the study reveal that global energy prices and food inflation significantly and positively affect inflation in Pakistan. The study suggests that there is a need to formulate monetary policy in collaboration with fiscal policy carefully to control foreign inflation pass-through to domestic inflation in Pakistan.

III. THEORETICAL LINK

Conceptually, the pass-through of world oil prices into domestic inflation refers to a rate at which the fluctuations in the oil price are reflected in the general price level (Mandal *et al.,* 2012). Oil prices fluctuations have been

considered by policymakers, econometricians and economists as a main source of business cycle instability since mid 1970s. Many efforts have been made to examine the means whereby world oil prices exert upsets effect on the domestic inflation, economic growth and other macroeconomic variables (Jones and Kaul, 1996; Brown and Yücel, 2002).

Theoretically, increase in oil prices is expected to affect the inflation rates through different channels. Direct effect explains the effects through the demand side: a rise in the world oil prices is considered as an exogenous inflationary shock because energy is part of households' basket (for details *see*, Pierce and Enzler, 1974; Hickman, Huntington and Sweeney, 1987).

While, on the other hand, indirect effect works through supply side, *i.e.* it can be observed via producer prices (Rasche and Tatom, 1977). An increase in oil prices exerts bad impact on supply of goods and services which leads to an increase in the cost of energy causing the reduction of basic inputs required for production of goods and services and ultimately leads to an increase in inflation. Third, high oil prices can be translated into higher consumer prices expectations and higher wages. In response to that workers can demand for higher wages to compensate the decline in real income which may lead to an increase in cost-push inflation.

IV. DATA AND MODEL SPECIFICATION

This study uses monthly data for world oil prices in dollars, inflation rate and exchange rate for the period of January 2000 to December 2014. During these 15 years world has experienced two oil shocks, *i.e.* world oil crisis 2007-08 and world oil price shock 2014-15. The data on world oil prices is taken from Energy Information Administration (Thomson Reuters) and data on exchange rate and inflation is collected from *International Financial Statistics* (IFS) and monthly *Statistical Bulletin* of State Bank of Pakistan (SBP).

MODEL: ERROR CORRECTION VERSION OF ARDL MODEL

$$\Delta INF_t = \alpha + \varphi INF_{t-1} + \rho LOILP_{t-1} + \delta LER_{t-1} + \beta \sum_{i=i}^{i=m} \Delta INF_{t-1} + \phi \sum_{i=0}^{i=m} \Delta LOILP_{t-i} + \gamma \sum_{i=0}^{i=m} \Delta LER_{t-i} + \varepsilon_t \quad (1)$$

Null hypothesis:

$H_0 = \varphi = \rho = \delta = 0$ (No cointegration)

$H_0 = \varphi \neq \rho \neq \delta \neq 0$ (Existence of long-run relationship)

INF Inflation rate (Monthly Data)

LOILP Log of World Oil Prices in US $ per Barrel (Monthly Data)

LER Log of Nominal Exchange Rate (Monthly Data)

LONG-RUN PASS-THROUGH OF OIL PRICES ON INFLATION IN PAKISTAN

The short-run pass-through measures the impact of rise in oil prices on inflation at the same time. Whereas, long-run pass-through effect estimates aggregated pass-through by considering previous period oil price changes and inflation.

$$LRPT_{OILP} = \frac{\rho_{t-1}}{1-\varphi_{t-1}} \tag{2}$$

V. EMPIRICAL RESULTS AND DISCUSSIONS

The standard Augmented Dickey-Fuller (ADF) unit root test is applied to check the order of integration of selected variables (Dickey and Fuller, 1979). Table 1 shows ADF unit root test results, which indicate that out of three variables two are stationary at level, *i.e.* INF, ER, while one has unit root, *i.e.* Oilp. As variables are not stationary at same order of integration, *i.e.* I(1), so Johanson Cointegration would not be the valid procedure for analysis. Thus ARDL bound testing approach would be appropriate technique for econometric analysis.

TABLE 1

Unit Root Estimation

Variables	Level		1st Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
INF	–4.943319* (0.0000)	–5.099266* (0.0002)	–7.467654* (0.0000)	–7.496760* (0.0000)
LOILP	–1.617780 (0.4714)	–1.886390 (0.6574)	–10.51776* (0.0000)	–10.54170* (0.0000)
LER	–0.212764 (0.9332)	–1.692567 (0.7507)	–5.673454* (0.0000)	–5.680976* (0.0000)

The VAR Lag Order Selection, Akaike information criterion (AIC) explains that 2 lags are feasible for this model (for details *see* Annexure I).

Table 2 shows the results of bound test for co-integration analysis. The computed F-statistic of 14.94 is greater than the upper bound at 1 percent level, so we can safely conclude that there is evidence of a long-run relationship among the variables under consideration.

TABLE 2

Bounds Test for Cointegration Analysis[1]

Critical value	Lower Bound Value	Upper Bound Value
1%	5.15	6.36
5%	3.79	4.85
10%	3.17	4.14

The estimated long-run equation is given below:

$$(INF)_t = 2.664482^* + 1.88^* (LOILP)_t - 1.35^* (LER)_t \quad [1](3)$$

Equation (3) reveals that the coefficients of the long-run relationship between INF, OILP and ER appear to be significant. Furthermore, it indicates that LOILP has positive relationship with inflation rate and LER has negative relationship with inflation rate in Pakistan as per expectations. These findings are consistent with the study of Chou and Tseng (2011). The long-run relationship between variables indicates that an increase in world oil prices by one percent may lead to an increase in inflation by 1.88 percent. Furthermore, if domestic currency appreciates by one percent then in response to that inflation will be reduced by 1.35 percent. The results of this study clearly explain that in the long-run international oil prices and exchange rate significantly affect the inflation rate in Pakistan over the sample period.

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[1]**Note**: Computed F-statistic: 14.86473 (Significant at 0.01 marginal values). Critical values are cited from Pesaran *et al.* (2001), Table CI (*iii*), Case 111: Unrestricted intercept and no trend.

Calculation of multipliers:

long-run multiplier between LOILP and INF = –[(LOILP(–1)) / INF(–1)]
= –[(1.611063) / (–0.857786)] = 1.88

long-run multiplier between LER and INF = –[(LOILP(–1)) / INF(–1)]
= –[(–1.161622) / (–0.857786)] = –1.35

LONG-RUN PASS-THROUGH OF OIL PRICES ON INFLATION IN PAKISTAN

The study explains long-run pass-through of world oil prices to inflation in Pakistan empirically by using monthly data from 2000M01 to 2014M12. Results of the study show strong pass-through of world oil prices to domestic inflation in Pakistan. It has serious implications for the policymakers of small open economies like Pakistan for maintaining price stability. The mass of long-run pass-through largely depends upon food and energy items' share in CPI, exchange rate, world oil prices and world CPI because petroleum payments have largest share in imports bill of Pakistan and CPI includes energy items in its baskets. Thus results of the study are consistent with prevailing economic condition of Pakistan. The pass-through estimates $LRPT_{OILP} = 0.867$ are consistent with the study of Chou and Tseng (2011) for developing economies which investigate oil prices' short-run and long-run pass-through into domestic consumer prices. The results of the study explain that oil prices have significant long-run pass-through effects on inflation in Pakistan and short-run pass-through has not been found significant.

TABLE 3

Granger-Causality Test (Wald Test F-statistic)

Null Hypothesis	F-Statistic	Prob.
OILP does not Granger Cause INF	7.13082*	0.0011
INF does not Granger Cause OILP	0.36723	0.6932
ER does not Granger Cause INF	0.64375	0.5266
INF does not Granger Cause ER	8.11265*	0.0004
ER does not Granger Cause OILP	1.34574	0.2631
OILP does not Granger Cause ER	9.10812*	0.0002

*, *** denote significant at 1% and 10% level. Figures in brackets refer to marginal significance values.

The findings of Granger causality test are presented in Table 3. The estimates explain that there is unidirectional causality that runs from world oil prices to inflation rate. The F-statistics and p-values clearly depict the rejection of null hypothesis. The results show that world oil prices significantly cause inflation in Pakistan. These results are consistent with the

study of Subhani *et al.* (2012). Theoretically, oil prices cause inflation because of direct effect that occurs by the transmission from oil prices to the prices of refined goods that are part of Consumer Price Index (CPI). Energy being a component of household's basket, the indirect effect of producer prices is reflected into the prices of final products including input prices which influence CPI in Pakistan. The results presented in Table 4 explain unidirectional causality which runs from inflation to exchange rate and from world oil prices to exchange rate in Pakistan.

VI. CONCLUSION

The empirical analysis of the relationship between oil prices and domestic inflation has received a lot attention of the researchers and policymakers. The results of most of the studies in developing and developed countries conducted in different time periods have revealed that oil prices exert adverse impact on the development process. Being an oil importing country, Pakistan has been spending a considerable amount of foreign exchange on oil imports which is a significant part of total imports and ratio of oil imports to total imports has been increasing over time. Furthermore, Pakistan has experienced double digit inflation during the last decade and the measures taken by the government to reduce the intensity of inflation failed to achieve the objectives. This brings up the need to have a fresh look into the impact of energy prices on domestic inflation in Pakistan economy using appropriate estimation technique.

The present study is an attempt to investigate the impact of global oil prices on domestic inflation in Pakistan using monthly data for the period January 2000 to December 2014. The standard Augmented Dickey-Fuller (ADF) unit root test has been applied to check the order of integration of selected variables. The results of ADF test provide justification of using ARDL approach for finding the long-run relationship between the variables under consideration. Granger causality test is applied to investigate the direction of causality between the variables. From the above analysis it can be concluded that in long-run international oil prices and exchange rate significantly affect inflation rate in Pakistan. The oil prices have positive relationship with inflation and Exchange rate has negative relationship with inflation rate in Pakistan. Furthermore, the findings of Granger causality test reveal that Oil Prices Granger cause inflation, Inflation Granger causes Exchange Rate, and Oil Prices Granger Cause Exchange Rate. Keeping in view the above empirical analysis it is suggested that government should formulate policies which help in establishing relative consistency in oil

prices and domestic prices and try to reduce the adverse effects of severe fluctuations of world oil prices on Pakistan economy. Furthermore, these policies should be helpful in reducing the impact of the pass-through of oil prices on domestic prices.

The major limitation of this study is that it includes only one control variable along with the inflation and oil prices. The inclusion of more control variables in the model may be helpful in obtaining the true picture of the analysis. The analysis based on the above suggested model may help the policymakers to formulate and implement policies which may reduce the intensity of oil shocks on the smooth functioning of the economy.

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ANNEXURE I

1. VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: D(INF)
Exogenous variables: C INF(–1) OILP(–1) ER(–1)
Date: 04/25/15 Time: 07:24
Sample: 2000M01 2014M11
Included observations: 159

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–186.0485	NA	0.639340	2.390547	2.467752*	2.421899
1	–186.0204	0.054434	0.647210	2.402772	2.499279	2.441962
2	–180.9854	9.689911	0.615191*	2.352018*	2.467826	2.399046*
3	–180.7071	0.532101	0.620814	2.361096	2.496205	2.415962
4	–180.6585	0.092425	0.628305	2.373062	2.527473	2.435767
5	–180.4084	0.471768	0.634283	2.382496	2.556208	2.453038
6	–180.4029	0.010360	0.642296	2.395005	2.588018	2.473386
7	–180.2983	0.194658	0.649607	2.406268	2.618583	2.492487
8	–179.7615	0.992578	0.653446	2.412095	2.643710	2.506151
9	–179.7215	0.073449	0.661437	2.424170	2.675087	2.526065
10	–179.3933	0.598664	0.667110	2.432620	2.702838	2.542353
11	–175.0847	7.804351*	0.639984	2.391002	2.680521	2.508573
12	–174.8582	0.407365	0.646319	2.400732	2.709552	2.526141
13	–174.4843	0.667795	0.651519	2.408608	2.736730	2.541855
14	–174.3760	0.192054	0.658969	2.419824	2.767247	2.560909
15	–173.1878	2.092413	0.657525	2.417457	2.784181	2.566380
16	–172.1254	1.857531	0.657135	2.416672	2.802698	2.573433
17	–171.7166	0.709708	0.662181	2.424108	2.829435	2.588707
18	–171.6356	0.139468	0.670037	2.435669	2.860297	2.608106

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

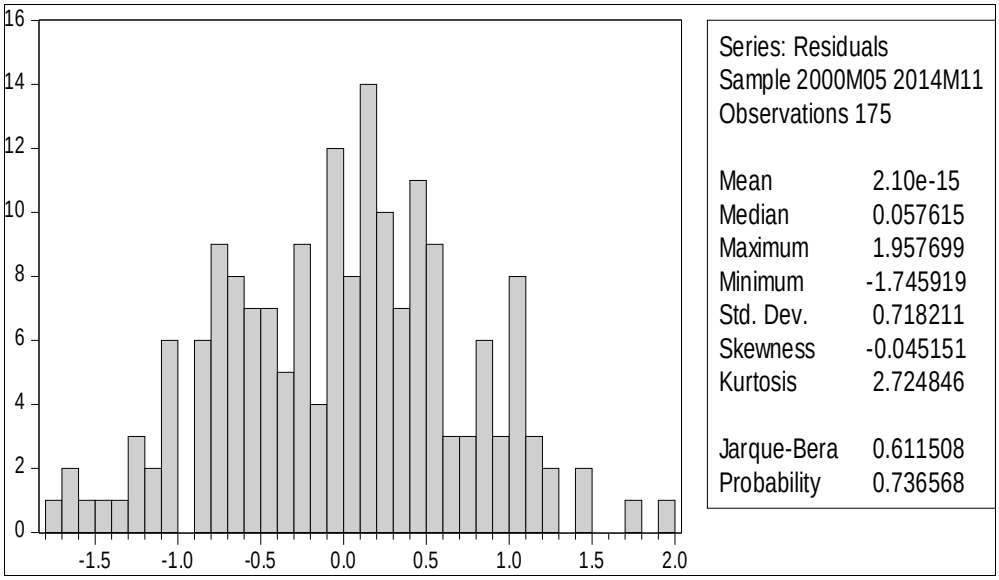
AIC: Akaike information criterion

SC: Schwarz information criterion

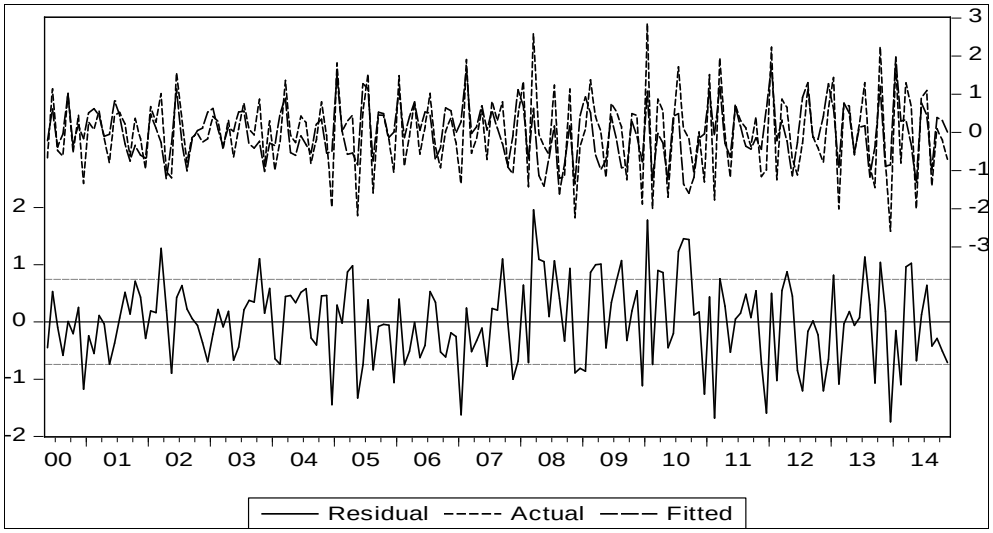
HQ: Hannan-Quinn information criterion

2. Test for Serial Correlation

Test for Normality



3. Residuals, Actual and Fitted



4. F-statistics Obtained for Bound Testing

Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	14.94350	(3, 163)	0.0000
Chi-square	44.83049	3	0.0000
Null Hypothesis: C (2) = 0, C (3) = 0, C (4) = 0 Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C (2)		–0.857786	0.133442
C (3)		1.611063	0.377838
C (4)		–1.161622	0.390104

Restrictions are linear in coefficients.

5. Pairwise Granger Causality Tests

Pairwise Granger Causality Tests Date: 04/25/15 Time: 07:43 Sample: 2000M01 2014M11 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
OILP does not Granger Cause INF	176	7.13082	0.0011
INF does not Granger Cause OILP		0.36723	0.6932
ER does not Granger Cause INF	176	0.64375	0.5266
INF does not Granger Cause ER		8.11265	0.0004
ER does not Granger Cause OILP	177	1.34574	0.2631
OILP does not Granger Cause ER		9.10812	0.0002

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MACROECONOMIC INSTABILITY AND ITS IMPACT ON GROSS DOMESTIC PRODUCT
An Empirical Analysis of Pakistan

AMJAD ALI AND HAFEEZ UR REHMAN*

Abstract. This study tries to answer the question, "has macroeconomic instability detrimental impact on gross domestic product of Pakistan over the period of 1980 to 2012?" For reviewing macroeconomic instability a comprehensive macroeconomic instability index is constructed by incorporating inflation rate, unemployment rate, trade deficit and budget deficit. Autoregressive Distributed Lag (ARDL) model has been used for examining the cointegration among the variables of the models and Vector Error-Correction model is used for short-run dynamics of the models. For investigating the causal relationship among the variables of the model Granger causality test has been applied. The empirical results of the study confirm the existence of cointegration between macroeconomic instability and gross domestic product in Pakistan. The results of the study show that macroeconomic instability has deep rooted and detrimental impact on gross domestic product of Pakistan. Hence, for achieving desired level of gross domestic product, Pakistan should make macroeconomic environment stable.

Keywords: Macroeconomic instability, Gross domestic product, Financial development, Secondary education, Foreign direct investment

JEL classification: E22, F63, G32, I21, P24

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I. INTRODUCTION

The basic challenge for economics is to understand the nature and causes of economic progress. Ricardo (1817) refers that the total goods and services produced in a country are the best scale to know economic progress. The economy is like a machine which transforms inputs to outputs and the amount of inputs determines the amount of outputs. After World War II, most of the countries adopted aggressive economic policies to improve the growth rate of real gross domestic product (Crafts, 2000). Exogenous technological progress and accumulation of factors of production are considered to be main determinants of economic growth. Solow (1956) explains that with physical inputs there are some nonphysical (skill, knowledge) factors which determine steady state economic growth. Nelson and Phelps (1966) suggest that size and capability of labour absorb new technology which is discovered elsewhere. But the last decade of 20^{th} century has changed the direction of research about economic growth when Lucas (1988), Romer (1990) and Grossman and Helpman (1991) developed endogenous growth theory.

The policymakers and economists are much interested in sustainable level of economic growth and are much worried in downward movement of economic growth. Barro (1991), Baker (1998) and Caballero (2007) mention that internal and external factors are responsible for instable economic progress. There are three main sources of instable gross domestic product in developing countries like Pakistan. First, big exogenous shocks which come from financial markets and terms of trade. Second, less developed nations experience domestic shocks due to intrinsic instability and self-inflicted policy faults (Kharroubi, 2006). Lucas (1988), Barro (1991) and Kraay and Ventura (2007) explain that the specialization of developing countries with traditional technologies and unskilled labour make the output of these countries more volatile. Raddatz (2007) finds that domestic shocks in developing nations are more forceful for creating macroeconomic instability as compared to external shocks. Third and the most important factor is that the underdeveloped nations have weak shock absorption capacity (De Ferranti and Ferreira, 2000).

The economy of Pakistan has been facing external and internal shocks throughout its history but the magnitude of these shocks has become severe after 9/11. The downward and unsustainable trend of economic progress in Pakistan has made the policymakers and economists worried. In Pakistan fiscal deficit, high inflation, political instability, lack of human and physical capital, increasing foreign debt, low exchange rate, natural disasters and

unfavourable law and order conditions for investments are responsible for instable economic progress. The main objective of this study is to find the impact of macroeconomic instability on GDP in Pakistan. This type of exercise is hardly done in case of Pakistan. So this study will be a healthy contribution in existing literature.

The organization of study is as follows: Section II presents review of literature. Theory and econometric methodology are presented in Section III. Empirical results and discussion are given in Section IV. The final section concludes the study.

II. LITERATURE REVIEW

Following the mid of the 20th century, the empirics of economic growth got especial attention by data collection agencies and policy makers. The main reason is that most of the researchers and policy makers have much concern to study the determinants of economic growth at national and international levels. The most studied determinants of economic growth in literature are factor productivity, financial development, domestic investment, foreign direct investment, savings, literacy rate and inflation rate. Some of the main and relevant studies are given below:

While discussing the determinants of economic growth, Mundell (1963) and Tobin (1965) mention that it is high inflation which increases the cost of holding capital. High inflation reduces investment and capital accumulation which further leads to low economic growth. Moreover, rising inflation work as helping hand for inflation tax and reduces incentive to work. Hence low incentives to work rise unemployment and process not only reduces national output but also lower economic growth rate. Goldsmith (1969), Shaw (1973) and McKinnon (1973) study the determinants of economic growth.

Fischer (1991) gives theoretical framework which elaborates how economic growth reacts to changing pattern of macroeconomic policies. The study concludes that for achieving sustainable economic growth for a longer period macroeconomic stability is necessary. Moreover, government is interested in social and physical infrastructure which decide the pattern of economic growth.

Dornbusch and Edwards (1990) and Onis (1997) conclude that the situation of macroeconomic instability is occurred in developing countries because of bad fiscal and monetary management followed by structural features like inequality of income distribution. The results of both studies show that there is negative relationship between macroeconomic instability and economic growth. The results of the cross-country study of Easterly and

Kraay (2000) show that macroeconomic stability and economic growth are positively related to each other. The results of the study support the findings of Dornbusch and Edwards (1990) and Onis (1997).

Shabbir and Mahmood (1992), Iqbal (1993; 1994), and Khilji and Mahmood (1997) investigate the determinants of economic growth in case of Pakistan. They find that real interest rate, foreign direct investment, trade openness, dependency ratios and terms of trade are responsible for ups and downs of economic growth in Pakistan.

Pagano (1993) mentions that positive and significant relationship exists between financial development and economic growth. The improved productivity of investment leads to less transaction costs on investment. Financial development increases the national savings and investment and ultimate desired economic growth is achieved. Cardoso (1993) investigates the impact of economic growth, terms of trade and real exchange rate on private investment in case of Latin American countries over the period of 1970 to 1985. The study finds that 74 percent private investment is explained by economic growth and there exists positive and significant relationship between them. The results show that rate of depreciation and exchange rate have no significant impact on private investment, whereas economic instability has negative and significant impact on private investment.

Iqbal (1994) examines the impact of structural adjustment programme lending on output growth in Pakistan. The results of the study show structural adjustment programme lending has negative and significant impact on output growth in Pakistan. Moreover, this structural adjustment programme lending disturbs output by worsening terms and trade of Pakistan. The study suggests that real domestic saving and favourable weather condition enhance real output in Pakistan. Iqbal and Zahid (1998) investigate the determinants of economic growth using three gap model for Pakistan. The results of the study show utilization capacity, real devaluation and foreign direct investment determine economic growth in Pakistan.

Ramey and Ramey (1994) find that macroeconomic instability exerts heavy burden on poor class of the economy and it has negative relationship with economic growth. The study uses inflation as the proxy for macroeconomic instability. The results of the study show that there is negative relationship between government spending volatility and economic growth. Mobarak (2005) concludes that the welfare of the poor class is closely related to macroeconomic instability, as the consumption of the poor is very sensitive to their income. The results of the study show that there is a negative relationship between macroeconomic volatility and economic

development in case of non-democratic Muslim countries. Ismihan (2003) highlights that macroeconomic instability creates fiscal slump in developing countries, because the government of developing country faces budget constraints. So in the presence of high budget deficit the government is unable to make specific amount of public spending on development which is necessary for social progress. The study concludes that there is a negative relationship between macroeconomic instability and economic development in case of Turkey.

Khor (2000) argues that foreign direct investment enhances economic growth by improving the quality of factor of production and transfer of improved technology from developed countries to developing countries. This increases exports and savings which further stimulates investment and employment for higher economic growth.

Dewan and Hussein (2001) investigate the determinants of economic growth and mention that total labour force, technological advancement, low inflation rate and trade openness are main determinants of economic growth. The study claims that technological advancement increases the efficiency in developing countries but it depends on the public policies followed in developing countries. Moreover, the developing countries have large but labour intensive agriculture sector so the advancement in technology does not have significant impact on economic growth in developing countries.

Ismihan (2003) investigates the impact of macroeconomic instability on different types of investment in case of Turkey over the period 1963 to 1999. The study finds that macroeconomic instability has negative impact on economic growth and capital formation in case of Turkey. The study concludes that long-run macroeconomic instability damages the relationship between private investment and public investment. Klein (2003) explores the relationship between per capita income and financial development using quadratic interaction. There is positive and significant relationship between financial development, trade openness and economic growth in case of middle-income countries but it is *vice versa* in case of poor and rich countries. In case of developing countries, capital absorption capacity is low so financial development exerts negative impact on economic growth.

Subramanian and Satyanath (2004) investigate the determinants of macroeconomic stability. They conclude that democracy and economic growth have positive and significant relationship with macroeconomic stability. The study finds that conflicts either internal or external have negative impact on macroeconomic stability.

Iqbal and Satar (2005) examine the impact of workers remittances on economic growth in Pakistan. The results of the study show that worker remittances, public investment and private investment have positive and significant impact on economic growth. But external debt, rate of inflation and worsening terms of trade have negative and significant relationship with economic growth. Nelson (2005) investigates that there is negative relationship between inflation and living standard. So in the environment of macroeconomic instability when the increase in prices of household goods decreases the supply of these goods which further decreases the welfare or standard of living of the household. Wolf (2005) confirms that macroeconomic instability has negative relationship with future consumption through low output growth. The relationship between environment and economic performance is controversial. For achieving macroeconomic stability developing countries cannot ignore the pollution problems and global warming which directly affect the living standard of the people.

Holmes and Silverstone (2006) empirically test the Okun's Law for US for post war period. The coefficients of Okun's law are based on dynamic model that investigate the asymmetry relationship between unemployment and economic growth in US. The study has two main conclusions, first the cyclical output has positive impact on unemployment and second the cyclical output has negative impact on unemployment.

Shahbaz (2009) examines the relationship between some macroeconomic variables and economic growth in case of Pakistan. The study uses credit to private sector as a proxy for financial development. The results of the study show that financial development enhances economic growth in Pakistan over the long-run. The study concludes that investments and exports have positive whereas imports and inflation have negative impact on economic growth in Pakistan. Ismihan (2009) explores the relationship of potential growth and macroeconomic instability in case of Turkey over the period of 1960 to 2006. The results show that during the episodes of macroeconomic instability Turkey faces a significant loss of real output. On the other hand, during those episodes when macroeconomic instability shows downward trend real output has shown upward trend. The study concludes that if Turkey wants to maintain high economic growth it should reduce macroeconomic instability.

Rodrik (2012) analyzes how Turkish economy reacts during and after the global financial crisis. The financial crisis of 2008-2009 brings episode of macroeconomic instability in Turkey. Rodrik mentions that it is the need of hour for policymakers to find out the root cause of domestic and

international shocks for Turkey. After financial crisis, domestic savings in Turkey have shown downward trend, on the other hand external deficit and unemployment have shown upward. So it is necessary for Turkey to control macroeconomic environment for sustainable economic growth. Piece (2012) mentions that economic growth is necessary as well as sufficient condition for generating employment; it also provides better opportunities to an economy to cope with other social and critical issues like clean drinking water and sanitation and other health services. The study concludes that immediate goal of macroeconomic policies is to achieve sustainable economic growth, and this immediate goal enables economies to achieve stability of intermediate variables like poverty reduction, income distribution which have very strong relationship with economic growth.

III. ECONOMIC THEORY AND ECONOMETRIC METHODOLOGY

The main objective of economic theory is to construct economic models that define the economic behaviour 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 decide the validity of an economic model. This study examines the impact of macroeconomic instability on social progress in Pakistan. Inflation rate, unemployment rate, trade deficit and budget deficit have been 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 all four models provides strong basis for construction of these models.

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 solution of macroeconomic instability becomes the center 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), Azam (1997), Azam (1999), Yiheyis (2000), Caballero (2007), Iqbal and Nawaz (2010) and Shahbaz (2013) have used inflation as a proxy for macroeconomic instability. Azam (2001) examines the determinants of macroeconomic instability. He suggests that an index of inflation and nominal exchange rate is used for measuring macroeconomic instability instead of relying on only inflation rate. 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. Iqbal and Nawaz (2010) have used misery index as macroeconomic instability in Pakistan that consists of inflation rate and unemployment rate. Ali (2015) uses inflation rate, unemployment rate, budget deficit and trade deficit for measuring macroeconomic instability in Pakistan.

The above discussion reveals that only a single variable or the combination of two or more variables is not enough for explaining the whole macroeconomic situation of an economy. Very first time Ismihan (2003) constructs macroeconomic instability index for Turkey, using four indicators (inflation rate, external debt to GNP ratio, public deficit to GNP, exchange rate). Sanchez-Robles (2006) also have constructed macroeconomic instability index for Spain using inflation, public deficit and various types of public expenditure as a share of the GDP and market distortions for the period of 1962-1995. But they do not mention the criteria for the selection of variables for macroeconomic instability index. For the better understanding of macroeconomic instability this study uses early warning system for the selection of macroeconomic variables. This study has strong theoretical and valid empirical reasons for the selection of variables as compared to Ismihan (2003) and Sanchez-Robles (2006).

In theoretical and empirical economics normally Probit or Logit Multi-variable models are used for the selection of the variables, because it has the best predicting power for the occurrence of the crisis in a time period. One of the main advantages of these models is that they give complete information about the probability of crisis occurrence. Secondly, these models consider the behaviour of all variables simultaneously and remove those variables which do not have enough explaining power in the model. Kaminsky *et al.* (1998) mention that these models have not provided specific mechanism for

ranking and valuating different types of variables, on which they measure the accuracies of actual and predicting crisis. These models can simply give the opinion that the selected variable is insignificant or significant and they can only determine the reliability rate of the variables in specific predictions. When the econometric process is conducted on data the reliability of a variable may not clear and one cannot distinguish either the calculated or estimated reliability that means the prediction of the major portion of the crisis with the considerable number of incorrect warnings or it means losing the major parts of the crisis as the results of producing the limited amount of incorrect warnings. These models cannot give enough interpretations for shortcomings and weak points of economic system.

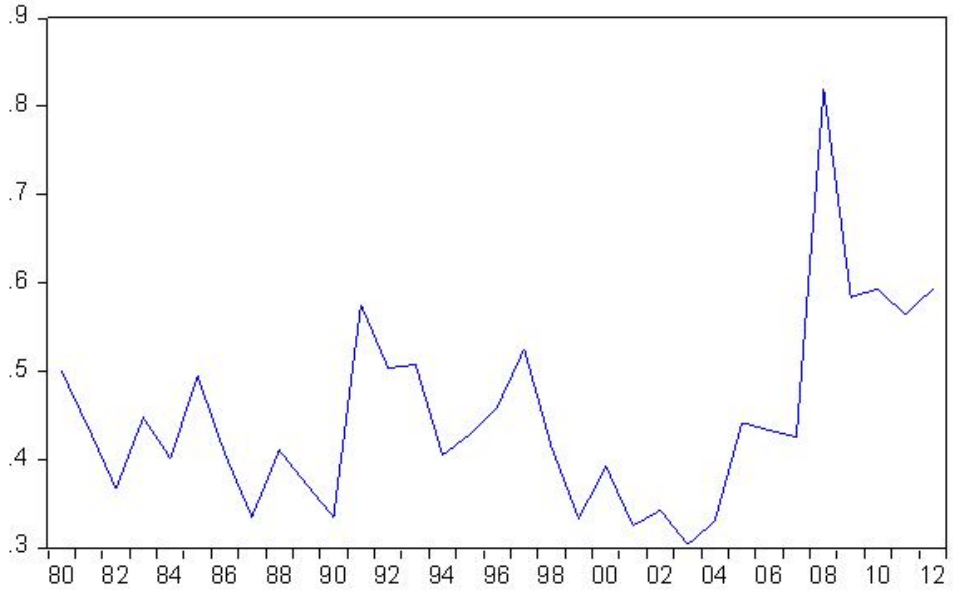
Kaminsky *et al.* (1998) present the most recent methodology for understanding the crisis prediction which is known as Warning Algorithm or the Early Warning System (EWS). This is the best method for evaluating the reliability of financial time series and regulating the business cycle and their turning points and give detailed guideline for the occurrence of crisis. Berg and Pattillo (1999), Berg and Rebecca (2004) and Berg *et al.* (2005) claim that EWS is a system which has behavioural control on economic variable over the time and the existence of the all variables passing through threshold limit is considered the occurrence of crisis over time period in future. On the basis of these arguments, this study will use EWS for determining the best predicting variables for the macroeconomic instability and for the construction of macroeconomic instability index in case of Pakistan. Warning variables are selected according to the theoretical and empirical literature. By following the methodology of Ali (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.

$$MII_t = \beta_1\left(\frac{Inf_t - \min Inf}{\max Inf - \min Inf}\right) + \beta_2\left(\frac{Un_t - \min Un}{\max Un_t - \min Un_t}\right) + \beta_3\left(\frac{TD_t - \min TD_t}{\max TD_t - \min TD_t}\right) + \beta_4\left(\frac{BD_t - \min BD_t}{\max BD_t - \min BD_t}\right) \quad (1)$$

The value of the index is in between zero and one, 1 means high macroeconomic instability and 0 means stability. The data for macroeconomic instability index variables is taken from various issues of *Pakistan Economic Survey* and World Bank databases *World Development Indicators*.

FIGURE 1

Macroeconomic Instability Index



Why does output of some countries grow faster than other? Most of theoretical and empirical literature of development economics revolves around this question. Kormendi and Meguire (1985) Grier and Tullock (1989), Barro (1991), Sala-i-Martin (1997), Fernández *et al.* (2001), Barro and Sala-i-Martin (2003), Hendry and Krolzig (2004) and Sala-i-Martin *et al.* (2004) have conducted time series and panel studies for investigating the determinants of economic growth. The main focus of above theoretical and empirical literature is to achieve sustainable level of economic growth.

For finding the impact of macroeconomic instability on economic growth the study uses the Cobb Douglas production function:

$$Y = f(KL) \tag{2}$$

This shows that output depends upon total capital and total labour. Ghura (1997) and Ramirez (1998) analyze that finance and labour are two main factors which are responsible for economic growth in case of Cameroon and Mexico. Following the methodology of Ghura (1997), Ramirez (1998) and Christopoulos and Tsionas (2004) the model of this study becomes as:

$$GPD_t = f(SSE_t, FIN_t, TLF_t, MII_t, FDI_t) \tag{3}$$

GPD = gross domestic product

SSE = secondary school enrollment

FIN = financial development

TLF = total labour force

MII = macroeconomic instability

FDI = foreign direct investment

t = time period

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

$$GPD_t = \alpha_0 SSE_t^{\alpha_1} FIN_t^{\alpha_2} TLF_t^{\alpha_3} MII_t^{\alpha_4} FDI_t^{\alpha_5} e^{t\alpha_6} \quad (4)$$

e = represent for the base of log

Following the log linear form of the function the model becomes as:

$$LGDP_t = \alpha_0 + \alpha_1 LSSE_t + \alpha_2 LFIN_t + \alpha_3 TLF_t + \alpha_4 MII_t + \alpha_5 LFDI_t + e_t \quad (5)$$

The main objective of this study is to analyze the impact of macroeconomic instability on GDP of Pakistan from 1980 to 2012. The data for all variables is taken from various issues of *Pakistan Economic Survey* and *World Development Indicators* databases maintained by World Bank.

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 existence or non-existence of unit root helps to check the authenticity of data generating process. Stationary and non-stationary data have some different features. The stationary time series data have temporary shocks which disappear over the time and series move back to their long-run means values. Whereas, shocks are permanent in non-stationary time series data. As a result, the variance and mean of a non-stationary time series depend upon time trend and series has: (*a*) no long-run mean to which the series returns, and (*b*) variance will depend on time and approach infinity as time goes to infinity. In case if the time series data has only negative or positive shocks, the time series data is non-stationary (for details *see*, Dickey and Fuller, 1979). In literature, several unit root tests are available for making data

stationary. For this purpose, the 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 (Illiott *et al.*, 1996).

AUGMENTED DICKEY-FULLER (ADF) TEST

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

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{1t} \tag{6}$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{2t} \tag{7}$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{3t} \tag{8}$$

X_t is a time series for testing unit roots, t is the time trend and e_t is error term having white noise properties. If $j = 0$, it represents the simple DF test. The lagged dependent variables in the ADF regression equation are included until the error term becomes white noise. For checking the serial correlation of error terms LM test is used. The null and alternative hypotheses of ADF unit roots are:

H_0: $\delta = 0$ non-stationary time series; so it has unit root problem.

H_a: $\delta < 0$ stationary time series.

Applying OLS and computing τ statistic of the estimated coefficient of X_{t-1} and comparing it with the Dickey Fuller (1979) critical τ values, if the calculated value of τ statistic is greater than the critical value then reject the H_0. In this case the time series data is stationary. On the other hand, if we fail to reject H_0, the series is non-stationary. In this way by applying this procedure on all variables, we can easily find their respective orders of integration.

PHILLIPS AND PERRON (PP) UNIT ROOT TEST

Null hypothesis of PP and ADF have same normalized bias statistics and asymptotic distributions. PP has two main advantages over ADF. First PP test has strong power to predict the heteroskedasticity and serial correlation in error term. Second, it is not needed to specify the lag length of test regression.

THE DF-GLS UNIT ROOT TEST

Elliott *et al.* (1996) propose modifying DF test statistic 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.

AUTOREGRESSIVE DISTRIBUTIVE LAG (ARDL) APPROACH TO COINTEGRATION

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. Moreover, the analysis based on these tests of cointegration do not provide information about the structural breaks of time series data and also have low power of prediction. With the passage of time structural changes have occurred in time series such as economic crises, new institutional arrangements and changes in policy regime. The problem with these traditional methods is that the testing of the null hypothesis of structural stability against the alternative of a one-time structural break only. If such structural changes are present in the data generating process, but not allowed for in the specification of an econometric model, results may be biased.

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.

$$\Delta \ln Y_t = \beta_1 + \beta_2 t + \beta_3 \ln Y_{t-1} + \beta_4 \ln X_{t-1} + \beta_5 \ln Z_{t-1} + ... + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{t-k} + ... + u_{it} \quad (9)$$

At first the study will find the direction of relationship among the variables in case of Pakistan by applying the bounds test using Wald test. This study uses different proxies for social progress as dependent variable and every model has different control variable with macroeconomic instability.

H_0: $\beta_3 = \beta_4 = \beta_5 = 0$ (no cointegration among the variables)

H_A: $\beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ (cointegration among variables)

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:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (10)$$

For observing the causality among the variables, the study uses Granger causality test. For conserving time, effort and space the study avoids presenting the book material.

IV. EMPIRICAL RESULTS AND DISCUSSION

For overviewing the temporal properties of data the descriptive statistics is presented in Table 1. The estimated results reveal that gross domestic product, financial development and macroeconomic instability are negatively skewed and secondary school enrollment, total labour force and foreign direct investment are positively skewed. The results show all variables have positive kurtosis. The estimated kurtosis and skewness are insignificant and different from zero so we reject null hypothesis of no normality. The values of Jarque-Bera show that all the variables of the model have zero mean and finite covariance, this confirms that selected data sets are normally distributed.

TABLE 1

Descriptive Statistics

	GDP	SSE	FIN	TLF	MII	FDI
Mean	12.687	4.167	8.631	3.617	0.449	19.903
Median	12.741	4.095	8.680	3.555	0.428	19.858
Maximum	13.360	4.553	9.198	4.083	0.819	22.444
Minimum	11.859	3.859	7.981	3.221	0.304	17.198
Std. Dev.	0.438	0.223	0.277	0.265	0.107	1.344
Skewness	–0.200	0.436	–0.221	0.265	1.280	0.074
Kurtosis	2.004	1.806	3.092	1.848	5.336	2.407
Jarque-Bera	1.585	3.004	0.282	2.209	1.838	0.513
Probability	0.452	0.222	0.868	0.331	0.398	0.773
Sum	418.680	137.534	284.855	119.365	14.819	656.813
Sum Sq. Dev.	6.162	1.592	2.460	2.251	0.370	57.870
Observations	33	33	33	33	33	33

Table 2 reports the correlation matrix of variables, the results reveal that gross domestic product has positive and significant correlation with secondary school enrollment, financial development, total labour force and foreign direct investment whereas it has positive but insignificant relationship with macroeconomic instability in case of Pakistan. Secondary school enrollment has positive and significant correlation with financial development, total labour force, macroeconomic instability and foreign direct investment. The results show financial development has positive and significant correlation with total labour force and foreign direct investment but it is insignificant in case of macroeconomic instability. Total labour force has positive and insignificant correlation with macroeconomic instability whereas it has positive and significant correlation with foreign direct investment. Macroeconomic instability has positive and significant correlation with foreign direct investment. The overall estimated results show that all the variables of the model have positive and significant correlation when gross domestic product is dependent variable. The results of the correlation matrix shows there is no problem of multicolinearity among the explanatory variables.

TABLE 2

Pairwise Correlation

GDP	1.000					
SSE	0.962 (9.63)***	1.000				
FIN	0.916 (8.74)***	0.500 (9.01)***	1.000			
TLF	0.981 (8.72)***	0.587 (5.34)***	0.586 (10.67)***	1.000		
MII	0.716 0.255	0.183 (1.03)*	0.109 0.613	0.153 0.867	1.000	
FDI	0.916 (8.73)***	0.472 (9.96)***	0.639 (6.11)***	0.685 (10.60)***	0.242 (1.38)*	1.000
	GDP	SSE	FIN	TLF	MII	FDI

NOTE: The asterisks ***, ** and * denote the significant at 1%, 5% and 10% levels, respectively.

ESTIMATED RESULTS OF UNIT ROOT TESTS

The results of unit root tests of gross domestic product model are reported in Table 3. The results of ADF and PP tests show gross domestic product is stationary at level but it is non-stationary at level in case of DF-GLS test. The results of ADF, PP and DF-GLS tests reveal that macroeconomic instability is stationary at level. The estimated results of ADF, PP and DF-GLS tests highlight that secondary school enrollment, financial development, total labour force and foreign direct investment are not stationary at level. At first difference gross domestic product, secondary school enrollment, financial development, total labour force, macroeconomic instability and foreign direct investment are stationary in case of ADF, PP and DF-GLS tests. Hence there is mixed order of integration which is suitable condition for applying ARDL cointegration approach.

LAG LENGTH SELECTION CRITERIA

By keeping in view the number of observations and variables the lag order selection criterions are reported in Table 4; maximum two lags are allowed

to Vector Auto-Regressive process. The results show that all criterions 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 the variables of this model.

TABLE 3

Unit Root Tests

Variables	ADF	PP	DF-GLS
GDP	–3.147**	–2.653*	0.344
SSE	0.302	0.556	1.216
FIN	–1.286	–1.322	0.343
TLF	0.991	2.223	0.830
MII	–2.953**	–3.033**	–2.862***
FDI	–1.462	–1.502	–0.945
At First Difference			
ΔGDP	–3.545***	–3.514***	–2.999***
ΔSSE	–6.710***	–6.710***	–6.785***
ΔFIN	–4.882***	–4.882***	–3.890***
ΔTLF	–6.372***	–6.405***	–6.402***
ΔMII	–7.902***	–8.348***	–7.547***
ΔFDI	–4.546***	–4.584***	–4.352***

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
GDP, SSE, FIN, TLF, MII, FDI
Time Period: 1980-2012

Lag	LogL	LR	FPE	AIC	SC	HQ
0	123.684	NA	2.03e-11	–7.592	–7.314	–7.502
1	319.261	302.829*	7.20e-16*	–17.887	–15.945*	–17.254*
2	356.913	43.724	8.59e-16	–17.994*	–14.386	–16.818

* 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

ESTIMATED ARDL BOUNDS TESTING APPROACH

For investigating the cointegration among gross domestic product, secondary school enrollment, financial development, total labour force, macroeconomic instability and foreign direct investment ARDL bounds testing approach is used. The results of ARDL bounds testing approach are presented in Table 5.

TABLE 5

ARDL Bounds Testing Approach
Dependent Variable: GDP
ARDL (1, 0, 1, 0, 0, 0)

Critical Value	F-Statistics 4.536		W-statistic 27.218	
	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 calculated F-statistic (4.536) is greater than the upper bound (4.518) value of Pesaran, Shin and Smith (2001) at 5 percent and the calculated W-statistic (27.218) is greater than the upper bound (27.108) value of Pesaran, Shin and Smith (2001) at 5 percent. So null hypothesis of no cointegration is rejected which confirms cointegration among the variables of the model. The calculated F-statistic and W-statistic have verified the existence of cointegration among the variables of model. Now long-run relationship among GDP, secondary school enrollment, financial development, total labour force, macroeconomic instability and foreign direct investment can be examined. The estimated long-run results are presented in Table 6.

TABLE 6

Estimated Long Run Coefficients using the ARDL Approach
ARDL (1, 0, 1, 0, 0, 0)
Dependent Variable: GDP
Time Period 1981-2012

Regressor	Coefficients	Standard-Error	T-Ratio (Prob)
SSE	0.775	0.316	2.450 [0.022]
FIN	0.348	0.081	4.330 [0.000]
TLF	0.157	0.312	0.504 [0.618]
MII	–0.080	0.043	–1.846 [0.077]
FDI	0.089	0.014	6.221 [0.000]
C	4.409	0.613	7.189 [0.000]

The coefficient of secondary school enrollment shows there is positive and significant relationship between secondary school enrollment and GDP. The results show 1 percent increase in secondary school enrollment creates (0.772) percent increase in GDP in Pakistan and this relationship is significant at 5 percent. There is positive and significant relationship between financial development and GDP. The estimated results show 1 percent increase in financial development brings (0.348) percent increase in GDP and this relationship has 1 percent level of significance level. Total labour force has positive and insignificant relationship with GDP in case of

Pakistan. The estimated results show that there is negative and significant relationship between macroeconomic instability and GDP in case of Pakistan. The results reveal that 1 percent increase in macroeconomic instability brings (–0.080) percent decrease in GDP and this relationship is significant at 10 percent. The coefficient of foreign direct investment shows that there is positive and significant relationship between foreign direct investment and GDP in Pakistan. The estimated results show that 1 percent increase in foreign direct investment brings 0.089 percent increase in GDP at 1 percent level of significance. The overall long-run results show that secondary school enrollment, financial development and foreign direct investment have positive and significant impact on GDP. Whereas macroeconomic instability has negative and significant impact on GDP in Pakistan. So we reject the null hypothesis that macroeconomic instability does not have impact on GDP in Pakistan. This shows that for increasing GDP the government should reduce the macroeconomic instability and increase secondary school enrollment, financial development and foreign direct investment in Pakistan.

ESTIMATED SHORT RUN DYNAMICS

The short-run dynamics are presented in Table 7, the study uses Vector Error-Correction Model (VECM) for investigating the short-run dynamic among GDP, secondary school enrollment, financial development, total labour force, macroeconomic instability and foreign direct investment in case of Pakistan. The estimates show that secondary school enrollment has positive and significant impact on GDP in Pakistan. The results show that in short-run there is negative and insignificant relationship between financial development and GDP and this relationship is opposite to long-run results. The estimates show that there is positive but insignificant relationship between total labour force and GDP in Pakistan. The estimated results show that there is negative and significant relationship between macroeconomic instability and GDP in Pakistan. There is positive and significant relationship between foreign direct investment and GDP in Pakistan. The short-run dynamics show that secondary school enrollment and foreign direct investment are more fruitful for increasing GDP in Pakistan whereas by reducing macroeconomic instability the government can also achieve targeted GDP in Pakistan. The negative and significant coefficient (–0.252) of 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 three years and nine month to converge in the long-run equilibrium. Moreover, short-run deviations in the last period are corrected by 25.286 percent in future in case of Pakistan.

TABLE 7

Error Correction Representation
ARDL (1, 0, 1, 0, 0, 0)
Dependent Variable: dGDP
Time Period 1981-2012

Regressor	Coefficients	Standard-Error	T-Ratio (Prob)
dSSE	0.196	0.064	3.058 [0.005]
dFIN	–0.039	0.036	–1.071 [0.294]
dTLF	0.039	0.083	0.475 [0.639]
dMII	–0.020	0.011	–1.762 [0.090]
dFDI	0.022	0.006	3.754 [0.001]
ECM(–1)	–0.252	0.055	–4.586 [0.000]
R-Squared	0.727	R-Bar-Squared	0.647
S.E. of Regression	0.011	F-Stat. F (6, 25)	10.671 [0.000]
Mean of Dependent Variable	0.046	S.D. of Dependent Variable	0.019
Residual Sum of Squares	0.003	Equation Log-likelihood	102.68
Akaike Info. Criterion	94.683	Schwarz Bayesian Criterion	88.82
DW-statistic	2.193		

DIAGNOSTIC TESTS

The estimated results of diagnostic tests are shown in Table 8. The estimated 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 shows 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 problem of heteroscedasticity.

TABLE 8

Diagnostic Tests

Test Statistics	LM-Version	F-Version
A-Serial Correlation CHSQ(1)	0.502 [0.478]*F(1,23)*	0.366 [0.551]*
B-Functional Form CHSQ(1)	1.352 [0.245]*F(1,23)*	1.015 [0.324]*
C-Normality CHSQ(2)	1.333 [0.513]*	Not-applicable
D-Heteroscedasticity CHSQ(1)	0.329 [0.566]*F(1,30)*	0.311 [0.581]*

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

MODEL SPECIFICATION

The stability of model provides information regarding the estimated model of Gross Domestic Product has been shifted or not over time. The results of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUMSQ) tests are reported in Figures 2 and 3. These figures show that Cumulative Sum (CUSUM) and Cumulative Sum of the Squares (CUSUMSQ) lie between the two critical lines which indicates that the estimated model is stable.

FIGURE 2

Plot of Cumulative Sum of Recursive Residuals

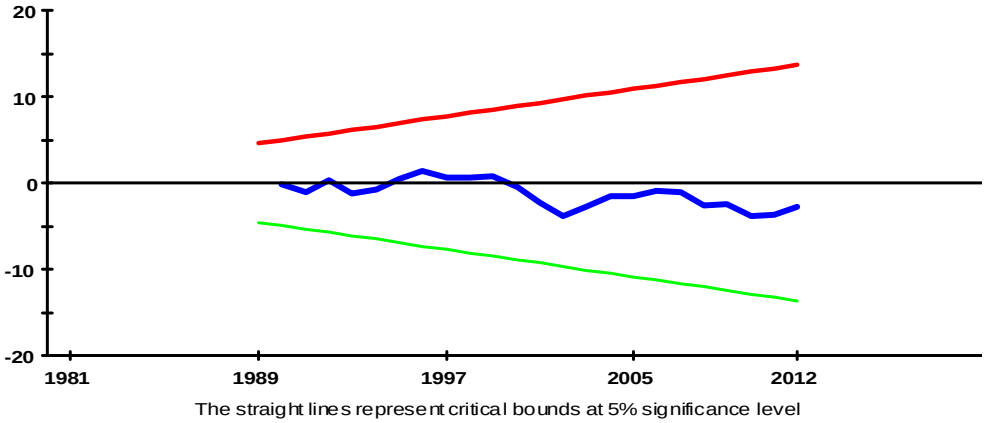
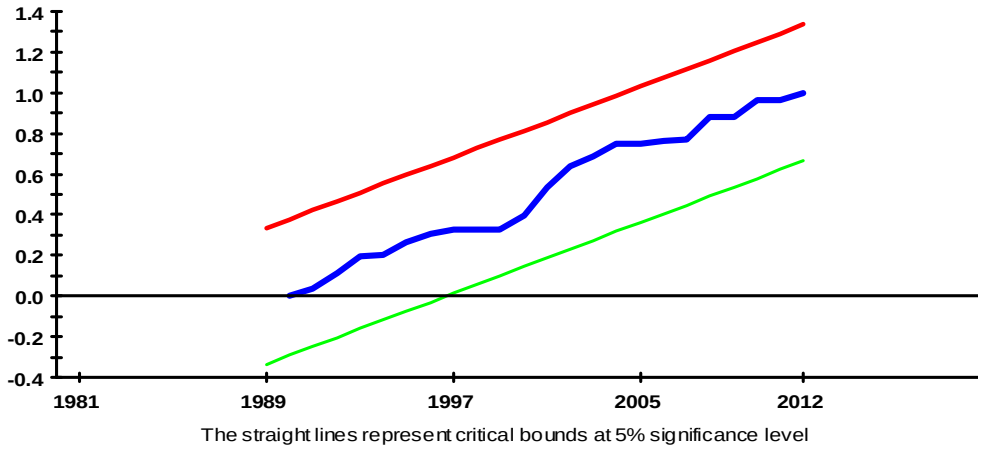


FIGURE 3

Plot of Cumulative Sum of Squares of Recursive Residuals



ESTIMATED GRANGER CAUSALITY TEST

Granger causality test results are presented in the Table 9. The estimated results reveal secondary school education does cause GDP but GDP does not cause secondary school education in Pakistan. This shows unidirectional causality running from secondary school education to GDP in Pakistan. The results show unidirectional causality also runs from GDP to financial development in Pakistan. The results show total labour force does cause GDP but GDP does not cause total labour force in Pakistan. So there is unidirectional causal relationship between total labour force and GDP in Pakistan. The estimated results reveal that macroeconomic instability does cause GDP but GDP does not cause macroeconomic instability in Pakistan. This shows unidirectional causality running from macroeconomic instability to GDP in Pakistan.

The results show that there is bidirectional causal relationship between foreign direct investment and GDP in case of Pakistan. The results show secondary school education has no causal relationship with financial development, macroeconomic instability and foreign direct investment in Pakistan. But unidirectional causality running from total labour force to secondary school education in Pakistan is observed. The estimated results reveal that foreign direct investment does cause financial development but financial development does not cause foreign direct investment in Pakistan. The results reveal that unidirectional causality running from macroeconomic instability to foreign direct investment in Pakistan is observed. The results of Granger causality test suggest that for increasing GDP, the government of

Pakistan should reduce macroeconomic instability and at the same time level of secondary education, financial development, quality of total labour force and foreign direct investment should be increased.

TABLE 9

Pairwise Granger Causality Tests
Sample: 1980 - 2012

Null Hypothesis	F-Statistic	Prob.
SSE does not Granger Cause GDP	1.880	0.015
GDP does not Granger Cause SSE	0.327	0.889
FIN does not Granger Cause GDP	0.693	0.635
GDP does not Granger Cause FIN	2.870	0.046
TLF does not Granger Cause GDP	1.921	0.066
GDP does not Granger Cause LTLF	1.040	0.426
MII does not Granger Cause GDP	1.948	0.021
GDP does not Granger Cause MII	1.449	0.257
FDI does not Granger Cause GDP	2.951	0.042
GDP does not Granger Cause FDI	2.566	0.066
FIN does not Granger Cause SSE	0.657	0.660
SSE does not Granger Cause FIN	1.493	0.243
TLF does not Granger Cause SSE	2.811	0.049
SSE does not Granger Cause TLF	0.822	0.550
MII does not Granger Cause SSE	1.879	0.150
SSE does not Granger Cause MII	0.341	0.880
FDI does not Granger Cause SSE	0.557	0.730
SSE does not Granger Cause FDI	1.347	0.292
TLF does not Granger Cause FIN	1.450	0.257
FIN does not Granger Cause TLF	1.557	0.225
MII does not Granger Cause FIN	0.558	0.730
FIN does not Granger Cause MII	0.347	0.876
FDI does not Granger Cause FIN	3.161	0.033
FIN does not Granger Cause FDI	1.409	0.270
MII does not Granger Cause TLF	1.485	0.246
TLF does not Granger Cause MII	0.346	0.877

Null Hypothesis	F-Statistic	Prob.
FDI does not Granger Cause TLF	1.390	0.277
TLF does not Granger Cause FDI	1.551	0.226
FDI does not Granger Cause MII	1.385	0.278
MII does not Granger Cause FDI	3.806	0.017

V. CONCLUSIONS

The results of the ARDL bound testing approach show that there is cointegration among the variables of the model. The long-run results show that secondary school education has positive and significant relationship with GDP in Pakistan. The long-run estimates show that there is positive and significant relationship between financial development and GDP in Pakistan. The total labour force has positive and insignificant impact on GDP in Pakistan. But macroeconomic instability has negative and significant long-run relationship with GDP in Pakistan. The estimated long-run results show foreign direct investment has positive and significant impact on GDP in Pakistan. The short-run dynamic shows that secondary school education and foreign direct investment have positive and significant relationship with GDP in Pakistan. Financial development has negative and total labour force has positive but insignificant short-run relationship with GDP in Pakistan.

The short-run coefficients reveal that macroeconomic instability has negative and significant impact on GDP in case of Pakistan. 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 four year to converge in the long-run equilibrium. The diagnostic tests results reveal that there is no serial correlation, heteroscedasticity and model has correct functional form with normally distributed data. The results of the Granger causality test show all the independent variables have causal relationship with GDP in Pakistan. This confirms that for getting a targeted GDP, Pakistan should make macroeconomic environment stable with suitable financial development and education level.

The study concludes that the government has to play its role in raising the pace of economic growth in Pakistan. For this purpose, appropriate policies need to be formulated and implemented for making the economic environment conducive to economic growth. These policies may also help in bringing macroeconomic stability. It helps in reaping the full fruit of economic development in the country.

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AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN TRADE LIBERALIZATION AND TAX REVENUE IN PAKISTAN

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Abstract. This study examines the empirical relationship between trade liberalization and tax revenue in Pakistan for the period 1982-2013. Estimation results based on ARDL model show that there exists positive relationship between trade liberalization and total tax revenue in Pakistan over the study period. The coefficient of lagged error term (ECM_{t-1}) in short-run model is negative and significant suggesting speed of convergence to equilibrium. The coefficient (–0.3119) implies that deviation from the long-term equilibrium is corrected by 31.19% over one year. Sound and stable trade policy along with favourable environment are needed that promotes import of raw material, capital and intermediate goods which enhances trade in the country leading to enhancement of tax collection in Pakistan.

Keywords: Trade liberalization, Tax revenue, ARDL, ECM

JEL classification: C22, F13, H20

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I. INTRODUCTION

Trade liberalization has become an important development policy initiative in many developing countries since the 1980s. Under Structural Adjustment Programs (SAPs) suggested by the World Bank and the IMF countries have been shifting from destructive protective policies to free trade. Trade liberalization is defined as "the total or part elimination of trade barriers such as quotas, import duties, tariffs and non-tariff barriers imposed by governments on imported and exported goods" (Marchant and Snell, 1997).

During 1980s Pakistan's economy moved towards trade liberalization, deregulation and privatization. In 1995, Pakistan became member of the World Trade Organization (WTO) as a result of the Uruguay Round (UR) of trade negotiations to extract gains from implementation of multilateral trade liberalization. Trade liberalization leads to growth, competition, efficiency, productivity and, hence, development in developing and developed countries (Newman, Rand and Tarp, 2013; Manni and Afzal, 2012; Topalova and Khandelwal, 2011; Geng, 2008; Utkulu and Ozdemir, 2004; Dornbusch, 1992).

Recently, the subject of trade liberalization and tax revenue has become an important issue both theoretically and empirically. Theoretically, trade liberalization is expected to increase total tax revenue by increasing the share of trade tax revenue through imposing custom and excise duties on both imports and exports (Keen and Ligthart, 2002). In contrast, others argue that under trade liberalization reforms the reduction of trade restriction leads to reduction in trade tax receipts to federal government and thus less proportionate increase in total tax collection (Pritchett and Sethi, 1994).

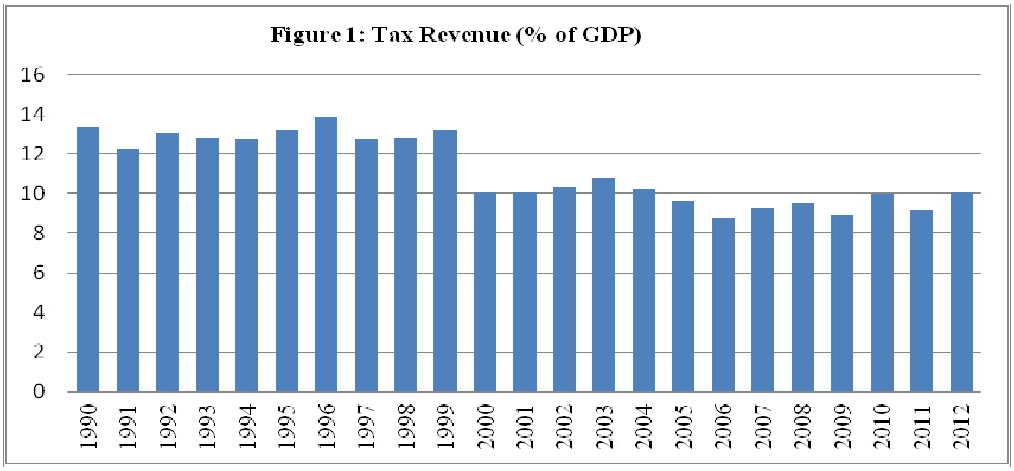
The impact of trade liberalization is an empirical question because when trade liberalization reduces import duties and other trade restrictions then there will be revenue loss but if volume of trade increases then tax revenue can increase (Tanzi, 1989; Glenday, 2002; Greenaway, Morgan and Wright, 2002; Suliman, 2005).

In case of Pakistan, there are a number of factors that influence tax revenue such as exchange rate, openness, per capita income, urbanization, population, inflation, external debt, foreign aid, effective rate of trade taxation, political stability and broad money (Mahmood and Chaudhary, 2013; Chaudhry and Munir, 2010). Studies regarding determinants of tax revenue in Pakistan show that there is lack of such studies which look at the impact of external factors consistent with trade liberalization period.

According to *Pakistan Economic Survey* (2013-14), tax to GDP ratio in Pakistan is below 10% even worse than its neighboring countries. The main issues related to tax revenue are the structural problems and low tax base. The historical trend of tax revenue from 1990 to 2012 has been shown in Figure 1.

FIGURE 1

Tax Revenue (% of GDP)



Data Source: *World Development Indicators* (WDI), World Bank.

II. LITERATURE REVIEW

Basirat *et al.* (2014) examined the empirical relationship of economic determinants and aggregate tax revenue in Iran by using annual time series data. Findings show that exchange rate, imports, value added by agriculture and industry sector have significant effect on tax collection during 1974-2011 (Basirat *et al.*, 2014).

Velaj and Prendi (2014) provide the evidence on factors that determine taxes in Albania during 1993-2013. Findings show that inflation, GDP and imports increase tax revenue. Coefficient of GDP indicates that with 1% increase in GDP the taxes grow by 0.62% while unemployment has negative effect on tax revenue. Karagöz (2013) discussed the determinants of tax revenue in Turkey using the time series data for the period 1970-2010. Results show that variables that significantly affect tax revenue include agricultural and industrial sector share, monetization, foreign debt and urbanization. Agriculture share has negative effect while trade openness found to be as insignificant variable among all variables.

Cagé and Gadenne (2012) analyzed the fiscal cost of trade liberalization using a panel data set of 103 developing countries for the period 1945-2006. Trade liberalization leads to lower tax revenue. Revenue can be increased from trade openness by investing in tax capacity because countries which are trapped in high tax capacity have experienced positive effect of trade openness on tax revenue.

Ghani (2011) focused on both conventional and non-conventional determinants of tax to GDP ratio by using the panel data set of 104 countries. Conventional factors such as foreign aid, agriculture value added, GDP per capita, urbanization and trade openness are found as important determinants of tax ratio. Moreover, governance factors, *i.e.* rule of law and control of corruption are found as important significant determinants of tax ratio during 1996-2005. The study has also constructed tax effort index of Pakistan which has indicated that there is downward trend in tax to GDP ratio.

Mahmood and Chaudhary (2013) analyzed the effect of FDI on tax revenue in Pakistan by using time series data over the period of 1972 to 2010. Findings show that FDI and GDP per person have positive effect on tax revenue. Error correction coefficient –0.017 indicate 17% adjustment speed in dependent variables toward long-run equilibrium.

Mushtaq *et al.* (2012) have empirically investigated determinants of trade and aggregate tax revenue in Pakistan for the period 1975 to 2010. To estimate the determinant of total taxes different influencing factors were included in econometric model. Ratio of total trade to trade taxes was used as a proxy variable for trade openness. Empirical findings based on Ordinary Least Square (OLS) method show that GDP, population growth, trade openness and urbanization significantly affect total taxes. Exchange rate, GDP, population and urbanization are significant determinants of trade taxes.

Chaudhry and Munir (2010) investigated the factors responsible for low tax revenue in Pakistan by using time series data over the period of 1973-2009. Results show that social, external and economic policies affect tax to GDP ratio. External debt, exchange rate, trade openness, foreign aid, broad money and political stability are most important determinant of tax effort in Pakistan. Remittances, inflation, agriculture, industry and services share have insignificant effect on tax revenue.

III. METHODOLOGY AND RESULTS

In the light of empirical literature this study has examined the impact of trade liberalization on total tax revenue along with some control factors. All the

variables are transformed in log form. Following Immurana *et al.* (2013) and Karagöz (2013) log-log model has been estimates to test the hypothesis that trade liberalization affects total tax revenue collection in Pakistan or not.

$$LTTR = \alpha + \beta_1 (LOPEN) + \beta_2 (LAGR) + \beta_3 (LPCI) + \beta_4 (LGC) + \mu \quad (1)$$

Where,

LTTR is natural logarithm of total tax revenue,

LOPEN is natural logarithm of trade openness measured as share of trade in GDP,

LAGR is natural logarithm of share of agriculture in GDP,

LPCI is natural logarithm of per capita income, and

LGC is natural logarithm of government consumption.

For the empirical relationship between trade liberalization and tax revenue this study has used annual time series data for the period 1982-2013. Data was collected form Federal Board of Revenue (FBR) annual reports, World Development Indicators (WDI) and from Economic Survey of Pakistan.

In Tables 1 and 2 stationarity tests based on Augmented Dickey Fuller (ADF) and Phillips Perron are applied on all variables to check order of integration.

TABLE 1

Stationary Test Based on ADF

Variable	At Level		At First Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
	Test Statistics		Test Statistics	
LTTR	0.37 (0) (0.9785)	–1.84 (0) (0.6606)	–4.61 (0)*** (0.0009)	–4.56 (0)*** (0.0053)
LOPEN	–2.68 (0)* (0.0879)	–3.16 (0) (0.1107)	–7.90 (0)*** (0.0000)	–7.80 (0)*** (0.0000)
LAGR	–2.76 (0)** (0.0547)	–2.13 (0) (0.5069)	–5.45 (0)*** (0.0001)	–5.79 (0)*** (0.0003)
LPCI	1.40 (0) (0.9986)	–1.79 (0) (0.6815)	–5.13 (0)*** (0.0002)	–5.45 (0)*** (0.0006)
LGC	0.23 (0) (0.9706)	–1.05 (0) (0.9211)	–4.81 (0)*** (0.0005)	–4.79 (0)*** (0.0030)

TABLE 2

Stationary Test Based on Phillips Perron (PP)

LTTR	0.37 (0.9785)	–2.06 (0.5462)	–4.57*** (0.0010)	–4.51*** (0.0060)
LOPEN	–2.77* (0.0730)	–3.15 (0.1111)	–7.93*** (0.0000)	–7.83*** (0.0000)
LAGR	–2.74* (0.0775)	–2.25 (0.4439)	–5.45*** (0.0001)	–5.78*** (0.0003)
LPCI	1.40 (0.9989)	–1.81 (0.6729)	–5.13*** (0.0002)	–5.49*** (0.0005)
LGC	0.12 (0.9623)	–1.35 (0.8546)	–4.82*** (0.0005)	–4.81*** (0.0029)

NOTE: Asterisks ***, **, * show that probability is less than 0.01, 0.05 and 0.10 respectively.

Both tests are applied at level and first difference. Both tests indicate that order of integration is mix of I(0) and I(1). In this situation traditional techniques such as Engel Granger and Johansen Cointegration are not applicable which require the same order of integration. Pesaran *et al.* (2001) developed an approach for testing the existence of level relationship between dependent and independent variables when variables have mix order of integration, *i.e.* I(1) and I(0) data. However, there are some prerequisites of this methodology such as dependent variable must be I(1) and none of variable is I(2). Thus, suitable technique is Bound Testing Procedure or Autoregressive Distributed Lag (ARDL) approach to cointegration because the key assumptions of ARDL model are fulfilled here.

TABLE 3

VAR Lag Order Selection Criteria for Model

Lag	AIC	HQ
0	–5.652576	–5.578745
1	–14.10556	–13.66258
2	–15.05786	–14.24572
3	–16.45635*	–15.27505*

*Indicates lag order selected by Akaik information criterion (AIC) and Hannan-Quinn (HQ) criterion

In the first step, Vector Autoregressive (VAR) is applied to determine the appropriate lag structure of the model. Maximum lags are determined by various information criteria such as Akaik Information Criterion (AIC) Schwarz Criterion (SC) and Hannan Quinn (HQ) in Table 3. Here the value of both AIC and HQ at 3 lags is smaller than other lags so three lags are selected based on both criteria.

$$\Delta LTTR = \gamma_0 + \gamma_{1i}\sum_{i=1}^{3}\Delta LTTR_{t-i} + \gamma_{2i}\sum_{i=0}^{3}\Delta LOPEN_{t-i} + \gamma_{3i}\sum_{i=0}^{3}\Delta LPCI_{t-i} + \gamma_{4i}\sum_{i=0}^{3}\Delta LAGR_{t-i} + \gamma_{5i}\sum_{i=0}^{3}\Delta LGC_{t-i} + \gamma_6 LTTR_{t-1} + \gamma_7 LOPEN_{t-1} + \gamma_8 LPCI_{t-1} + \gamma_9 LAGR_{t-1} + \gamma_{10} LGC_{t-1} + \varepsilon_t \quad (2)$$

Null Hypothesis:

$H_0 = \gamma_6 = \gamma_7 = \gamma_8 = \gamma_9 = \gamma_{10} = 0$ (No cointegration)

$H_1 = \gamma_7 \neq \gamma_8 \neq \gamma_9 \neq \gamma_9 \neq \gamma_{10} = 0$ (Existence of long-run relationship)

TABLE 4

ARDL Bounds Testing Analysis

Model Estimated (LTTR)		
F-Statistic Selected Lag Length (Criteria)	6.7129*** 03 (AIC)	
	Critical values from Pesaran *et al.* (2001) Table CV (v)	
Critical Bound values	Lower	Upper
1%	5.17	6.36
5%	4.01	5.07
10%	3.47	4.45

NOTE: Asterisk *** denotes the significance at 1% level.

After the determination of appropriate lag structure through VAR model the Wald coefficient test (F-test) is applied. If the calculated F-statistic falls above the upper value bound provided by Pesaran *et al.* (2001) the null

hypothesis of no cointegration is rejected. If F-calculated is less than the lower value bound then null hypothesis of no long-run relationship is accepted but if F-calculated falls between the upper and lower critical value bounds then results are inconclusive. The calculated F-statistic for model (*LTTR*) is 6.7129 which is greater than upper critical value bound at 1 percent level of significance thus showing the existence of strong cointegration between *LTTR* and all other independent variables.

The results of the long-run coefficients of model are given in Table 5.

TABLE 5

Long-Run Analysis

Variable	Dependent Variable: *LTTR*		
	Coefficient	t-statistic	Prob
Constant	–1.16	–1.05	0.3038
LOPEN	0.43**	2.08	0.049
LAGR	–0.4379**	–2.03	0.0536
LPCI	0.1794	1.15	0.2607
LGC	0.0789	0.7101	0.4845
LTTR(–2)	0.9053***	25.92	0.0000
R^2	0.9978		
ADJ R^2	0.9973		
F-statistic	2179.04		
Prob. (F-statistic)	0.0000		
S.E. of Regression	0.0573		
J-B Test (prob.)	2.2455 (0.3254)		
ARCH Test (prob.)	0.3046 (0.5810)		

NOTE: Asterisks ** denotes the significance at 5% level.

Results of estimated long-run model show that openness has significant and positive effect on tax revenue. A 1% increase in trade liberalization (proxied by trade openness as a % of GDP) leads to 0.43 percent increase in tax revenue. Thus, it answers the question of this study that trade

liberalization exerts significant and positive effect on total tax revenue in Pakistan. Possible explanation of the positive relationship between trade liberalization and tax revenue in Pakistan is that trade takes place at specified entry and exit point with less chance of tax evasion. Another explanation is that the impact of trade openness on tax revenue depends on elasticity of imports. If imports are inelastic the demand will not affect to increase in price due to high import duty rates or due to other import restrictions and tax collection will rise. This finding is consistent with earlier findings of other studies (Dawoodi and Grigorian, 2007; Gupta, 2007; Dioda, 2012; Nwosa *et al.*, 2012).

Agriculture sector share in total GDP has negative effect on total tax revenue in Pakistan during the period of study. Its coefficient is significant at 10% level with the value of –0.43 which show that 1% increase in agriculture share leads to 0.43 percent reduction in total tax revenue. Implication of this evidence is that in Pakistan taxes are not levied on agriculture sector production. It is difficult to levy tax due to its informal and subsistence nature of economy. Agriculture sector share in GDP is 20% and in employment is 45% but its contribution in tax revenue is not more than 2.5% this exemption from tax is adversely affecting the economy[1]. Previous studies have also pointed out that agriculture share negatively affect tax revenue (Immurana *et al.*, 2013; Karagöz, 2013: Basirat *et al.*, 2014).

Per capita income has insignificant effect on tax revenue in long-run in Pakistan. These findings are not consistent with earlier evidence. In practice Pakistan's income taxation policy is regressive where the income and average tax rate have inverse relationship as income increases the tax rate on taxable amount decrease.[2]

Short-Run Analysis

ECM results of the following estimated model are given below:

$$\Delta LTTR = \gamma_0 + \gamma_{1i}\sum_{i=1}^{3}\Delta LTTR_{t-i} + \gamma_{2i}\sum_{i=0}^{3}\Delta LOPEN_{t-i} + \gamma_{3i}\sum_{i=0}^{3}\Delta LPCI_{t-i} + \gamma_{4i}\sum_{i=0}^{3}\Delta LAGR_{t-i} + \gamma_{5i}\sum_{i=0}^{3}\Delta LGC_{t-i} + \gamma_6 ECM_{t-1} + \varepsilon_t \quad (3)$$

[1]A Report on Tax Reforms in Pakistan, March 2015.

[2]Budget 2014-15: Another Ritualistic Exercise!

TABLE 6

Short-Run Analysis

Variable	Dependent Variable: Δ*LTTR*		
	Coefficient	t-statistic	Prob
Constant	0.1116	10.352	0.0000
Δ*LOPEN*	0.3560***	3.0171	0.0068
Δ*LAGR*	0.2863	1.2996	0.2085
Δ*LAGR*(–1)	0.5752	2.8548	0.0098
Δ*LPCI*	0.2036	1.3722	0.1852
Δ*LPCI*(–1)	0.3324	2.2172	0.0384
Δ*LGC*	0.0169	0.1984	0.8447
Δ*LGC*(–1)	–0.0793	–0.9222	0.3674
ECM(–1)	–0.3119*	–1.7984	0.0872
R^2	0.6986		
ADJ R^2	0.5787		
F-statistic	5.7951		
Prob. (F-statistic)	0.00067		
S.E. of Regression	0.0391		

***, * denote the significance at 1% and 10% level of significance.

The stationary test of ADF is tested against the null hypothesis for ECM. The ADF of ECM is –4.93 with probability of 0.0005 which reject the null of unit root and confirm that ECM is stationary at 1% significance level. The coefficient of –0.3119 indicates a high rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 31.19% over one year.

The coefficient of openness variable is positive and significant at 1% significance level. The sign of coefficient is same in both long-run and short-run. In the short-run 1% increase in trade liberalization measured by trade as a percent of GDP (OPEN) leads to 0.35 percent increase in total tax revenue.

To check the validity, accuracy and dynamics of model certain diagnostic tests are applied. There are three major types of diagnostic tests: coefficient tests, residual tests and stability tests.

J-B test statistic (0.358) has probability (0.835) greater than 0.05, so residuals are normally distributed. Serial correlation LM test is applied to check autocorrelation, probability of LM test is (0.2137) which is greater than 0.05 indicating no serial correlation. The Autoregressive conditional heteroskedasticity test is used to check the presence of heteroskedasticty. The probability of ARCH test is (0.6120) greater than 0.05, accepting the null hypothesis of non-existence of heteroskedasticity. The Ramsey RESET test is used to check the specification of the model that whether it is correctly specified. The results of Ramsey RESET F-stat (0.1129) and prob (0.7405) show that model is correctly specified.

IV. CONCLUSION AND POLICY IMPLICATIONS

Empirical results of the study show that there is positive relationship between trade liberalization and tax revenue over the study period. This is because of the fact that trade takes place at specific entry and exit points with low chance of tax evasion. In Pakistan duty rates on import are higher than other developing countries which have contributed in raising tax revenue. The study also found negative relation between agriculture sector share and tax revenue in Pakistan. This result is consistent with the fact that share of agriculture in GDP is almost 20% but its contribution in taxes is not more than 2.5% which reflects tax evasions and tax exemptions on agricultural output in Pakistan.

Policy implications based on empirical evidence of the study is that government should take steps to reduce the trade restrictions in order to enhance trade so that maximum gains in tax revenue can be achieved.

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AN ANALYSIS OF BANKS PERFORMANCE IN PAKISTAN USING TWO-STEP DOUBLE BOOTSTRAP DEA APPROACH

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Abstract. This study analyzes the technical efficiency and sources of technical efficiency of conventional banking sector of Pakistan by applying the DEA double bootstrap technique. In the first stage, we applied the bootstrapped DEA variable returns to scale model for measuring the efficiency scores by utilizing the two inputs and three outputs. In the second stage, we employed the bootstrapped truncated maximum likelihood regression model to determine the sources of technical efficiency. As per our results, size of banks does not matter for technical efficiency of banks as the coefficient was insignificant. The liabilities of banks negatively and significantly affect efficiency of banks. Privately owned banks significantly perform better than public sector banks in terms of efficiency scores. Thus, our results shed support in favour of privatization hypothesis.

Keywords: Technical efficiency, Banks, DEA double bootstrap, Truncated regression, Pakistan

JEL classification: G21

I. INTRODUCTION

Banks play a significant role in growth and development of any economy where they hold the savings of the public and finance the expansion of

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business, investment and trade. So, it is not possible to work effectively in the fast developing world without a strong banking system. Empirical evidence shows a positive relationship between financial sector growth and economic growth (Zaidi, 2005). Since commercial banks are the leading financial institutions, therefore, developing countries have focused their attention on the performance of banking sector. This is because efficiency of banking sector affects economic growth positively while their inefficiency retards economic growth by creating financial crisis. Evaluation of efficiency is significant for the investors, expected depositors and policy makers as banks play a vital role in the formation and implementation of monetary policy.

It is important for companies, organizations or banks to touch the optimal level in order to compete with their business rivals all over the world. It is a pre-requisite for every country to observe that its institutional performance is adorable with high efficiency and maximum output in order to attain its targets. Fundamentally, performance measurement examines the achievement of different organizations, companies or banks by comparing the facts and figures about what really occurred to what was preliminarily decided or intended (Wholey and Hatry, 1992). Maximization of the output or profit and minimization of the cost are the basic criteria for measuring the efficiency. Under certain conditions, the technical efficiency (TE) is measured as the ability of a bank or unit to produce. An organization or a bank is known as technically efficient if it is producing a certain quantity of output by utilizing the minimum quantity of inputs or producing maximum output from a certain given quantity of inputs. According to Koopmans (1957), "A possible point in the commodity space is called efficient whenever an increase in one of its coordinates (the net output of one good) can be achieved only at the cost of a decrease in some other coordinate (the net output of another good)."

Farrell (1957) was the first to introduce the measuring of the efficiency of producing units. A lot of work has been done on Farrell's (1957) classic TE. There are two basic techniques for the measurement of efficiency: parametric and non-parametric. Meeusen and Broeck (1977) and Aigner *et al.* (1977) have initiated the parametric technique which is known as stochastic frontier analysis (SFA). Linear programming models of Charnes *et al.* (1978) and Fare *et al.* (1985) provided the basis for the production efficiency analysis. Charnes *et al.* (1978) developed the DEA. Banker *et al.* (1984) further modified it on the basis of frontier efficiency concept first defined by Farrell (1957).

Simar and Wilson (2007) have identified several limitations of the two-stage DEA technique, *i.e.* the data generating process (DGP) is not described in these models and the efficiency scores, which are estimated in DEA, are serially correlated. As such, the general two-stage DEA techniques are statistically invalid due to these limitations. Simar and Wilson (2000) also explain that DEA efficiency scores are exaggerated because of the underestimation of the frontier by this technique. In view of these severe drawbacks of DEA, Simar and Wilson (2007) proposed an alternative estimation and statistical inference procedure based on a double-bootstrap approach. In this study, the DEA double bootstrap is employed for analysis.

The remaining of the study is designed as follows: Section II contains review of related literature in the context of this study. Section III provides methodological framework and describes sources of data. Empirical results of conventional banking sector are discussed in section IV. Section V concludes this study and provides some recommendations.

II. REVIEW OF LITERATURE

Several studies are found in literature on measuring the performance of banking sector. But almost in every study, two approaches (DEA and SFA) are widely used to analyze the efficiency of different sectors including banking sector. But empirical analysis with respect to the appropriate technique is limited in Pakistan. Very rare, if any, study is found in Pakistan which has analyzed the efficiency of banking sector by applying DEA double bootstrap technique.

Percin and Ayan (2006) measured the efficiency of 31 commercial banks of Turkey over the 2003 to 2004 period by applying the DEA and Malmquist Productivity Index (MPI). They used two outputs and four inputs for measuring output oriented efficiency scores. They found that eleven banks were efficient under the assumption of constant returns to scale while sixteen banks remained efficient under the assumption of variable returns to scale in DEA. Meanwhile, they found that there was a significant increase in the efficiency of banking sector for the 2003 to 2004 period as MPI analysis showed.

Akmal and Saleem (2008) measured the efficiency of thirty commercial banks of Pakistan for the 1996 to 2005 period. They applied general two-stage DEA approach to measure the efficiency in the first stage and in the second step they used Tobit regression to find the impact of macroeconomic and internal bank factors on efficiency. They found that efficiency of foreign

banks was greater than local national and privatized banks and overall efficiency level of banking sector started to increase after 2000.

Chansarn (2008) applied the DEA to examine the relative efficiency of 13 Thai commercial banks for the 2003 to 2006 period. He used DEA under two different approaches: operational approach where three inputs and two outputs were utilized and intermediation approach where two inputs and two outputs were used to measure the relative efficiency. It was found that efficiency of Thai commercial banks was very high and stable under operational approach and the efficiency was moderately high and little volatile under the intermediation approach.

Nazir and Alam (2010) applied the traditional method and DEA approach to calculate efficiency scores of twenty-eight commercial banks of Pakistan over the 2003 to 2007 period. They also tested whether privatization really improved the efficiency of banks? Their results suggested that privatization could not help banks in improving their operating income. It was also noted that public banks were better able to cover their interest and non-interest expenses from their corresponding revenues.

Akhtar *et al.* (2011) analyzed the determinants of profitability for conventional banks of Pakistan over the 2006 to 2009 period. They employed the OLS method for analyzing the multivariate regression. They formulated two different regression models with different dependent variables (return on equity and return on assets as proxies of profitability) and the same independent variables for both models. Gearing ratio, assets management and non-performing loans showed a significant impact in both models while size of banks was insignificant indicator where return on equity was used as the proxy for profitability.

Assaf *et al.* (2011) measured the efficiency of nine Saudi banks for the 1999 to 2007 period. They applied DEA double bootstrap technique for measuring the TE in the first stage and found out determinants of efficiency by applying the truncated regression in the second stage. They used three inputs and three outputs based on the intermediation approach to evaluate the efficiency scores. They found that Saudi banks were operating in a highly efficient environment.

Haque and Tariq (2012) evaluated the efficiency of banking sector of Pakistan including sixteen conventional and six Islamic banks for the 2006 to 2010 period. They applied non-parametric frontier technique of DEA analysis for measuring efficiency by utilizing three inputs and three outputs based on intermediation approach. They found that efficiency of overall

banking sector deteriorated from 1 in 2006 to 0.73 in 2009 while during this period Islamic banks performed significantly better than conventional banks.

Ngo (2012) analyzed the changes in performance of Vietnamese banking sector over the 1990 to 2010 period. He applied the DEA window analysis in the first stage. In the second stage, he used a Tobit model for regression analysis to find out the impact of macroeconomic variables on TE. He found that performance of banks under study decreased with the increase in their size over time. He proposed that tight monetary policy or loose fiscal policy could help improve the efficiency of Vietnamese banking sector because of the great impact of government spending and short-term interest rate on efficiency.

Sangeetha and Mathew (2013) analyzed the efficiency of twenty six public banks of India for the 2009 to 2011 period. They employed input-oriented multi-stage DEA to measure the efficiency by utilizing two inputs and two outputs on the basis of intermediation approach. They found that only three banks (IDBI, Corporation Bank and State Bank of India) were consistently efficient over the entire period. They also found that forty to fifty percent banks were under the average efficiency scores and suggested that these three banks could be taken as reference for other banks to improve their efficiency.

Thilakaweera *et al.* (2014) measured the efficiency of fifteen commercial banks of Sri Lanka in the post conflict period (2009 to 2012) of economic expansion. They applied the bootstrapped DEA simulation approach to measure the bias-corrected efficiency scores. They used both intermediation perspective (with three inputs and one output) and operating perspective (with two inputs and two outputs). They found that national banks were less efficient in the 2009 to 2010 period and their efficiency increased in 2011 and 2012 under the intermediation approach while state-owned banks showed high efficiency under the operating approach for the whole period.

It can be observed from the review of existing literature that there are several studies on measuring efficiency of banking sector with different techniques. In these studies, mostly general DEA approach and Tobit regression analysis have been employed which are not appropriate approaches as severely criticized by Simar and Wilson (2007). In Pakistan, there is much space to work on banking sector using the most appropriate technique. That is why an application of DEA double bootstrap technique will be employed in this study to analyze the technical efficiency.

III. METHODOLOGY

Farrell (1957) was the first who introduced the method of measuring the efficiency of producing units. A lot of work has been done on Farrell's (1957) classic TE. It is obvious that there are two basic techniques for the measurement of efficiency: parametric and non-parametric. Meeusen and Broeck (1977) and Aigner *et al.* (1977) initiated the parametric technique which was known as stochastic frontier analysis (SFA). The SFA technique requires specification of functional form and estimates the cost frontier such as parametric approaches require some assumptions. The main quality of this technique is to incorporate the stochastic error in the specification of the model. However, the main problem associated with this technique is the enforcement of the distributional assumption of the error term. Further, SFA technique is sensitive to functional form of the objective variable. In addition, as said by Mahadevan (2002), "Different specifications of the production function under the parametric approach provide different results and this is a serious methodological problem."

Linear programming models of Charnes *et al.* (1978) and Fare *et al.* (1985) provided the basis for the production efficiency analysis. Where the convexity assumption is adopted in the literature, those techniques are known as data envelopment analysis (DEA). Charnes *et al.* (1978) developed the DEA and Banker *et al.* (1984) further modified it using the frontier efficiency concept first defined by Farrell (1957). It is a non-parametric technique and is widely used for measuring the efficiency of decision making units. It does not require specification of functional form with respect to the inputs and outputs or the setting of weights for various factors. DEA creates an efficient frontier for every observation. The maximum output can be obtained empirically by a given set of inputs. The details of DEA are available in Coelli *et al.* (2005).

Despite these features, DEA has several drawbacks. The error term is not specified in DEA which means that errors are included in the efficiency estimates. There is no explanatory quality in DEA technique to determine the sources of technical efficiency. In addition, it is assumed in DEA that decision making units have full control over the inputs which can be discretionary variables. So, it is a weak assumption because non-discretionary variables (environmental variables) are present in every sector of the economy, which are to be necessarily incorporated in the production function for measuring the accurate efficiency (Ouellette and Vierstraete, 2004). A lot of work has been done on incorporating the environmental variables in DEA technique. Banker and Morey (1986) and Ruggiero (1996) directly

incorporate the non-discretionary variables in DEA technique and measure the efficiency in a single stage model while others like Ray (1991), Muñiz (2002) and recently Simar and Wilson (2007) omit the environmental variables from the DEA programme and introduce them in the second stage of the technique.

Simar and Wilson (2007) identified severe limitations of two-stage DEA technique which is frequently applied by the existing studies. They revealed that previous literature involving production process of DEA two-stage models were defective because the data generating process (DGP) was not described in these models. Thus, TE scores estimated by DEA are highly doubtful. They also found that these efficiency scores were serially correlated. Therefore, the general two-stage DEA techniques are statistically invalid. Simar and Wilson (2000) also explain that DEA underestimates the frontier and hence efficiency scores are exaggerated. Keeping in view these severe drawbacks of DEA, Simar and Wilson (2007) proposed an alternative estimation and statistical inference procedure based on a double-bootstrap approach. We have employed this approach in our study.

IV. DATA ENVELOPMENT ANALYSIS AND DOUBLE BOOTSTRAP

We have used the output oriented variable returns to scale (VRS) model for obtaining the efficiency scores because constant returns to scale (CRS) is applicable in the case where banks or branches are operating at their optimal scale. However, due to varying size of banks, imperfect competition and financial constraints banks are not working at their optimal scale. The output-oriented DEA efficiency estimator $\hat{\theta}_{vrsi}$ for any data set (x_i, y_i) for each conventional bank can be attained by solving the following linear programming equation.

$$\hat{\theta}_{vrsi} = \max \left(\begin{array}{l} \theta > 0 \mid \theta_i Y_i \le \sum_{i=1}^{n} \gamma_i Y_i;\ X_i \ge \sum_{i=1}^{n} \gamma_i X_i; \\ \sum_{i=1}^{n} \gamma_i = 1;\ \gamma_i \ge 0,\ i = 1,\ldots n \end{array} \right) \tag{1}$$

In equation (1), Y and X are observed outputs and inputs and $i = 1, \ldots, n$ is the specific bank. The $\theta_i Y_i$ is the efficient level of outputs, θ is the scalar and γ_i is the non-negative vector of constants defining the optimal weights of inputs to outputs. The obtained value of $\hat{\theta}_{vrsi}$ is the technical efficiency

estimate for ith bank. In case of output oriented, outputs should be increased for getting the higher technical efficiency by a given set of inputs where $\hat{\theta}_{vrsi} = 1$ means that the bank is considered fully efficient while $\hat{\theta}_{vrsi} < 1$ means that the bank is not fully efficient and it needs to increase the outputs from the given set of inputs for reducing the inefficiencies.

Two things should be made clear with respect to equation (1). First, the assumption of VRS is applied in this linear programme and second, it is observed by Simar and Wilson (2000) that $\hat{\theta}_{vrsi}$ is upward biased estimator, as banking frontier can be underestimated. Due to limitations of DEA, the smooth bootstrap technique of Simar and Wilson (1998, 2000) is applied in this study for getting the bias-corrected efficiency scores and their confidence intervals accompanied by the DEA with bootstrapping approach.

The bias-corrected efficiency scores which are estimated in the first stage are left truncated by 1. In the second stage, a single truncated regression with bootstrap will be employed for regressing these TE scores of all banks against a set of explanatory factors in the following truncated maximum likelihood regression model.

$$\hat{\theta}_{vrsi} = b + z_i\beta + \varepsilon_i \tag{2}$$

In equation (2), b is the constant term, ε_i is the identically and independently distributed random error term, and z_i is a vector of specific variables (these are known as environmental variables) for bank i that is expected to be related to the bank's efficiency score. We applied algorithm 2 of Simar and Wilson (2007) for bootstrap procedure in this study. This algorithm consists of seven steps and provides inference about coefficients. A step by step DEA double bootstrap procedure is described briefly in various studies such as Barros and Assaf (2009) and Assaf *et al.* (2011).

V. SELECTION OF VARIABLES AND SOURCES OF DATA

There are two perspectives for selecting the inputs and outputs for DEA: intermediation perspective and production perspective. According to Berger and Humphery (1997), intermediation perspective considers a bank as a unit that uses labour and capital to transform funds. On the other hand, production perspective considers a bank as a producer of various services for its clients. They also found that production perspective was more appropriate for finding the efficiency of the branches of the bank whereas intermediation

perspective was more appropriate for finding efficiency of overall banks. We have employed the intermediation approach for selecting the inputs and outputs for measuring TE.

In this study, two inputs (operating fixed assets and total deposits) and three outputs (net investments, net interest income and total advances) are employed to measure the TE. The entire data is collected in thousands of Pak rupees. The selection of inputs and outputs are supported by various studies, such as Chansarn (2008), Burki and Niazi (2010), Haque and Tariq (2012) and many others.

To find out the sources of TE, the bias-corrected efficiency will be regressed against the environmental variables in truncated regression. For this purpose, following truncated regression model will be employed and description of the variables is given under this model.

$$\hat{\hat{\theta}}_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 L_{it} + \beta_3 O_{it} + \beta_3 E_{it} + \varepsilon_{it} \tag{3}$$

$\hat{\hat{\theta}}_{it}$ is the estimated *TE* scores based on the assumption of VRS. Where *A* represents the log of total assets of i^{th} bank in time period t which is used as a proxy for economies of scale and *L* denotes the log of total liabilities of i^{th} bank in time period *t*. *O* is a dummy variable which is 1 for private banks and 0 for public sector banks which shows the ownership impact while *E* represents the age of the bank which is a proxy for learning by experience.

The data of twenty conventional banks is collected from their Annual financial reports for the 2007 to 2013 period.

VI. EMPIRICAL ANALYSIS

The results of *VRS TE* scores based on 2500 bootstrapped iterations for the 2007 to 2013 period are presented in Appendix A. Banks' names are given in the first column. The original DEA efficiency scores are presented in the second column. Bias-corrected efficiency scores are given in the third column. The lower and upper bounds of confidence interval are presented in the fourth and fifth columns, respectively. The same is shown for the 2007 to 2013 period.

It can be observed that original efficiency scores, which are denoted by DEA, overestimate the results and underestimate the frontier, as described in the limitations of DEA by Simar and Wilson (2000). Bias-corrected efficiencies (which are denoted by BC in the following tables) are estimated after 2500 iterations which are free of exaggeration. The main importance of

these estimations is that they also fall within the confidence intervals while DEA scores do not fall within the confidence interval because it under-estimates the frontier and shows the inefficient units as efficient units.

In this study, output oriented DEA Double Bootstrap model is applied, the efficiency score 1 shows the technically fully efficient bank while estimated efficiency score less than 1 shows the inefficient or less efficient bank. In case of output-oriented model, different levels of output are produced by utilizing same set of inputs. So, for minimizing the inefficiencies, maximum level of output should be obtained with the fixed set of inputs.

In the existing results, bias corrected technical efficiency scores vary for every entity in the given time periods. It can be observed from Table 1 that overall bias corrected efficiencies deteriorated during 2008 and 2013. In 2008, the bias-corrected mean efficiency score is at its peak with the score of 0.7620 which shows that almost 24% overall level of output can be increased by utilizing the same set of inputs. In 2013, this score is 0.5603 which shows that after the financial crisis conventional banking sector of Pakistan could not resist against the financial crisis and the efficiency score decreased to this level.

TABLE 1

Mean Efficiencies of Banks

Year	DEA	BC
2007	0.8548	0.7248
2008	0.8812	0.7620
2009	0.866	0.7615
2010	0.8527	0.7125
2011	0.8251	0.6633
2012	0.8143	0.6326
2013	0.7969	0.5603

Source: Authors' own estimates.

Truncated Regression

After measuring the bias-corrected TE of the conventional banking sector for the 2007 to 2013 period, the efficiencies of 20 banks for seven years were

pooled in one truncated regression form as showed in equation (3) and maximum likelihood method was applied for truncated regression as discussed in the second step of the Simar and Wilson's (2007) double bootstrap procedure. Results of determinants of VRS TE, standard errors and t-statistic are presented, respectively, in column 2, 3 and 4 of Table 2.

TABLE 2

Determinants of VRS Technical Efficiency Scores
Using a Bootstrapped Truncated Regression

Regressor	B.hat	SE	t-statistic
Constant	2.9776	1.0752	2.7695*
Total assets	2.52734	1.5665	1.6134
Total liabilities	–2.7279	1.4946	–1.8252***
Ownership	0.2597	0.1182	2.1979**
Experience	0.0013	0.0031	0.4217

NOTE: *, ** and *** mean the coefficients are significant at 1, 5 and 10 percent levels, respectively. The number of observations was 140.

In the second stage, coefficients were bootstrapped 2000 times. Log of total assets which is a proxy for the size of banks has a positive but insignificant impact on the efficiency score. It means economies of scale are weakly prevailing in the conventional banking sector. Log of total liabilities has a negative and significant impact on efficiency of banks. The coefficient was statistically significant at 10 percent level of significance. Third variable was the dummy variable which was used to measure the impact of private ownership on TE. The coefficient of private ownership was positive and statistically significant at 5 percent level. It was found that private banks were almost 26 percent more efficient in terms of technical efficiency scores as compared to public sector banks. Thus, this empirical evidence sheds support in favour of privatization hypothesis. The fourth variable was the age of banks which was used as a proxy for learning by experience. Its coefficient was very small and statistically insignificant signifying the fact that new and older banks do not differ in terms of TE score if other things were held constant.

VII. CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to estimate the technical efficiency of conventional banks of Pakistan including 16 private and 4 public sector banks. The core objective of the managers is to analyze the performance of their entity because they desire to know as to how well are their entities working under the given resources. There are many techniques to measure the efficiency but in this study, DEA double bootstrap is applied to measure the technical efficiency because it is an appropriate approach as compared with other existing techniques.

In the first stage, we have estimated the bias-corrected TE scores because DEA measures the biased efficiencies due to its underestimating the frontier. It can be observed from the results of this study that DEA scores do not fall within the confidence interval and these efficiencies are beyond the confidence interval because of the bias while 2500 times bootstrapped TE scores fall within the interval.

It was found in this study that not even a single bank was technically fully efficient in bias-corrected form over the whole period of estimations. It is found that overall efficiency, which was measured in the form of mean efficiency, has decreasing trend over time. The main reason for this fall might be the existence of alternative banking sector in Pakistan which is known as the Islamic banks which were much less affected by financial crisis. It might be the reason of decline in efficiency that people concentrated on Islamic banking after 2008 which may be filtered after a separate study with an appropriate technique. This study is distinct because it provides the evidence of post impact of financial crisis on conventional banking sector of Pakistan.

In the second stage of this approach, the bias-corrected TE scores were specified as the dependent variable with left truncation, and truncated bootstrapped maximum likelihood regression model was applied because the general regression models were not suitable. In this paper, coefficients were bootstrapped with 2000 simulations because the coefficients did not significantly change beyond 2000 iterations. It is found in this study that there is no evidence of economies of scale in the conventional banking sector of Pakistan. Total liabilities had negative and significant impact on the technical efficiencies. Private ownership had positive impact while learning by experience had a very small positive but insignificant impact.

On the basis of results of the present study, it can be suggested that banks should focus on increasing their efficiency scores by eliminating all

wastages. Secondly, banks should start their business with high own funds and keep the liabilities at their minimum level because they have a significant negative impact on efficiency scores. Thirdly, privatization should take place as it has a significant positive impact on efficiency scores. Finally, there is a need for banks to learn from their experience as it can improve the efficiency scores.

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APPENDIX A

DEA and Bootstrapped Efficiency Scores
Along with Lower and Upper Bounds

Banks Name	DEA	BC	LB	UB
2007				
ABL	0.9913	0.8868947	0.8134358	0.9845777
Alfalah	1	0.7636393	0.7139825	0.9921935
Askari	1	0.8841982	0.8259743	0.9923271
Bank Alhabib	1	0.8465987	0.7440769	0.9894482
BOP	0.9714	0.8910172	0.8261875	0.9661439
BOK	0.9933	0.8668471	0.7820302	0.9848314
MCB	0.3368	0.3047535	0.2815624	0.3341559
NBP	0.6645	0.6079229	0.5724726	0.6593115
Faysal	1	0.6689269	0.6046142	0.9924602
FWB	0.9161	0.8419926	0.7765655	0.9093601
Habib Metro	1	0.6827768	0.6075341	0.9915928
HBL	0.7263	0.6551918	0.6013273	0.7212279
JS	0.8842	0.778036	0.7071001	0.878126
Kasb	1	0.6607094	0.6060995	0.9920569
NIB	1	0.8865748	0.8126461	0.990695
Samba	0.7541	0.6750395	0.6087037	0.749165
Silk	0.6967	0.645887	0.6004565	0.6924715
Soneri	0.7	0.63454	0.5861315	0.6967062
Summit	1	0.9030429	0.8494038	0.9924217
UBL	0.4609	0.4107977	0.3815581	0.4579071
2008				
ABL	1	0.844497	0.7707727	0.9946969
Alfalah	0.8571	0.7699734	0.6950376	0.8519749
Askari	1	0.8490413	0.7879032	0.9935858
Bank Alhabib	1	0.8833969	0.8258159	0.9938814
BOP	0.4783	0.4420953	0.4155876	0.4757415
BOK	0.9379	0.8619358	0.8088133	0.9318636
MCB	1	0.8716771	0.8095318	0.9938846
NBP	0.7	0.6478036	0.6032173	0.6976257
Faysal	1	0.7668486	0.6642723	0.993174
FWB	0.818	0.7345867	0.6690609	0.8125353
Habib Metro	1	0.7587581	0.6645484	0.9951587
HBL	0.8181	0.7416148	0.6695984	0.812729

Banks Name	DEA	BC	LB	UB
JS	1	0.8178728	0.7521966	0.994497
Kasb	1	0.8442263	0.7873467	0.9935189
NIB	0.9914	0.8899787	0.7822886	0.9862739
Samba	1	0.7681273	0.6663911	0.9942616
Silk	0.55	0.5014646	0.4590651	0.548279
Soneri	0.8	0.7574037	0.7097966	0.7976763
Summit	1	0.8672996	0.8143134	0.9938561
UBL	0.6724	0.6218917	0.5789347	0.6682834
2009				
ABL	1	0.8472387	0.7737356	0.9940105
Alfalah	1	0.8539829	0.7720012	0.9929865
Askari	1	0.855309	0.7877378	0.9935541
Bank Alhabib	1	0.8882674	0.8241423	0.9926429
BOP	0.923	0.8574079	0.7959575	0.9174935
BOK	1	0.7780055	0.6788138	0.9938002
MCB	0.5119	0.4727526	0.4337232	0.5091641
NBP	0.8035	0.7547922	0.7058788	0.799445
Faysal	1	0.858386	0.7714953	0.99362
FWB	0.7768	0.6999878	0.656076	0.771507
Habib metro	0.7911	0.7049297	0.6392111	0.7864577
HBL	0.7678	0.7046762	0.6424688	0.7628706
JS	1	0.8431856	0.7862296	0.9934075
Kasb	0.6139	0.5606915	0.513901	0.6105349
NIB	1	0.8841968	0.8380822	0.9942093
Samba	1	0.7758856	0.6805201	0.9940429
Silk	0.7816	0.7168559	0.6621407	0.7765572
Soneri	0.85	0.7980613	0.7467369	0.8477328
Summit	0.8006	0.7131485	0.6476283	0.7958972
UBL	0.7	0.6619487	0.6204193	0.6975933
2010				
ABL	0.5882	0.518376	0.4621594	0.5835707
Alfalah	0.7209	0.6367084	0.5793534	0.7158912
Askari	0.3623	0.3177091	0.2771995	0.3598776
Bank Alhabib	0.9323	0.7941148	0.7050352	0.9255444
BOP	1	0.8609668	0.7839041	0.9924516
BOK	1	0.7138339	0.6490402	0.9912478
MCB	0.7111	0.6379154	0.592042	0.7054952
NBP	0.9455	0.8653354	0.8096151	0.9383408

Banks Name	DEA	BC	LB	UB
Faysal	1	0.8175399	0.7521035	0.9921877
FWB	1	0.6621999	0.6140489	0.9928669
Habib metro	0.9306	0.8122226	0.699627	0.9236349
HBL	1	0.8234238	0.7502331	0.9922895
JS	0.4053	0.3599202	0.332293	0.4023254
Kasb	0.7343	0.6539697	0.6041795	0.7295029
NIB	1	0.8360287	0.7905343	0.9926834
Samba	1	0.6429223	0.6123589	0.9906812
Silk	1	0.880685	0.7998402	0.9931774
Soneri	0.9611	0.8720247	0.8064794	0.9529883
Summit	1	0.8483201	0.7841422	0.992908
UBL	0.7614	0.6964762	0.6518783	0.7555124
2011				
ABL	0.7126	0.6157394	0.559347	0.7061279
Alfalah	0.6222	0.5339226	0.481668	0.6171273
Askari	0.3	0.2595908	0.2280102	0.2985987
Bank Alhabib	1	0.6171997	0.5913291	0.9908648
BOP	0.95	0.8110092	0.7331692	0.9462146
BOK	1	0.6076795	0.5909971	0.9909721
MCB	0.6728	0.5858506	0.544278	0.6672331
NBP	0.8	0.7129492	0.6507528	0.7967999
Faysal	1	0.6003368	0.591311	0.9897504
FWB	1	0.6181601	0.5906825	0.9919034
Habib metro	0.9152	0.7898975	0.7024209	0.907314
HBL	1	0.8061625	0.7705402	0.9891564
JS	0.4168	0.3646639	0.3400623	0.4123182
Kasb	0.8271	0.7570733	0.6995221	0.8231073
NIB	1	0.8108747	0.7829616	0.9927121
Samba	1	0.8036321	0.7364169	0.9919446
Silk	0.75	0.6954417	0.6462634	0.7468666
Soneri	1	0.9039536	0.8443603	0.9916007
Summit	0.85	0.7705001	0.7010136	0.8467652
UBL	0.6855	0.6022466	0.5559586	0.6803816
2012				
ABL	0.7328	0.6324101	0.5864202	0.7239207
Alfalah	0.5965	0.5065222	0.4717017	0.5902381
Askari	1	0.8658744	0.810584	0.9894933
Bank Alhabib	0.3201	0.263151	0.2373402	0.316819

Banks Name	DEA	BC	LB	UB
BOP	0.377	0.3350098	0.3138279	0.3734963
BOK	1	0.5710303	0.5998128	0.9876488
MCB	0.7665	0.6739135	0.6254075	0.7588208
NBP	1	0.5540983	0.5973985	0.9899665
Faysal	1	0.5678265	0.5982251	0.9911486
FWB	1	0.7409388	0.7208833	0.9875875
Habib metro	1	0.851592	0.775268	0.9887259
HBL	1	0.5803306	0.5973934	0.9906522
JS	0.6626	0.5845115	0.5449614	0.6565334
Kasb	0.6304	0.5482075	0.512148	0.6242656
NIB	1	0.7559521	0.7440604	0.9885901
Samba	0.9278	0.7984742	0.7370789	0.9196298
Silk	0.75	0.6795656	0.6291172	0.7457948
Soneri	1	0.8000938	0.7446296	0.9901158
Summit	0.826	0.7414744	0.6790398	0.8188303
UBL	0.6967	0.6004602	0.5528406	0.6910079
2013				
ABL	0.5733	0.4820355	0.4542599	0.5645008
Alfalah	0.5769	0.4482681	0.421878	0.5678886
Askari	0.9166	0.7885282	0.7188115	0.9029226
Bank Alhabib	0.4597	0.3473763	0.3251018	0.4527521
BOP	0.7046	0.5793806	0.5437199	0.6954437
BOK	1	0.4678412	0.5755642	0.9845926
MCB	0.75	0.6407865	0.5976342	0.7456239
NBP	1	0.4831267	0.5760097	0.9861818
Faysal	1	0.4756806	0.5766608	0.9865488
FWB	1	0.7390269	0.7347122	0.9865017
Habib metro	1	0.7843632	0.7536718	0.9848182
HBL	1	0.4789353	0.5764076	0.9856697
JS	0.6666	0.5841691	0.5437742	0.6566691
Kasb	0.4837	0.3978047	0.3739955	0.4771952
NIB	1	0.4537872	0.5749461	0.9860237
Samba	0.25	0.212566	0.1960353	0.2481619
Silk	0.8	0.6954094	0.6453263	0.7932151
Soneri	1	0.778802	0.7520262	0.9841971
Summit	1	0.7391737	0.726552	0.9864456
UBL	0.7575	0.6285852	0.5898238	0.7463

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IMPACT OF EMPLOYER BRAND ON SELECTION AND RECRUITMENT PROCESS

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Abstract. This research aims to explore the relative advantages of using employer branding in recruitment process. The research question is raised whether there is some association between the facilitated recruitment scores and in the perceived employer branding score. The dynamics of Employer-branding as effective long-term recruitment strategy was explored. This research was laid out through combination of qualitative case study and with quantitative survey design. The data collection methods were entail interviews, collection of existing departmental record: archival analysis etc. The substantive support was sought from few questionnaires like employer-branding checklist and recruitment resources checklists. In order to explore the impact of Employer-branding on recruitment and selection, two organizations practicing employer branding and the other following the traditional, customized image building was sought. The cross comparison of the data from both organizations reveal the differences that perception of employer branding carries in different dimensions. For the sake of the differential analyses in both organizations, the independent sample t-test reveal the differences in the consumption of resources for recruitment and selection. The correlation analyses reveal that there is significant positive relationship between employer branding and the facilitated recruiting process. The findings are carried both theoretical and practical implications which are discussed in the light of evidential findings.

Keywords: Employer brand, Selection, Recruitment process

JEL classification: C52

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I. INTRODUCTION

The crucial aim of this research is the exploration of impact of the employer branding on recruitment and selection. The concept of employer brand is quite recent. In developing countries like Pakistan, the term employer brand is not generally understood and practiced in the indigenous and local organizations. The term Employer brand is very recent and was introduced in 1992 when an academic article was published to underline the importance of perception of employer brand in facilitating the process of recruitment and selection.

Researching and Conceptualizing Employer Branding

Brands are an organization's mainly precious resource (Dawson, 2013), brand management is a primary action in most organizations. Even though many organizations, in regard to branding efforts, mainly emphasize on product development and on corporate brands but concept of branding can also be utilized in domain of human resource management (Backhaus and Tikoo, 2004; Ballantyne and Aitken, 2007; Berthon, Ewing and Hah, 2005; Hulberg, 2006; Ito, Brotheridge and McFarland, 2013; Saini, Rai and Chaudhary, 2014). Employer branding is the appliance and use of branding philosophy to human resource management. Many organizations are using employer brandings not only to attract recruits but also to engage current employees in strategy and culture of the organization. Employer branding can be explained as process of developing the perception of the brand for the audience and make it that much unique that it could be differentiated from their competitors (Ito, Brotheridge and McFarland, 2013; Sokro, 2012; Sparrow and Otaye, 2015; Sullivan, 2004). Employer branding produces a reflection of the organization which portrays the organization as a comfortable place to work (Sullivan, 2004). More recently Ewing, Pitt, de Bussy and Berthon (2002) emphasize the practicality of employer branding in an progressively knowledge-based economy where skillful employees are often short in supply (Biswas and Suar, 2013; Cable and Turban, 2001; Edwards, 2010; Elving, Westhoff, Meeusen and Schoonderbeek, 2013).

Initially branding was used to discriminate substantial products, but afterwards it was applied to discriminating between different people, organizations, groups and places (Peters, 1999). According to Aaker (1991), recognized brand is supposed as a critical mean for creating differences between different products and generating new advantages for the success of an organization. In addition employer branding has become a way to compete with modern world to keep pace with them. To achieve position in the market it became really important to introduce employer branding and

making a brand message of a company by using marketing principles to know about the position of employer's choice (Sutherland *et al.*, 2002). According to Barrow and Richard (2005) employer branding is used to represent the image of a company and its personality to target the employer of own choice. It is also used to motivate the current employees working in that company. Employer branding is also an emotional attachment between an employer and employee.

Ambler and Barrow (1996) explain employer branding as growth and joining culture of an organization and introducing him as an employer. It is combination of a lot of benefits which are identified with the employing company. It represents the culture of an organization how that people work and move, and its place in the market, to encourage people for achieving their goals and share them with others.

Employer Branding

According to the American Marketing Association, a brand is a design, name, sign, icon and combination of all these, which differentiate the company and vendors from the competitors in the market (Jones, Willness and Madey, 2014; Schneider, 1987).

Literature of human resource practitioners defines employer branding as a triad process. First step is to create and maintain the value proposition by the company that is there in the brand. Second is to use information about the management style, culture of organization, current employment image, impressions of product or service and qualities of current employees. Quality managers convey a message about the value, their organization offers to the employees (Cable and Turban, 2001; Davies, 2008; Mokina, 2014; Sullivan, 1999).

In order to develop value proposition, the organization markets it to its targeted potential people, employing agencies and placement counselors. External marketing does not only attract the targeted employees rather it helps to support and increase the employer's product or corporate brands. It is essential to employer branding that particular brand has to be persistent with all other branding efforts (Nolan, Gohike, Gilmore and Rosiello, 2013; Sharma and Kamalanabhan, 2013; Sullivan, 1999).

Another important aspect of employer branding is internal marketing which transfers the brand promise made to recruit into the organization and includes it as part of the culture of an organization (Frook, 2001). Internal promotion is very important because it plays a vital role in developing goals for the company's success. There is similarity between employer brand and

the product and corporate brand, but there are differences as well. Product and corporate oriented brands mostly target external audience while proprietor brand target both internal and external audience. It is more employment oriented and it represents organizational identification (Wallace, de Chernatony and Buil, 2013).

Theoretical Foundation

Employer branding has got much consideration in professional and practical setups, but little in the academia. That is why the underlying theoretical foundation is not fully developed for employer branding. Resource-based view describes that if your organization has unique features you can get better work force (Barney, 1991; Love and Singh, 2011). Presence of distinctive feature makes it unique among other competitors and gives it different position among others (Barney, 1991; Wayne and Casper, 2012). Among other things plant, tools and assets as resources that create competitive advantage, employer branding is also important as well and can create advantages for the company (Edwards and Edwards, 2013; Priem and Butler, 2001). Employer banding builds image for the external market they attract and wish to join or to attach with them. Employer branding makes the company different from others and gives it a unique position in the market. Internal marketing is also very important which helps to bind the individuals with the organization. Employer brand helps the individual to adopt unique culture which makes them different among the others in market and gives them a place in the market. It makes them different and gives them more chances to grow (Stamler, 2001). Employer branding gives more competitive environment (Barney, 1991). Employer branding helps to recruit the best workforce and it also helps to maintain their position (Ambler and Barrow, 1996). The use of employee branding helps to make employment more powerful in the company. They show more psychological contract with the organization and bind them with the organization if they get security in return from them. This makes workforce more powerful and strong (Hendry and Jenkins, 1997). Although there is a current trend of employees outsourcing and downsizing, it is very effective for the employees to make their psychological contract more strong. Employer branding demands for being flexible and requires more efforts (Baruch, 2004). Different companies use employer branding to advertise their benefits, training sessions and chances of personal growth and other opportunities for their development. Mostly organizations failed to do so, they get less chance to get work force (Newell and Dopson, 1996; Hendry and Jenkins, 1997) so employer branding helps to change the general trends in marketing.

Brand equity is also important to explain employer branding. Brand equity is all those resources that are attached to the brand. It is important because it provides the opportunities for the customers to get involved with the organization. It is the success of the organization (Aaker, 1991). Customer based brand equity is the publicity and knowledge of the brand to the customers and how they respond to it (Breaugh, 2008; Keller, 1993).

Further, employer brand equity is to motivate the employees currently working in the organization. Employer brand equity is the result of the branding activities. Other employees react differently who are already working in the organization (O'Halloran, 2003).

Conceptual Framework of Employer Branding

Brand relations are the ideas and thoughts that brand develops in the minds of customers (Aaker, 1991). Brand associations are the predictors of brand image. Brand image is the combination of thoughts associated with the products and product related attributes and related benefits of the product (Keller, 1993). Attributes describe the objectives and benefits of the product or the service.

Employer brand has also been termed as a very successful long term recruitment strategy that can be equally prolific in attracting the best talent pool for the organization. This can help the corporate recruitment managers in maintaining a continuous flow of the talent for the organization. The way that the current employees are treated makes a lot of difference in building the perception of employer brand and the employer's image (Aaker, 1991).

Globalization, pressures for speed, efficiency etc. compel the organizational professionals to invest their systematic efforts in the building of employer brand. There are several benefits that employer branding offers like economical use of resources in recruitment, reduced lay-offs, increased volume of unsolicited and talented candidates, better committed prospective employees, greater levels of job and organizational commitment. But on the top of all these benefits lie the advantages of facilitated recruitment and selection (Collins and Stevens, 2002; Riordan, Gatewood and Bill, 1997). The hiring that is subsumed as recruitment and selection is greatly affected by the way, some organization is perceived by the people from outside and inside of the organization. The way some organization builds, maintains and highlights its image determines the way; this is perceived by its possible stakeholders like employees and the consumers. This is so natural for the employees to desire to work for the organizations that have well-established reputation and image. The talent pool in its best quality is attracted by the

organization that has best employer brand, and the acceptance of the offers by the best polished employees is greater. There are lesser turnovers and lay-offs. People hanker after working with such organizations and they strive to maintain their output and performance to the best of their efforts by holding their organizational and job commitment to an optimal level. All this not only helps to save the time and resources for the organization in undertaking recruitment but also helps to maintain the stability and work perpetuity, which is a greater determinant feature of all successful organizations (Allen, Mahto and Otondo, 2007; Ewing, Pitt, de Bussy and Berthon, 2002; Priyadarshi, 2011).

Effective employer branding takes a practical approach because latent employees also develop employer brand associations that are based on sources of information and they are not controlled by the employer, that is, by ascertaining anticipated brand associations and then determined to develop these associations (Gioia, Schultz and Corley, 2000).

A number of areas of recruitment research support the practice of skills and developing desirable brand associations and brand images. First, employer image has been found to influence applicant's fascination to the organization (Collins, 2007; Turban and Greening, 1997), which relates to similarity attraction (Byrne and Neuman, 1992; Highhpuse, Thornbury and Little, 2007) or person-organization fit. Similarly research shows that the better the match between the values of the organization and the values of the individual, the more likely the individual is to be concerned to the organization (Chapman, Uggerslev, Carroll, Piasentin and Jones, 2005; Collins and Stevens, 2002; Judge and Cable, 1997).

Social identity theory also explains a connection between employer brand image and its attraction to the employee. Social identity theory states that people get to know about themselves with the group they belong (Tajfel, 1982). We become part of that group we follow having the same likes and dislikes (Catanzaro, Moore and Marshall, 2010; Underwood *et al.*, 2001). As brand awareness is are the customers have positive image of the brand the more they have positive image with more frequently they will follow them. Social identity theory also explains that if people see that specific group follow that which have positive image, more frequently they will follow them. Similarly, if the prospective employees find positive facets of the employer image, they are more likely to identify with the brand and will look for the affiliation with that organization. This is because to seek the sense of sharp self-image that was promised by the membership. The employer branding becomes useful because of the ability to use a brand to convey

representative benefits to potential employees. Branding is the symbol which represents the brand. The branding represents the benefits of the brand and its objectives (Hirschman, 1980). Branding are the ideas which represent the product's image that is built by employer branding. It plays a vital role in the success of brand and organization (Elliott and Wattanasuwan, 1998). In employment branding, it makes the job more attractive for the employees.

Branding work shows that significance of the symbolic functions increases when functional variances between different brands are limited. Within the same industry job related factors are the same and then it became difficult for the other competitors (Cober, Brown, Keeping and Levy, 2004; Lievens and Highhouse, 2003). For developing higher brand image, employer branding becomes more useful for the organization. To support this contention, Lievens and Highhouse (2003) discuss that pay and other incentives for the employees are important to describe to attract the employee and represent the status of the employee in the organization.

Objectives and Scope of Employer Brand

Defining the objectives of the employer brand saves the time and money in the long-run and keeps the programme on time and within the budget. The objectives may be related to the whole employer brand programme or a specific employer brand project. Other objectives may include integrating the cultures of two companies during a amalgamation, declining staff turnover rates, increasing volume of hires for a recruiting campaign, civilizing candidate quality, or evaluating and updating the career website to appeal the audience (Knox and Freeman, 2006).

Relationship Between Marketing, Communications and HR

Employer brand strategy is usually a gray area that should be clearly defined so that everyone; stakeholders and potential employees achieve accord and are incorporated in the goals and objectives. To acquire order to get both budget and buy-in, HR often has to drive employer branding through internal education and awareness building. The employer brand is a long-term, strategic talent management enterprise; however, some level of misunderstanding or standards adherence is natural and may vary depending on the organization (Kotler and Lee, 2008; Kucherov and Zavyalova, 2012; Ritson, 2002; Sparrow and Otaye, 2015). The strategies are intended to attract, connect and preserve talent, which clearly sets up a strong case for teamwork between human resources, marketing, and communications. In cases where there is a lack of teamwork and groups tasks, power struggles ensue, projects can be delayed, and creativity/strategy diminished to the harm of the

consequence (Crumpacker and Crumpacker, 2007; Harthine, Maxham and McKee, 2000; Knox and Freeman, 2006; Kotler, 2003; Nishii, Lepak and Schneider, 2008; Underwood, Bond and Baer, 2001).

Justification and Likely Benefits

In Pakistan, the research scenario is quite weak with little efforts that are being undertaken to explore phenomenon on empirical grounds. Very few researches have been done in this area, although it is important for organizational success. There could be many reasons people don't have any idea about that and who have they don't want to use. People usually avoid adopting new concept, they use old methods which have been used for many times.

There are multiple reasons for this like limited resources, rigidity of the system to adopt some new concept and infrastructural barriers. In spite of all this, the concept of employer brand is being widely practiced informally by the international and some national organizations. The wide acceptance of such novel and recently developed concepts can take place if extensive efforts are being carried on to explore such topics on theoretical and empirical grounds. Therefore this topic is greatly significant in the background of Pakistani perspective. Employer branding has got much attention in practitioner settings, but little in the academia, the underlying theoretical groundwork for it is not fully developed.

Employer branding is to increase the image and reputation of the organization. Moreover it increases the familiarity of employees with the organization and to their jobs. Employer branding helps in facilitating the process of recruiting the employees. Literature has suggested that employer branding saves resources and time in selection process of employees. Further it builds a positive image of the employer organization to attract the potential people to build a positive workforce. This helps in recruiting the right employees for the right job. Hence employer branding affects the recruitment and selection process. In the light of the reviewed literature, the present research has been formulated.

Aims and Objectives

The following aims and objectives are to be achieved through the current research study:

1. To systematically streamline and arrange the available theoretical and empirical data on such sparsely explored topic.

2. To juxtapose the two organizations, *e.g.* the one following Employer-branding and other not following this recent in order to highlight for hiring the advantages and facilitations trends that Employer-Branding offers in recent times.
3. This study would help the professionals to focus on the need for the development and exploration of effective Employer-Branding techniques and strategies/interventions.
4. The awareness towards effective Employer-Branding would be enhanced among professionals and the policy-makers.
5. The findings would shed light on how to cut expenses of organization by propagating a conflux.
6. Exploration of employer branding as a long-term strategy of effective hiring (recruitment and selection).
7. The provision of an insight to future researchers and mangers, concerning the role of employer image in recruiting.
8. The provision of insight and orientation to recruiters on the importance of efficient and well-organized recruitment process.
9. This is an effective solution to the problem of talent retention within an organization. This is due to the fact that the employer branding is the only available solution to the corporate recruiters in maintaining the flow of talent within some organization.
10. Last but not the least providing the empirical scenario of employer branding in Pakistani perspectives.

Research Questions

The following research questions have been explored in the current research study:

- Does Employer Branding help to reduce the recruitment expanses?
- Does the budget for marketing and HRM reduce due to Employer Branding?
- Does the Employer Branding increase the organizational commitment of the employees?
- Is the perception of employer brand inevitable for the organization?
- Is the better talent pool generated in the organizations, which are practicing employer branding?

- Do organization brand associations affect the image of the firm as an employer?
- Does organization brand present information that contributes to formation of a psychological contract between the employer and the employee?
- Is organization brand association positively related to employer attraction?

II. METHOD

Research Design

This research study was laid through qualitative case study. Interview method and content analyses was used since in depth data on employer branding is scanty and sparse. Thus, this was an explorative case study to unravel the dynamics of the organization.

Sample

The sample for the current case study comprises the data from juxtaposed organizations, *e.g.* the one actively practicing the employer branding and the other not following the employer branding for the sake of recruitment.

Sampling Strategy

Non-probability purposive sampling was used as there is certain criterion measure on the basis of which the eight organizations were selected.

Measures/Instruments

Employer-Branding Checklist

Checklist was developed on the basis of previous literature findings. Number of questions was 20 which were measuring organizational image, organizational reputation, organizational familiarity, perceived attractiveness of the organization. The responses of checklist were on seven rating (1-7) scale including strongly disagree to strongly agree.

Recruitment Facilitation Checklists

Previous records of the companies were obtained for getting their criteria of recruitment. It included written tests, task performance, interview, experience, and academic qualifications. These were obtained on the basis of seven rating scale (1-7). The record collected was from January 2009 to 2011.

Demographic Questionnaire

Demographic questionnaire included the demographic information of the employees, including their name, company name, designation, age, gender, marital status, and satisfaction level of their job.

Procedure

This case study cum survey research was based on the extensive studies of the organization, *i.e.* one following the employer branding and the one following the customized practices. For the sake of the data collection, the companies were formally accessed and the permission was sought. The employer branding was evaluated through employer branding check list which was made on the basis of previous literature. Recruitment records of these employees were sorted out from the companies. For finding out the effect of employer branding focus group was conducted of the employers of two groups of the companies. The scores of recruitment facilitation scale indicated how conveniently, the recruitment process takes place in an organization.

Ethical Issues

Following ethical issues were fulfilled/ maintained in the study under speculation:

Informed Consent

All the data was acquired from the participants with their permission and will. The objectives were explained to all the participants from whom the data was collected. The organizations' heads were also be contacted for the due permission.

Debriefing

This refers to the process of explaining the exact aims and objectives of the research to the participants and this also involves the clarification of all dubious notions in the minds of the participants, including the answers to all the queries that are raised by the participants, pertaining to the research.

Confidentiality

It was assured that the data sought from the organizations will be kept confidential and no information related to the participants or the organization will be used other than that of the academic and empirical objectives; thus no breach of confidentiality will take place.

III. RESULTS

For the present study Pearson Product Moment Correlation analysis and Independent sample t-test was used to assess the data.

TABLE 1

Independent Sample t-test Comparing Recruitment Records and Perceived Employer Branding of Group *A* and Group *B*

	Group *A* *n* = 150		Group *B* *n* = 150		t	df	p
	M	SD	M	SD			
Recruitment Records	4.10	0.90	4.60	0.72	5.298	298	0.00
Perceived Employer Branding	3.55	0.42	4.58	1.18	9.981	298	0.00

*p < 0.05

Independent sample t-test was applied to compare the recruitment records and perceived employer branding of two groups of companies. Results showed the significant difference in recruitment records of the two groups (p = 0.00, N = 300, df = 298). Means showed that recruitment records of group *B* were higher than group *A*. further results of independent sample t-test analysis revealed a significant difference between scores of perceived employer branding of both groups (p = 0.00, N = 300, df = 298). Means showed that scores of group *B* were higher than group *A*.

TABLE 2

Correlation Between Recruitment Records of Participants and Perceived Employer Branding (N = 300)

	Recruitment Records	Perceived Employer Branding
Recruitment Records	–	0.584**

**p < 0.01

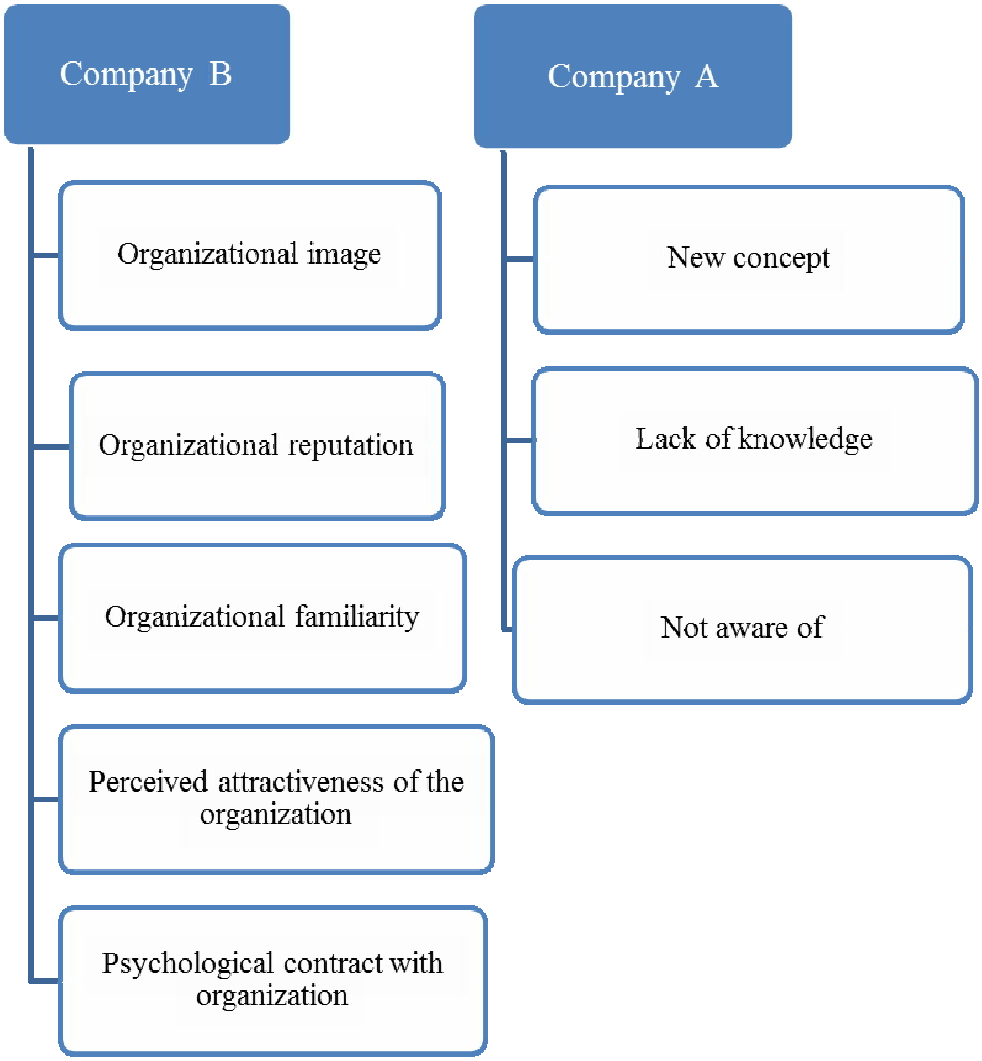
Results of the correlation revealed that there is a significant positive correlation between recruitment records of participants and perceived

employer branding scores at 0.01 significant level ($r = –0.584$, $N = 300$, $p < 0.01$).

Results of the correlation and t-test analysis showed that employer branding and recruitment are related to each other. The recruitment records of employees and employer branding have significant positive correlation. Whereas the organization that uses employer branding and the one that doesn't use employer branding are different in their recruitment and selection.

FIGURE 1

Factors of Perceived Employer Branding



Qualitative Analysis

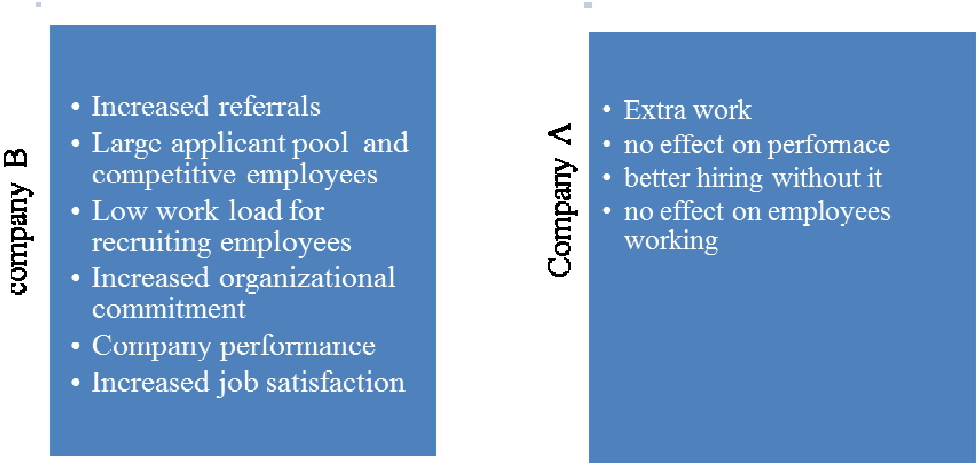
Results of the focus group indicate that there is a difference between perceived employers branding of employees of two companies. Company *B* was having know-how about perceived employer branding and another thing that they explained was their psychological contract with the organization. Company *A* was not aware of the concepts for them that concept was not that much important. Results are shown in Figure 1.

Effects of Employer Branding

Results of focus group with employers indicated that company *B* showed more positive effects of perceived employer branding and for company *A* it was not that much worthy thing. Employers of company *A* showed that using Perceived Employer Branding would Increase referrals, Large applicant pool and competitive employees, Low work load for recruiting employees, Increased organizational commitment, Company performance, and Increased job satisfaction. For the company *A* it was an extra work and having no effect on performance of employees or company. Results are shown in the Figure 2.

FIGURE 2

Effects of Employer Branding



IV. DISCUSSION

This research aimed to explore the concept of employer branding and its relative advantages of using employer branding in recruitment process. Employer branding is an organization's marketing of its offers that it is given

to its potential and existing employees. Further employer branding involves techniques to attract employees, communicate with them effectively and maintain their loyalty to the organization. In short it involves people management.

In the current research impact of employer branding on recruitment and selection process has been studied. Two types of companies/organizations were included in the sample; one that was practicing employer branding and other one that was not practicing it. The results of two companies showed that there was an association between the facilitated recruitment scores and in the perceived employer branding score. The company *B* which is using employer branding strategy have highly positive association than company *A* which is not using employer branding strategy. These findings of the study are consistent with the literature as it suggests that positive employer branding increases the intention of applicants to get that job. According to Lievens, Van Hoye and Anseel (2007) organizational image is very closely related to applicant attractiveness to the organization and organizational identification. The results also show that attractiveness of the organization is predicted by employer image, employer branding and employer familiarity and employer reputation.

Lievens and Highhouse (2003) find that symbolic trait conclusion of organizations have additional value over and above active job and organizational attribute like pay or other increments in explaining a company's perceived attractiveness as an employer.

Organization brand presents information that contributes to formation of a psychological contract between the organization and the employee. According to Robinson and Rousseau (1994) accurateness of organizational image is very important, it gives reputation to the organization. If they don't have organizational image they don't want to stay in the organization. They want to quit, they don't want to be the part of that organization any more that shows lower job performance and if organization has organizational image, employees want to be part of it (Chapman, Uggerslev, Carroll, Piasentin and Jones, 2005; Robinson and Morrison, 1995; Robinson and Rousseau, 1994).

The results of the study also indicate that positive image of the employer is important for getting more applicants. Employer branding helps organizations to attract and retain high performing employees and increases the number of applicants. Turban and Cable (2003) conclude in their study that higher the positive perception of organization, there will be increased applicant pool. This is a positive point for the progress of the organization. By attracting and retaining people with the right attitude and for the right job,

the organization can create a more productive workforce to gain a long term success.

Study shows that proportion of hires from employee referrals will increase as a result of company employees' increased satisfaction and information about what makes their organization better than others. Increase in the number of referrals will be helpful in that it increases employee tenure in the recruiting process and at the same time reduce recruiter's workloads (Sullivan, 1999).

The results also reveal an important issue which is the reputation of the firm that is also an important factor for employee branding. Awang and Jusoff (2009) find that there are there very important factors of company emotional appeal towards the organization, emotional appeal towards that reputation, and social responsibility of the organization, contribute tremendously to the company standing of the organization.

Results also indicate that perceived brand image is positively associated with organizational commitment of employees. Levinson (2007) also propose that employees want to stay in the organization if they get what they want. They show more engagement with the organization and organizational commitment associated with organizational commitment.

Results also reveal that positive employer branding increase the job satisfaction of employees. As Riordan, Gatewood and Bill (1997) conclude that organizational image is positively related to job satisfaction and negatively related to intentions to leave the organization.

Employer branding helps to increase performance of the company. According to Ambler and Barrow (1996), the most important thing is that employer branding is helpful in achieving success for the organization. It gives him importance in the competition.

If an organization has been facing continuous talent scarcity, employer branding can help to get out of it. Employer branding is basically a process of creating organizational image and making organizational identity. This helps in attracting employees and right people for the right job. Employer brand develops the image of the organization and highlights what the company delivers to the employees, customers, public and shareholders. It also helps in recruiting talent saving time and budget and helps to overcome the shortage of talent.

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