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Impact of Democracy, Political Instability and Policy Uncertainty on Private Investment: A Case Study of Pakistan
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Impact of Democracy, Political Instability and Policy Uncertainty on Private Investment: A Case Study of Pakistan

Asad Mahmood Bhatti, Amanat Ali, Muhammad Nasir and Waheed Iqbal

Abstract
This paper examines the impact of political institutions on growth through the investment in private sector of Pakistan. Three main determinants of private investment in the politico-economy are democracy, political instability and policy uncertainty. The empirical results show that political instability and policy uncertainty are negatively related with gross fixed capital formation whereas democracy is not significantly affecting the level of private investment in case of Pakistan.

I. Introduction
The recent literature on growth indicates the importance of political stability in the growth of economy. Feng (2001) investigated the relationship between political freedom and investment, and found that it is positive. Feng and Chen (1997) also found democracy and investment to be positively correlated with one another. Ali (2001) shows that growth and political instability are negatively related to each other. Furthermore, for the investors and entrepreneurs micro-instability may not be taken that seriously as macro-instability. Similarly, uncertainty in the policies is also a key factor in determining growth of an economy. It has been empirically found that countries where there are fluctuations in the policies have led to the deterrence of private investment and hence growth (Ali 2001). Also consistency in the implication of long-term policies has been preferred over to short-term policies.

The objective of this paper is to study the significant effect of political freedom, political instability and policy uncertainty on the investment in the private sector of Pakistan. The determinants of private investment are economic, political and socio-economic. To be particular, our interest is to check that which of the following three models explains most of the variations in private investment. Is it the model with economic variables? Is it the model with political variables and finally is

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it the model with both economic and political variables that explains more of the variation in private investment in Pakistan?

This paper is organized in the following manner. There are five sections. Section II reviews the literature available on growth and its determinants: private investment in particular. Section III presents the theoretical model used in the study. Section IV describes the data and estimation procedure and presents empirical results. The last section V provides the conclusion and policy implications.

II. Review of Literature

Three main factors that effect the private investment in political economics are; democracy, political instability and policy uncertainty. The theoretical background of the effects of politics on the private investment was given by Feng and Chen (1997). This study suggests that, whatever is the level of political capacity of a government that it achieves or attain, the government that has fluctuations in its competency or waver between being a weak or a strong government is bound to induce uncertainty relating economic issues as compared to government that has a stable political capacity and a consistency in their policies. Therefore, private investment becomes a decreasing function of the political uncertainty.

The effect of political freedom (democracy) on investment and growth is a contradictory hypothesis. The existing literature indicates that one group of researchers favor the democracy to promote the private investment, where as, other one is opposite to it. The first one emphasizes the statement that can be categorized into two. (i) some economists; Persson and Tabellini (1990), Alesina and Rodrik (1994) have pointed out that where there is democracy and presented by the majority of a poor class i.e. the median voter belongs to a poor class then there will be incentives for the investors to invest less and hold on to their capital as they would be deprived of their rights when the redistribution will take place. Then there are those who speak in favor of democracy and promote that there is positive relation between political freedom and investment. (ii) According to others when there is political freedom, there is a desire for immediate consumption which reduces the quantity of resources at the disposal of the economy from which investment can be made, so investment reduces (Huntington and Dominguez, 1975).

If there is an autocracy or a dictatorship, there might be consistency and stability in the government but still autocracy lacks stability of a regime. Moreover in a democratic system, there is a political nature of democracy that is the essence of large investments and growth. In a democratic system, on one side there is support of the people on a large scale and on the other the method of consensus makes the political process more efficient and secure. The comparison that the investor makes is between the potential change of a regime under autocracy or the policy adjustments under a democratic government, which also reduces the long-term radical political change. But empirical approach does show the linkage of democracy with
investment. Pastor and Hilt (1993) finds that political freedom has a positive impact on the investment in private sector.

Political instability is another important issue, which effects the accumulation of capital and directly hits the investment plan. Along with political freedom the competency of the government and the stability of a regime play a key role in influencing the private investment. The instable regime mostly displaces people where they loose their jobs. Thus, it makes not only difficult but also impossible to save money under these circumstances. As there would be fewer saving it would be difficult for the investors to invest money in fixed capital stock and the only option left will be to hold their portfolios and assets in liquid form. Feng (2001) lists “in times of political instability both the supply of investment capital by savers and the demand for capital by investors will decrease”. Feng (1997) finds that government that changes irregularly and unsystematically clearly cost the investors which makes them cautious to long term investment. Almost all the economists who favor that the democracy promotes investment and growth having the view that instability in the regime hinders it. Alesina et al. (1996) finds an existence of inverse relationship between political instability and investment. Not only political instability creates havoc in the resource allocation and investment planning causing decline in the saving but also hits saving by decreasing the number of job opportunities. Instable regime provides less property rights and with hold foreign investment.

The issue of policy uncertainty is concerned with the uncertainty generated in an economy through changes in the policies. Here the total attention is towards the inconsistency and competency in the government policies and not in the changes of the political system. According to Brunetti and Weder (1998) the uncertainty in the policy can be measured through the “volatility of the institutional framework or through the volatility of outcomes”. The fundamental rationale of the fact that when there will be an increase in the policy uncertainty, it will cause investment to decline. Because if there is uncertainty in the policies, the risk avers investor tried to get the reward in form of profit by waiting. This waiting causes the investment to stop and hence leads to investment decline. There is a vast amount of literature that empirically tested the various impacts of uncertainty on investment. Many economist have put forward this issue namely Serven and Solimano (1993), Alesina and Perotti (1996) and Brunetti and Weder (1998). According to Feng (2001), “A strong government with a good policy is able to produce outcomes better than a weak government with the same good policy, but a strong government with a bad policy may produce catastrophic consequences compared to a weak government with the same bad policy”. Rodrik (1989) finds a strong inverse relation between policy uncertainty and private investment. Brunetti and Weder (1998) find that majority of the proxies that they have used for the measurement of policy uncertainty are negatively related to the investment in the private sector and growth.
III. Analytical Framework

1. Background of the Basic Model

There are two kinds of investment activities. Firstly, investment activity can be carried out in a market under the influence of the government and secondly, investment activity can be carried out in a market not under the influence of the government. When the investment is made in a market under the influence of the government the investment return is a random variable due to the random effect of government policy and its politics that are established. So this return is given as:

\[ R^* = (1 - \tau)r \quad (1) \]

Where:
- \( R^* \) = Investment returns under government influence and \( R^* \) is a random variable
- \( \tau \) = Cost of government policy on investment
- \( r \) = Certain return without government influence

Now \( \tau \) is distributed normally with the expected value of \( \tau \) as \( \bar{\tau} \) and the variance of \( \tau \) as \( \sigma^2_\tau \). From equation (1), which shows, that government policy has effect on returns it can be observed that \( \tau \) is playing both a positive and a negative role i.e.

\[ \tau < 0 \quad \text{Government policy has a negative effect on investment returns} \]
\[ \tau > 0 \quad \text{Government policy has a positive effect on investment returns} \]

So \( \tau \) is interpreted as the politics that affect the private investment. In this context equation (1) states that while investing in the private sector the government policy has it both a positive and a negative effect. Positive externalities of \( \tau \) include provision of public goods etc and negative externalities of \( \tau \) include violation of property rights etc.

When the investment is made in a market not under the influence of the government the investment return is certain due to the certain effect of government policy and its politics that are established. So this return is given as

\[ r^* = r \quad (2) \]

From equation (2), which shows, that government policy has no effect on returns the investor invests in the private capital market where both the politics and the policy have no effect on the capital return. This sort of market is assumed to be the case of outflows where the investors send their money abroad because they are fearful of the negative consequences of the government interventions at the domestic grounds hence home government is able to do nothing on the returns that is from investing capital abroad. The authors further assume that in the first market there are initially \( N \) investor, which is given by equation (1), each of them endowed with one unit of capital to invest. Equation (2) shows that with the given considerations they make the decision whether to switch to the alternative market or not. Further the authors assume that for the investors to invest they would have to bear an entry cost or exit
cost: \( \varepsilon \in (0, \infty) \). If there is no entry cost or exit cost all of the investors will invest in the market that will give the investors a certain return, given government policy has a negative effect on investment returns. In the entry cost \( \varepsilon \), the investors differ with each other and that entry cost \( \varepsilon \) is distributed according to the probability density function \( f(\varepsilon) \). So as a result with the entry cost \( \varepsilon \) the value of switching to the certain investment activity is

\[
V_c = r/\delta - \varepsilon
\]

(3)

Where:

\( \delta \) = Discount Factor

The authors has assumed for the sake of simplicity that once the investor makes the investment in any one of the two markets it will stay in the chosen market and not change again. If the decision by the investor is to stay in the uncertain market, then their investment value is

\[
V_u = (r - \bar{r})/\delta - \nu(\sigma^2_{\varepsilon})
\]

(4)

Because when the government politics will be having a high variance the value of the investment for a risk avers investor decreases. The investor will stay in the uncertain market if \( V_c < V_u \), i.e.

\[
V_c = r/\delta - \varepsilon < V_u = (r - \bar{r})/\delta - \nu(\sigma^2_{\varepsilon})
\]

(5)

Which will lead to?

\[
\varepsilon > \bar{r}/\delta + \nu(\sigma^2_{\varepsilon}) = \varepsilon_0
\]

(6)

Where:

\( \varepsilon_0 \) = Critical value of the entry cost

Thus, the investors will stay in the uncertain market only with \( \varepsilon > \varepsilon_0 \). From equations (5) and (6), it can be shown that the total amount of investments that remain in the uncertain market is

\[
I = N \int_{\varepsilon_0}^{\infty} f(\varepsilon) d\varepsilon
\]

(7)

From equation (7) the authors derive the effects of the expected economic cost of government policy and the variance of the cost of government policy on investment in the private sector of the economy. These two are the effects that the ongoing politics of the government currently in power have on the investment in the private sector of the economy.

By differentiating equation (7) with respect to \( \bar{r} \) and \( \sigma^2_{\varepsilon} \) we get the following comparative static results.

\[
dI/d\bar{r} = -Nf(\varepsilon_0) d\varepsilon_0 / d\bar{r} = -Nf(\varepsilon_0) r/\delta < 0
\]

(8)
\[
\frac{dl/d\sigma^2}{\sigma^2} = -Nf(\varepsilon_0)d\varepsilon_0/d\sigma^2 = -Nf(\varepsilon_0)\mu(\sigma^2)0
\]

Equation (8) confirms the intuitive reasoning that government politics that increases the expected economic cost will cause the investment in the private sector to decrease and that the government politics that decreases the expected economic cost will cause the investment in the private sector to increase. Equation (9) states that the variance of government politics on investment will also affect the amount of investment that takes place in the private sector of the economy. Higher the variance of government politics on investment will cause the investment to decrease and lower the variance of government politics on investment will cause the investment to increase.

2. **Model Specification, Variables and Data Sources**

So far we have followed the model that was developed by Feng and Chen (1997). The contribution that is made from here is that we are directing the model to the case scenario of Pakistan in which the variables that we will be linking with the model will be specific and the analysis that will be performed will be time series. Now there are two sets of variables that we need to link with the model. The first set of economic variables is the one, which are the indicators of the economic performance of a country. Among the economic variables used are the expected growth, inflation rate, literacy rate, real gross domestic product per capita and the public investment. Expected growth is the growth that is anticipated by the private sector investors based on the past economic performance of the economy. More investments will be there by the investors in the coming future the better the past economic record of growth of an economy is. An inflation rate effect on private investment is not clear. On one side inflation rate is considered to spur the investment activities and on the other side it is the cause that dampens it. According to the Tobin-Mundell Model an anticipated inflation causes the real interest rate to fall down which increases the investment, as there are changes in the adjustments of the portfolios that takes place. Others have propagated that the higher anticipated inflation will cause the economy to dampness and thus will reduce the investment activities.

Literacy rate is one of the key determinants of the private sector investments. Increase in the literacy rate will increase the human capital formation and a well-educated labor force can make better and efficient use of the capital that they are disposed with resulting in the higher returns. Real gross domestic product per capita is again influencing the investment in the private sector. If the real gross domestic product per capita is higher at the initial level then this means that the development of the economy is there. This development reflects more organized market system with holding rules and regulations under the free marketing laws. In such a situation the investments opportunities are more vacant and investment is always more conducive to such situations that are prevailing. Public investment increases the expectations of the private investors like provision of infrastructure. With these facilities the marginal product of private investment increases.
The second set of political variables is the one, which are the indicators of the social and political performance of a country. Among the social and political variables used are democracy, political instability indicator and policy uncertainty measure. Democracy is a variable that represents the civil liberties and political rights in a nation. The fundamental nature of the democratic process is the key to its relation with investment in the private sector. Where there is democracy there are civil liberties and political rights providing investors a secure opportunity to invest their capital. Political instability indicator is an index that is used to show the level of instability in the politics of a country. All the negative impacts of the variables that cause political instability are captured with this index. Negative externalities arising from revolutions per year, coups d'état per year, riots per year, strikes per year and number of terrorist attacks per year etc all leave its negative effects on the investment in the private sector. Policy uncertainty measure is a variable that is reflecting the change in the policies that are due to the change in the fiscal, monetary and trade policies of an economy. This sort of change is mainly caused by the major governmental change. Because of this the investors loses its confidence and would hesitate to invest in the private sector of an economy. Thus our main regression equation is as follows:

\[ PRI = \alpha_0 + \alpha_1 GDP + \alpha_2 INF + \alpha_3 LIT + \alpha_4 GDPPC + \alpha_5 PUB + \alpha_6 DEM + \alpha_7 INS + \alpha_8 UNC + \varepsilon \]  

(10)

We quantify the dependent variable of private investment \((PRI)\) in the form of gross fixed capital as a percentage of GDP. Expected growth \((GDPG)\) is measured by the average growth rate of real GDP Per Capita over time. Inflation rate \((INF)\) is measured by Consumer Price Index. Literacy rate \((LIT)\) is the socio-economic variable that we are using in our regression equation. We use the most common measure, which is called the adult literacy rate. GDP Per Capita \((GDPPC)\) is the gross domestic product divided by midyear population. Public Investment \((PUB)\) is described as the expenditure on the public sector of the economy as a percentage of GDP; it includes all government expenditures for the purchases of goods and services.

Democracy \((DEM)\) is the political variable that we are using in our regression equation. There are two sub-variables that are used to construct this main variable of democracy. These two variables are civil liberties and political rights. Civil liberties and political rights are ranked on a scale from 1 to 7 where 1 reflects the highest degree of freedom and 7 reflects the lowest. We take the average of these two variables for the representation of the state of political freedom or political instability in the region. We will be using an index for the measurement of political instability. For the construction of this index all those variables are put into consideration, which cause of the instability in the political system. So in the total five variables are taken which are revolutions, coups, riots, strikes and terrorist
incidents and all are numbers of occurring per year. Each of the variables is assigned a value of 0.1 in the particular year of its occurrence and the index is constructed. The higher value of the index reflects higher political instability and the lower value of the index reflects lower political instability. Policy uncertainty in our regression equation is measured by the use of a dummy variable. We have assigned the dummy variable taking the value of 1 in the years where there have been major governmental changes. This governmental change reflects the change in the fiscal, monetary and trade policies. The change in the government is taken as both the constitutional change and the unconstitutional change. The left over years where there have been the same government in power the dummy variable have been assigned a value of 0, which reflects no change in ongoing policies.

The data series for private investment are taken from World Development Indicators (WDI) and other explanatory variables are collected from Freedom House, World Development Indicators (WDI), and World Institute for Development Economic Research (WIDER).

IV. Empirical Findings

The cointegration method of estimation is used, when all the variables are integrated of order one, then co-integration analysis is used for estimation purpose. However, if most of the variables are stationary at their first difference and some are stationary at level, then Auto Regressive Distributed Lag (ARDL) model is normally used. Since ARDL is not a much-recommended technique, hence in such case partial co-integration analysis can be carried out using the Engle-Granger Approach. In this process, the error terms of the regression result are checked for stationarity. If these are found to be stationary at level, it is concluded that the long-term relation between the variables exist.

The study was focused to test whether democracy, political instability and policy uncertainty affect private investment. For this purpose, first, time series properties of the data were tested. We applied ADF test on all the economic and political variables. The results of the ADF test are given in table 1, which indicates that all of the variables are stationary at first difference except for GDPG and LIT that are stationary at the level. Hence, we made use of the partial co-integration approach for the estimation purpose. Regressions for several models with different variables and alternative specifications are estimated to check for their robustness. This also helps in dealing with the problem of multi co-linearity. We have carried out least square estimation procedure in general. This is the most appropriate way to capture the effects of independent variables on the dependent variable. The problem of multi co-linearity was considerably reduced by the alternative specifications and use of different variables in regression models. Auto correlation problem was also tackled and much of the auto-correlation was removed. The models explained more of the variations in the dependent variable of private investment. The remaining of
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Table: 1. ADF Unit Root Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level / First Difference</th>
<th>With Trend</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRI</td>
<td>Level</td>
<td>-2.433702</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-4.367836</td>
<td></td>
</tr>
<tr>
<td>GDPG</td>
<td>Level</td>
<td>-5.096374</td>
<td>I (0)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-10.90947</td>
<td></td>
</tr>
<tr>
<td>INF</td>
<td>Level</td>
<td>-0.441466</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-4.400648</td>
<td></td>
</tr>
<tr>
<td>LIT</td>
<td>Level</td>
<td>-4.197721</td>
<td>I (0)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-7.828683</td>
<td></td>
</tr>
<tr>
<td>GDPPC</td>
<td>Level</td>
<td>0.178316</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-3.733434</td>
<td></td>
</tr>
<tr>
<td>PUB</td>
<td>Level</td>
<td>-0.624178</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-4.053062</td>
<td></td>
</tr>
<tr>
<td>DEM</td>
<td>Level</td>
<td>-2.031309</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-5.915410</td>
<td></td>
</tr>
<tr>
<td>INS</td>
<td>Level</td>
<td>-1.559873</td>
<td>I (1)</td>
</tr>
<tr>
<td></td>
<td>First Difference</td>
<td>-5.910269</td>
<td></td>
</tr>
</tbody>
</table>

the variation may be due to other factors influencing investment in the private sector or it may be due to chance.

By using the least square estimation technique, we have tested several models with the help of economic, socio-economic and political variables. Table 2 reports the obtained results. In Model 1, we have initially considered only the economic variables that can effect the investment in the private sector. It is evident from the results that all the economic variables are significant at their standard levels. We interpret each economic variable one by one. GDP Growth turned out to be highly significant at the 1% level of the test and has the expected positive sign. As there is an increase in the expected growth it will attract the private investors and higher expected growth will eventually lead to large private investment as a percentage of GDP, the result is consistent with Feng (2001). The result for inflation is positive and significant at 5% level. We can say that in this case Tobin-Mundell hypothesis holds empirically. Contrary to our expectations, real GDP per capita, which is used to show the initial conditions of development in a country, turned out to be negatively related to private investment. However, this variable is significant only when the test is relaxed to 10% level. Possibly due to the concept of diminishing marginal returns the initial conditions of the economy is negatively related with the private investment. Barro (1997) has obtained similar results. The coefficient of public investment is highly significant at 1% level of the test. The result, as expected, is positive. In our case public investment and private investment are complements to each other. Larger the infrastructures built-up the larger will be the marginal utility of the private investor. This result is consistent with Taylor (1988). In Model 2, we have included the socio-economic variable of literacy rate. The inclusion of this
variable in our statistical model has originated very interesting results and has made the regression analysis to be discussed in detail. Firstly, the results of literacy rate contrary to our expectations have turned out to be negative. This variable is insignificant according to our estimation even when the tests were relaxed to higher level. Secondly, the negative results show that an increase in the level of education will result in the fall of investment in the private sector. For the case of our sample country this result can be justified as follows: Pakistan is a country in which the major contribution to the national income is largely by the agriculture sector. Then comes the sector of manufacturing in which textiles takes the major share and in the end comes the

<table>
<thead>
<tr>
<th>Table: 2. Politico-Economic Models of Private Investment</th>
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<tbody>
<tr>
<td>Model 1</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>GDP Growth</td>
</tr>
<tr>
<td>Inflation</td>
</tr>
<tr>
<td>Literacy</td>
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<tr>
<td>GDP Per Capita</td>
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<td>Public Investment</td>
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<tr>
<td>Democracy</td>
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<tr>
<td>Political Instability</td>
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<tr>
<td>Policy Uncertainty</td>
</tr>
<tr>
<td>R²</td>
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<tr>
<td>D.W</td>
</tr>
</tbody>
</table>

Standard Errors are in parentheses. *, **, *** show the level of significance at 10%, 5%, and 1%, respectively.
services sector. Though services sector contributes a lot but it is the only sector which require the higher human capital and hence literacy level. As far as agriculture sector is concerned the farmers and the labors required are equipped with old methods and techniques of cultivation and hence their return is not dependent on the level of education. So this independent relation will make the investor not to invest in the agriculture sector when taking account of the literacy level. The same is the case scenario for the manufacturing sector in which textiles takes the larger share of the pie. The services sector may not be able to accommodate the private investors because of ongoing high competition. So, eventually there will be little room left for the investment of the fixed capital formation causing deterrence in the private investors. Thirdly, by the definition of this variable, it includes all those individuals of age fifteen and above who with understanding can read and write a short statement. By this definition it also includes a large majority of those labors that are not actually contributing to the increase in private investment based on human capital formation due to the nature of the standard of the education that they receive.

In Model 3, it can be seen that both political instability and policy uncertainty turned out to be highly significant at 1% level of the test with the expected negative signs. This result is consistent with Feng (2001). As there will be increase in political instability and policy uncertainty it would lead to a smaller magnitude of private investment. However, for the case of democracy we have found the results opposite to our expectations. The coefficient of this variable is negative and insignificant. The reason might be that in Pakistan democracy has never been practiced in its true essence. Through out the history of this nation we find that a military dictator has overthrown the democratic governments. This dictator at the fall of his legend leaves his power to a puppet prime minister incapable to make key decisions. This results in the loss of the confidence that the private investor has in his plans thus deterring the investment of fixed capital formation.

Model 4, presents the estimates for both economic variables and political variables. It is found that the estimation of this politico-economic model explains more of the variation in private investment than when each of the economic model and political model is estimated individually. We have found very interesting results after estimating this model. Both political instability and policy uncertainty are highly significant at their standard levels and their coefficients are negative. Democracy, however, has been dropped from this model due to its insignificance in the previous estimation. As far as economic variables are concerned we have found out that public investment is highly significant at 1% level of the test with positive sign of its coefficient. Interestingly, GDP per capita have turned out to be significant at 10% level of the test with a negative sign of its coefficient. This means that when there is political instability and policy uncertainty the initial condition of the economy does matter. Also we have observed that expected growth becomes insignificant after the inclusion of political instability and policy uncertainty. It might be a case that the private investor looses its optimistic approach and see his costs
more than his benefits in the presence of political instability and policy uncertainty. The variable of inflation is not included in this estimation because of its high multi co-linearity with GDP per capita.

In Model 5, the political variables have almost the same results as in the previous model. As far as economic variables are concerned we have found that public investment is still positive and significant but at 5% level of test rather than 1% level. As mentioned above, between the two i.e. GDP per capita and Inflation, we have selected inflation and have dropped GDP per capita because of the problem of multi co-linearity. The coefficient of this variable is negative and significant at the 10% level of the test. The argument is that in the presence of political instability and policy uncertainty there is higher anticipated inflation, which dampens the economic activities and thus decreases the investment in the private sector. Indeed, Kormendi and Meguire (1985) and Schneider and Frey (1985) empirically found a negative relation between investment and inflation. Taking account of the growth variable we have found it to be insignificant and having negative relation with the gross fixed capital formation. May be the presence of political instability and policy uncertainty is the root cause of such result.

V. Conclusions and Policy Implications

The major focus of this study was to see the impact of democracy, political instability and policy uncertainty on private investment. The empirical evidence indicated that not only the economic but also the political variables are key determinants of private investment in Pakistan. Among all the economic variables, public investment is the most robust one and inflation remains significant in all the models. The expected growth variable has shown its volatility in our analysis. It not only changes its significance but also changes its direction; when estimating a politico-economic model. Furthermore, initial conditions and education level has a negative effect on the private investment. However, education was insignificant in all economic models and GDP per capita showed volatility regarding its significance. Among the political variables, political instability and policy uncertainty both are highly significant with expected negative signs in all the models. Thus, we can conclude that these two variables are key determinant of private investment. Moreover, democracy has a negative sign contrary to our expectations but is insignificant.

The results of the study lead to several policy implications. Firstly, to increase private investment, it is necessary that a favorable economic climate be provided in such a way that the investor becomes optimistic towards the expected growth of the economy. This can only be achieved if the average growth rate of the economy is maintained. Secondly, democracy is very important for a nation to sustain investment. Thirdly, instability in politics deters the investment plans. There should be a fair play in politics and everyone should have fair opportunity. Finally, long-term policies with certainty in their implications should be preferred over short-
term policies to achieve stable and sustained investment and as a result stable economic growth which is the ultimate goal of economic policies of the government.
References


Corruption and Growth: A Nexus Revisited

Amjad Naveed, Abdul Jalil and Nisar Ahmad

Abstract
This study revisits the relationship between corruption and growth. The different indices are used to measure the corruption but this study uses the corruption perception index. We estimated the conventional Barro equation along with the set of control variables, using annual data series for 104 countries. The results indicate a negative impact of corruption on GDP per capita but it does not affect the GDP growth. It is suggested that authorities should concentrate on anticorruption policies along with other economic and non-economic reforms to enhance the level of GDP.

I. Introduction
Corruption is affecting human life from the beginning of human beings. Treisman (2000) emphasized that it is hard to conduct an empirical study on corruption and its determinants. It is also mentioned that corruption occurs in secret and it cannot be directly observed like the other variables. Therefore, the reliability of the measurement and the consistency of data series for this variable are important issues in any empirical study for corruption-growth nexus. However, in the recent years, some major advances are witnessed to measure the corruption. Researchers have begun to look, with a trust, at corruption indices that are produced by private rating agencies. We also use Corruption Perceptions Index (CPI) that is produced by Transparency International. To accomplish our task, we use a panel data consisting of 104 countries and 11 years of period from 1995 to 2005.

Many renowned researchers replicated the pioneer work of Barro (1991), pertaining to corruption, economic growth and investment. Indeed, the replication is an essential part of scientific methodology and it should naturally invite skepticism about empirical results that are reported in economic journals (Dewald et al. 1986). The corruption-growth nexus is and remained long debated issue among the development economists. Even the classical text book literature explained the stories that the self interests drive the firms to make cartels, prevent the new entries to get more profits than the equilibrium level and try to keep workers’ wages below equilibrium. Corruption is simply an exercise in self-interest. Adam Smith did not say that the self-interest in all aspects was good; but it was a fact. However, theoretically, the economists put their views through two so-called strands that are,
efficiency-enhancing strand (Leff 1964, Huntington 1968, Lui 1985, Beck and Maher 1986, Lien 1986) and efficiency reducing strands (Santhanam 1964, Myrdal 1968 Andvig 1991). The contradictory outcomes of corruption depend on the different economic and noneconomic factors. Most of the studies utilize the neoclassical growth model to investigate the relationship between corruption and growth. The rationale behind this practice is that physical capital; labor, human capital and institutional variable (like corruption) contribute to the steady state per capita income level. However, there is problem to model the corruption-growth nexus because of the differences between institutions, culture and religion and the rate of growth (Islam 1995, Triesman 2000).

Institution, especially ‘public institutions’, play an important role in controlling corruption. Klitgaard, (1998) pointed out that corruption is an outcome of pathetic state administration when an individual or organization has monopoly power over a commodity or service, discretion over making decisions, limited or no accountability, and low level of income. However, there are still two contradictory views (Lambsdorff 1999) First; corruption greases the wheels by enabling individuals or organizations to avoid bureaucratic delays. Second, corruption “sands the wheels” mainly by lowering the protection of property rights and misallocating resources. Kaufmann and Wei (1999) and Johnson et al. (1998) oppose the view about greases the wheels by finding the positive correlation between corruption and the size of the hidden economy. Treisman (2000) finds a positive impact of state intervention on corruption. World Development Report (1997) explains the correlation between corruption and a measure of policy distortion for 39 countries.

Following Barro’s (1991) pioneering work, there has been a remarkable expansion in the empirical literature on economic growth and investment. Mauro (1995), by using Business International Index (BI), found a significant negative relationship between corruption and the average annual economic growth rate over the 1960-85 periods. He also found the same relationship between corruption and the investment-GDP ratio and other kinds of investments for 1960-85 and for 1980-85 as well. Interestingly, he also found empirical support for the speed money argument, which states that in the presence of a slow bureaucracy, corruption can get bureaucrats to work faster. Mauro (1997) found that corruption reduces expenditures on health and education.

Researchers provide a number of studies on the relationship between growth and corruption over the last 10 years. This research has been facilitated by a growing number of efforts to measure corruption at the national level. Both negative and positive, and statistically significant, signs are reported in different studies. For example, the negative correlation between corruption and GDP is supported by Brown et al. (2005), Kunicova and Rose-Ackerman (2005), Lederman et al. (2005), Braun and Di Tella (2004), Chang and Golden (2004) and etc. On the other hand, some studies also proved the positive relation between these variables like Braun and Di Tella (2004) and Frechette (2001). The positive relation between corruption and
income distribution is supported by the findings of Paldam (2002) and Amanullah and Eatzaz (2007). Then Pelligrini and Gerlagh (2004) add trade openness as an additional channel through which the effect of corruption on the growth is transmitted. However, a negative relationship between trade openness and level of corruption is also pointed out by various studies like: Gurgur and Shah (2005), Brunetti and Weder (2003) and Knack and Azfar (2003). On the contrary, a positive relation between these two is supported by the findings of Graeff and Mehlkop (2003) and Paldam (2001). Mo (2001) showed that the lower human capital accumulation and undermining political stability are the channels through which corruption affects economic growth. Moreover, Meon and Sekkat (2005) investigated the relationship between corruption and growth through the channel of quality of governance.

Most of the above cited studies utilized the cross-sectional data that ignores the endogeneity problem. If there are, some studies that care the endogeneity with panel data have small sample. Keeping in view these drawbacks, we revisited the relationship by using a panel data of 104 countries. We utilize the most recent data set for the maximum number of countries. Moreover, for the main estimation, we do not estimate for any specific group of countries as other studies do. We try to include a vast set of control variables that are different, according to our best knowledge, to reduce the chance of model misspecification.

The rest of the study is designed as follows. The model and econometrical issue are discussed in the section II. The section III concentrates on the rational for the selection of variables and data sets. Empirical results are discussed in section IV. Section V concludes the study and suggests some policy implications.

II. Methodology and Econometric Issues

Following Barro (1991), this study uses the growth model in the presence of various geographic, policy, and demographic variables that are affecting the growth. Our benchmark model looks like as following:

\[ g_{i,t} = a + b_1 IGDP_{i,t} + b_2 CRP_{i,t} + \beta_1 X_{i,t} + \beta_2 Z_{i,t} + u_{i,t} \]  

(1)

Where, ‘g’ is average annual GDP growth rate, CRP is an index that is used to measure the corruption level, IGDP is the initial level of GDP, \( X \) is a vector of regional dummies, ‘Z’ is a pool of policy, geographic and demographic variables, and \( u \) is the error term. Moreover, “\( i \)” refer to the unit of observation; \( t \) refers to the time period.

It is possible that corruption and growth respond simultaneously to an omitted factor. Such factor could be, for example, a cultural disposition towards

\[ \text{It is important to mention here, we also carried out estimation for different groups of countries but do not find any contradictory results with our main estimations.} \]
leisure or morality, the legal framework, the historical evolution of the nation in question, etc. Moreover, corruption may directly be affected by the rate of economic growth; as for example, it could be the case that rich and fast-growing countries have more resources to combat and control corruption. In either case, corruption would be correlated with the error term in the OLS regression and the estimates would be biased.

Many studies in the past have used instrumental variable techniques as an attempt to correct this potential bias. The main instrument in the literature has been the Ethno Linguistic Fractionalization (ELF) index. This variable, however, has been shown to be directly and indirectly correlated with economic growth (Easterly and Levine, 1997) and thus, it cannot be considered as a valid instrument in our regressions. Another method is widely used by different previous studies by taking averages of the variables. The use of averages reduces short run fluctuations and allows us to concentrate on the relationships of interest for this study.

In this study, we used fixed effect regression where the variables are averaged over three-year period: 1995-1997, 1998-2000, 2001-2003, and 2004-2005. Four observations are for each country. The last observation is average of two years because of data availability problem.

### III. The Data and Chart Analysis

We are focused to investigate the relationship between corruption and GDP growth. Therefore, the main variable of concern is corruption. It is important to mention here that corruption occurs in secret and it can not be directly observed like the other variables. Therefore the reliability of the measurement and the consistency of the data of this variable is an important issue in any empirical study for corruption-growth nexus. There are several indices that measure different aspects of corruption, such as the Business International Index (BI), the Institute for Management Development index (IMD), the International Country Risk Guide index (ICRG) from Political Risk Services, the Corruption Perceptions Index (CPI) from Transparency International and the World Bank’s Control of Corruption Index (CCI). Among these, CPI, CCI and ICRG indices are widely used for the empirical analysis. The ICRG index ranks the country on the basis of expert opinions. Importantly, it does not measure the corruption but it indicates about the political risks involved in the corruption (Lambsdorff 2004a, 2004b). Triesman (2000) also cautions and finds some rankings by the ICRG index puzzling. On the other side, CPI and the CCI are based on a number of separate surveys of businesses’ perceptions of corruption. For this study we use CPI following some recent studies like Gyimah-Brempong and de

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3 For detail see: Easterly and Levine, 1997.
4 Many other studies have used five-year averages for similar purposes. See, for example, Deinlinger and Squire (1996), Li et al. (2000), Fabio and Sepulveda (2004), and Paldam (2002, 20003).
Comacho (2006), Gyimah-Brempong (2002), and Ganuza and Hauk (2001) because it is available on the annually basis while the CCI is available only every other year. Therefore, it permits a larger set of data as compare to CCI. It measures perceived corruption rated on a scale from zero (most corrupt) to ten (no corruption). It has the advantage, as mentioned before, of being posted consecutively since 1995 for most countries in the sample. The expected direct effect of the CPI (higher value of CPI indicates a low level of corruption) on GDP is positive.

Other variables are taken, mostly, from World development Indicators (WDI 2006). These are GDP per capita level and growth, gross Fixed Capital formation percentage of GDP, gross enrollment rate in secondary schooling (SED), Public spending on education (PSED), Foreign Direct Investment as a percentage of GDP (FDI), average annual population growth (POP), openness measured as ratio of exports plus imports to GDP (OPEN), general government final consumption expenditures percentage of GDP (GEXP) and inflation measured as, log of Consumer Price Index (INFL). Along these variables, some important dummy variables for cultural and regional affect are also in this setting. For example, LA is a dummy variable taking the value of 1 for Latin American countries and 0 otherwise. Similarly, SSA for Sub-Saharan African, SA for South Asian countries, EAS East Asian countries, EU for European countries, OECD for OECD countries and MUS for Muslim countries are used.

The following two figures show the relationship among GDP growth and GDP per capita with corruption. Actual averaged data is used for the relationships. It is argued that high growth is associated with less corruption. As CPI increases growth rate will increase. The figure 1 depicts a weak relationship. Next relationship

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5 For detail see: net source (http://www.transparency.org).
is between log of GDP per capita level and corruption. The idea is about transition hypothesis. Corruption decreases when poor and middle-income countries moves through the grand transition from low income to high income. Fig. 2 shows strong evidence about transition hypothesis.

IV. Empirical Results

We estimated the two versions of the model that is specified by equation 1. One is estimated to investigate the relationship between corruption and GDP per capita and the other one is for the relationship between corruption and growth rate of GDP per capita. Table: 1 shows the result of fixed effect with; set of control variables, constant and time dummies by using log of GDP per capita as a dependent variable.

The coefficients of initial GDP have positive sign but insignificant meaning no sign of convergence as expected. It is evident from the table that our variable of interest, CRP, has positive sign and statistically significant. It indicates that as corruption goes down (corruption index goes up), the level of GDP must increase. The figure 2 also presents the same relation between these two variables. Therefore, it reflects that the countries, which are less corrupted, have high level of per capita, and vice versa. So analysis of causality is important to discuss. Therefore we also test the Granger Causality between these two and other variables. The quantitative effect of corruption index on log of GDP per capita can be measure by following Wei (1997). For example according to results table 1 column 4 the coefficient of CRP is

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8 The results of Fixed Effect with out time dummies are available on request.
### Table: 1. Dependent Variable is Log of GDP/Capita

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>8</th>
<th>Fixed Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnGDP-1</td>
<td>0.177 (0.088)</td>
<td>0.167 (0.09)</td>
<td>0.165 (0.112)</td>
<td>0.079 (0.103)</td>
<td>0.0573 (0.101)</td>
<td>0.032 (0.098)</td>
<td>0.101 (0.118)</td>
<td>0.086 (0.084)</td>
<td>-0.378 (0.0662)</td>
</tr>
<tr>
<td>CRP</td>
<td>0.311* (0.059)</td>
<td>0.307* (0.063)</td>
<td>0.162** (0.069)</td>
<td>0.285* (0.061)</td>
<td>0.216* (0.073)</td>
<td>0.197* (0.067)</td>
<td>0.107 (0.083)</td>
<td>0.245* (0.067)</td>
<td>-0.194 (0.134)</td>
</tr>
<tr>
<td>SED</td>
<td>0.001 (0.003)</td>
<td>0.0008 (0.003)</td>
<td>0.004 (0.003)</td>
<td>0.005*** (0.003)</td>
<td>0.002 (0.003)</td>
<td>0.059 (0.105)</td>
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<tr>
<td>PUBSED</td>
<td>0.101 (0.096)</td>
<td>0.004 (0.003)</td>
<td>0.005*** (0.003)</td>
<td>0.002 (0.003)</td>
<td>0.059 (0.105)</td>
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<tr>
<td>INFL</td>
<td>-0.123 (0.118)</td>
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<tr>
<td>UNEMP</td>
<td>-0.030 (0.024)</td>
<td>-0.022 (0.023)</td>
<td>-0.025 (0.026)</td>
<td>-0.020 (0.025)</td>
<td>-0.040 (0.029)</td>
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<tr>
<td>GEXP</td>
<td>0.006 (0.016)</td>
<td>0.041** (0.019)</td>
<td>0.035*** (0.019)</td>
<td>0.032*** (0.018)</td>
<td>0.028 (0.022)</td>
<td>0.013 (0.015)</td>
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<tr>
<td>FDI</td>
<td>0.003 (0.017)</td>
<td>0.006 (0.018)</td>
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<tr>
<td>POP</td>
<td>-0.088 (0.125)</td>
<td>-0.033 (0.120)</td>
<td>-0.040 (0.123)</td>
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<tr>
<td>OPEN</td>
<td>0.002 (0.002)</td>
<td>0.001 (0.002)</td>
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<tr>
<td>MUS</td>
<td>-0.773 (0.766)</td>
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<tr>
<td>OECD</td>
<td>0.469 (0.361)</td>
<td>0.426 (0.340)</td>
<td>0.408 (0.395)</td>
<td>0.652** (0.324)</td>
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<tr>
<td>LAM</td>
<td>0.083 (0.340)</td>
<td>0.067 (0.325)</td>
<td>0.146 (0.390)</td>
<td>0.548 (0.347)</td>
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<tr>
<td>SSA</td>
<td>0.262 (1.089)</td>
<td>0.087 (1.077)</td>
<td>0.314 (1.118)</td>
<td>-0.897** (0.392)</td>
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<tr>
<td>EAS</td>
<td>-0.363 (0.496)</td>
<td>-0.441 (0.490)</td>
<td>0.332 (0.750)</td>
<td>-0.010 (0.461)</td>
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</tbody>
</table>

Each equation is estimated by GLS (using OLS residuals). Data starts from 1995 to 2005. In parenthesis standard errors are reported. (*=1%, **=5%, ***=10%)

0.285, this would means that for Pakistan, a reduction in corruption from its current level (CRP averaged index 2.4) to a level of, say, Denmark (CRP averaged index 9.7) would increase Pakistan’s annual average log of GDP per capita during the period 1995-2005 by 2.08 percentage points ($0.285 \times (9.7-2.4) = 2.08$). Thus, in other words, if corruption in Pakistan could be reduced to levels existing in developed economy like Denmark, then during the period Pakistan could have increased its
annual average per capita rate by more than 2 percent. The results of fixed effect are also reported and these are not robust with corruption index.

Secondary education variables is used in 5 regressions but only in one regression this variable is significant at 10 percent level, while the sign of coefficient is positive, which indicates the positive impact on per capita. Second education variable is public spending on education, which is also insignificant in this regressions model. This implies that GDP per capita is not capturing the full effect of these educational variables.

All other explanatory variables except Government Consumption Expenditure (GEXP) are insignificant. This variable is significant and positively affecting the GDP per capita. The coefficient is about 0.035 in most regressions; its quantitative impact is not bigger but significant impact. Population growth and unemployment rate have negative sign but mostly insignificant. The result indicates that only CRP variable is important for log of GDP per capita when model is estimating with cultural variables. The cultural dummy variables are also reported in the same table. In cultural variables only OECD and SSA (African countries) are significant at one place. The dummy for Muslim culture has negative signs but insignificant. The other dummies EAS (East Asian countries) and LAM (Latin America) are also insignificant. In sum we can say, when dependent variable is log of GDP per capita then CRP variable is significant and has positive relation with GDP per capita. The next results displayed in table: 2 are based on the fixed effect and set of control variables that is using GDP per capita growth rate as dependent variables and the numbers of independent variables including corruption and initial GDP per capita. The results reported in table 2. It is not proved to be significant variable here in each regression.

There are 9 regressions and in all GDP growth is insignificant, meaning not different from zero. The sign of coefficient is also negative. The graph of these two variables, corruption and GDP growth is also not giving clear picture (figure 1). We also included a quadratic term for corruption that allows a test for a positive growth maximizing level of corruption. But this test fails to capture the maximizing level of corruption.\(^9\) As we expand the list of explanatory variables the magnitude of the coefficient on corruption remains roughly the same. The most significant variables in growth equations are inflation rate, and unemployment rate. These two variables have negative sign and mostly are significant.

Secondary school enrolment (SED) has positive sign but all coefficients are insignificant. Public spending on education is also same as SED not proving a significant variable. Government expenditure variable is also included in growth equation but it does not prove to be significant variable. And it means government consumption expenditure is not playing any significant role in growth. FDI has positive relation with growth but it is not significant. Population growth is negatively
affecting the growth as shown in table 2, but only one coefficient is significant at 10 percent. Trade openness is also not proved as a significant variable in the model.

Table 2 presents the results of combined economic and cultural variables on growth. When we expand our model with cultural dummies the results are almost same, and the corruption variable is same as without cultural dummies. Among

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Fixed Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnGDP-1</td>
<td>-0.150(0.156)</td>
<td>-0.053(0.193)</td>
<td>-0.057(0.192)</td>
<td>-0.106(0.196)</td>
<td>-0.100(0.216)</td>
<td>-0.194(0.194)</td>
<td>-0.0760(0.192)</td>
<td>-0.111(0.182)</td>
<td>0.031(0.143)</td>
</tr>
<tr>
<td>CRP</td>
<td>0.113(0.121)</td>
<td>-0.129(0.113)</td>
<td>-0.169(0.120)</td>
<td>-0.151(0.117)</td>
<td>-0.26*** (0.137)</td>
<td>-0.198(0.132)</td>
<td>-0.023(0.141)</td>
<td>-0.017(0.133)</td>
<td>0.053(0.292)</td>
</tr>
<tr>
<td>SED</td>
<td>0.003(0.006)</td>
<td>0.003(0.006)</td>
<td>0.004(0.006)</td>
<td>0.003(0.006)</td>
<td>0.001(0.006)</td>
<td>0.002(0.006)</td>
<td>0.001(0.005)</td>
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<tr>
<td>PUBSED</td>
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<td></td>
<td></td>
<td>0.238(0.191)</td>
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<tr>
<td>INFL</td>
<td>-0.448** (0.211)</td>
<td>-0.084(0.245)</td>
<td>-0.403*** (0.217)</td>
<td>-0.385*** (0.211)</td>
<td>-0.407** (0.202)</td>
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<tr>
<td>UNEMP</td>
<td>-0.074*** (0.043)</td>
<td>-0.070(0.043)</td>
<td>-0.053(0.043)</td>
<td>-0.060(0.047)</td>
<td>-0.086*** (0.049)</td>
<td>-0.096** (0.047)</td>
<td>-0.094** (0.046)</td>
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<tr>
<td>GEXP</td>
<td>-0.028(0.030)</td>
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<tr>
<td>FDI</td>
<td>0.025(0.034)</td>
<td>0.020(0.0334)</td>
<td>0.034(0.031)</td>
<td>0.016(0.031)</td>
<td>0.018(0.030)</td>
<td>0.023(0.029)</td>
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<tr>
<td>POP</td>
<td>-0.51*** (0.297)</td>
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<tr>
<td>OPEN</td>
<td>0.004(0.004)</td>
<td>0.002(0.005)</td>
<td>0.002(0.005)</td>
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<tr>
<td>EU</td>
<td>2.351* (0.801)</td>
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<td></td>
<td>2.397* (0.829)</td>
<td>2.001* (0.661)</td>
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<td>MUS</td>
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<tr>
<td>LAM</td>
<td>-1.28*** (0.699)</td>
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<tr>
<td>SSA</td>
<td>-0.181(0.800)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAS</td>
<td>0.806(0.951)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each equation is estimated by GLS (using OLS residuals). Data starts from 1995 to 2005. In parenthesis standard errors are reported. (*=1%, **=5%, ***=10%).

Among cultural dummies the OECD countries have positive coefficient, which indicates the positive impact on growth. MUS (Muslim countries dummy) are still insignificant, but it has negative sign. This indicates the Muslim countries have lower growth. The
LAM (Latin America) dummy has negative sign in all regressions and only one is significant, but their affect on growth is very low. Sub-Saharan Africa and East Asian dummies are insignificant.

In cultural dummies, we used new variable MUS for Muslim countries. For these countries, corruption is not proved to be significant. Other cultural variables EU, OECD, HY (high-income countries) and LAM (Latin America) are significant in most of the regression for corruption index. In growth model, the corruption does not affect the growth of GDP per capita, while corruption does affect the log of GDP per capita. Therefore, the relation with corruption and level growth is important and same results are found by Paldam (2002). In next section, we will present the granger causality between corruption and growth and log of GDP per capita.

1. The Causality Relationship

We also test the direction of causal relationship of the variable of interest by using Granger Causality test. Table 3 presents the results of test the null hypothesis that corruption does not granger cause to GDP growth rate, and rejected, which implies that corruption does cause to GDP growth rate. But this result should be taken cautiously. Because we find, as mentioned before, in our results that corruption is not significantly affecting growth but affecting the real GDP per capita. The possible explanation for this contradictory result is that we have only 4 observations for each country, when we test the Granger causality, we must take the enough lag value of variables and loose degree of freedom, hence we cannot fully trust on these results, but just overview of the results of existing data set. The null hypothesis that growth does not granger cause to corruption is also tested, and accepted, which implies that growth does not causing the corruption. In addition, this result is consistent with our results in previous section.

The table: 4 report the results about the causal relationship between corruption and GDP per capita. The null hypothesis that corruption does not Granger-cause the GDP per capita is tested. It is evident from the table that corruption does cause to per capita GDP, which is consistent with our findings. The null hypothesis that GDP per capita does not Granger cause to corruption is also rejected.

<table>
<thead>
<tr>
<th>Table: 3. Granger Causality Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
</tr>
<tr>
<td>Per Capita GDP Growth</td>
</tr>
<tr>
<td>Corruption</td>
</tr>
</tbody>
</table>

82
Table: 4. GDP per Capita does not Granger cause Corruption

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent Variable</th>
<th>Wald test for exclusion restriction Chi^2(2)</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of per capita GDP</td>
<td>Corruption</td>
<td>47.87</td>
<td>[0.0000]**</td>
</tr>
<tr>
<td>Corruption</td>
<td>Log of per capita GDP</td>
<td>6.80</td>
<td>[0.0091]**</td>
</tr>
</tbody>
</table>

V. Conclusions and Policy Implications

In this study, our main hypothesis was that corruption does affect the per capita GDP and GDP growth. To test this hypothesis, we utilized Barro (1991) equation by applying fixed affect along with a set of control variables. Our findings indicated that corruption does not affect the growth of GDP per capita, while corruption does affect the log of GDP per capita but it is not significant. Therefore, the relationship between corruption and real GDP per capita is important and Paldam (2002) finds same results. We have also applied Granger causality to test the sensitivity of our results. There are some contradictory results for relationship between corruption and GDP growth. We think that the lack of observation is a major reason because we do not take higher lags to avoid the risk of degree of freedom loss. For reliable results, more time series data is needed for Granger causality. However, we find the two-way causality between real GDP per capita and corruption.

Our study has some certain policy implications, especially for the developing countries. We find a statistical significant relationship between corruption and per capita GDP. It suggests that the authorities should focus on the anti-corruption policies along with the other economic reforms to encourage the economic growth. There is very interesting example that contradicts, at first sight, with our result but actually supporting our suggestion. China is the corrupt country according to CPI index (CPI for 2007 is 3.8), as compare to the other developed country but still it achieved the high growth over the several years. It is interesting to mention here that CPI was 2.16 in 1995. After that CPI improved gradually and the growth of GDP of China is highest among the competitors. Therefore, we claim, this is good support for our argument that per-capita GDP may increase with the increase of CPI. This is also true for the other developing countries, especially for the transitional countries.
References


Return on Investment in Microenterprises: Experience of the Borrowers of Pakistan Poverty Alleviation Fund (PPAF)

Nasim Shah Shirazi

Abstract
The paper estimates the return on investment in microenterprises by using the data collected by Pakistan Poverty Alleviation Fund (PPAF). The paper finds that in general borrowers remained successful in earning a net weighted average rate of return from 4.05 percent to 4.93 percent per month (or an uncompounded weighted average rate of 48.56 percent to 59.20 percent per year) across various businesses. Female borrowers earned higher return than male borrowers. There was also significant number of investors which suffered from losses. The paper also finds return to investment across various regions of the country. The highest rate of return was in the province of Baluchistan. It may be noted that small enterprises are almost neglected by the public sector. The findings of this study provide strong foundations to draw attention of public policy makers.

I. Introduction
The system of microfinance has been designed to give low income communities quick and easy access to socio-economic services, providing opportunities for self employment and, thus uplifting them out of poverty. The non-availability of the funds to the poor masses is considered as one of the major constraints for getting beneficial opportunities. If the funds are made available to them, then it is expected that the poor can change their destiny. Many scholars (see for example Ahmed, 2004) have quoted from Adam Smith in support of such expectations. “Money, says the proverb, makes money, when you have got a little, it is often easy to get more. The great difficulty is to get that little”.

The microfinance institutions have been growing rapidly in the developing countries especially after the experience of the Grameen Bank in Bangladesh. The most recent entrants to the microfinance industry are commercial banks. This modality includes many variants: transformed microfinance NGOs, government owned development banks, reformed state banks and diversification into

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microfinance by existing commercial banks. The Khushhali Bank and Kasab Bank in Pakistan are extraordinary examples of newly-established retail commercial banks; specialized in micro-finance and small business. The transformation of NGOs into commercial banks is still a relatively new phenomenon. However, they seem to be performing well in terms of profits and in expanding the scale of their operations significantly (Fernando, 2004). There are several examples of commercial banks diversifying into microfinance, either directly or through partnerships with NGOs. Even big multinational banks such as ABN Amro, Citibank and Deutche Bank are now involved in microfinance (Montgomery and Weiss, 2005). Moreover, big financial institutions, such as World Bank and the European Bank for Reconstruction and Development, are also helping and backing the microfinance industry (The Economist, 2007).

Just like other developing countries, microfinance institutions (MFIs) have been growing very rapidly in Pakistan. More than 18 different institutions are working for uplifting the poor masses. These include micro finance banks and commercial banks with microfinance as separate product line; institutions specialized in rural support programs, such as NRSP and PRSPs, and private NGOs. Moreover, special unit, Pakistan Poverty Alleviation Fund (PPAF), has been established in 2000 for development support to civil society organizations in the country. By the year 2008, PPAF has emerged as the major financier of microfinance market. The PPAF has disbursed Rs.34 billion through 73 partner organizations under its four regular windows i.e. lending for microcredit/enterprise (almost Rs.26 billion), development of infrastructure (Rs.5.5 billion), health and education (Rs.312 million), and human and institutional development (Rs.2.4 billion). The PPAF has cumulatively financed over 2.3 million loans, 16,450 infrastructure schemes, 180 health and education facilities and over 8,850 training events for participating communities and staff of partner organizations. The PPAF is playing a significant role of developing financial market and whole sale financier for the sector. Up to June 2008, PPAF had a market share of 55 percent. (For details see: PPAF, annual report, 2008).

Several aspects of microfinance and microenterprises have been addressed in the literature. Few empirical studies have quantified the impact of microfinance on poverty, some have focused on the relation between microfinance and socio-economic indicators, few other concentrated on the sustainability and profitability, and few others estimated the return to capital invested in the micro enterprises (see review of literature). However, estimates of return to capital in micro enterprises for Pakistan are not available so far. Therefore purpose of the paper is to provide estimates of return on investment in microenterprises in Pakistan. The rest of the paper is organized as follow: section II contains the review of relevant literature on the subject. Section III provides details of the data used and methodology employed in the paper, section IV describes empirical results and findings while section V concludes the paper.
II. Review of the Relevant Literature

A lot has been written regarding various aspects of microfinance and microenterprises especially after the establishment and the experience of the Grameen Bank in Bangladesh. Few empirical studies have quantified the impact of microfinance on poverty, some have focused on the relation between microfinance and socio-economic indicators, few concentrated on the sustainability (see Baumann, 2004) and profitability, and few others estimated the return to capital invested in the microenterprises.

Hulme and Mosley (1996), for instance, based on the counter-factual combined approach, analyzed the impact of microfinance on poverty alleviation using sample data for Indonesia, India, Bangladesh and Sri Lanka, and found that growth of income of borrowers always exceeds that of control group and that increase in borrower’s income was larger for better-off borrowers. Similarly MkNelly et al. (1996), found positive benefits for the borrowers. Khandker (1998), based on double difference comparison between eligible and ineligible households, and between program and control villages, focusing on Grameen Bank, Bangladesh and Bangladesh Rural Advancement Committee (BRAC), found that microcredit alleviated poverty up to 5 percent annually. Furthermore, it was found, that a loan of 100 taka to a female borrower, after it is repaid, allows a net consumption increase of 18 taka. For Thailand village banks, Coleman (1999), using the same approach as that of Khandker (1998), found no evidence of any impact of microfinance. Another study by Coleman (2004), found that programs are not reaching the poor as much as they reach relatively wealthy people. Khandker (2003), found that microfinance helps to reduce extreme poverty much more than moderate poverty i.e. 18 percentage points as compared with 8.5 percentage points over seven years. Welfare impact is also positive for all households, including non-participants, as there were spillover effects.

Mosley (2001), using data from Latin American countries, found a positive growth of income and assets of the borrowers than control group. The growth of income of the better-off borrowers was larger. However, he could not find any evidence of impact of microfinance on extreme poverty. Banegas et al. (2002), employing Logit model, found positive impact on the income of borrowers. Gallup Pakistan (2005), using Counter factual “Combined approach” found positive impact of PPAF microfinance on the consumption, income and assets of the borrowers. Shirazi (forthcoming) employed Counter-factual “Combined approach” and found that Micro credit has reduced the poverty level of the borrowers by 3.05 percentage points on average in Pakistan during 2003/4- 2004/5.

Few studies have focused on the impact of microcredit on employment and increase in income and expenditure of the borrowers in Bangladesh, which have been summarized in Rahman (2004). Results of these studies show that income of the recipients of micro credit has increased in the range of 8-40 percent. Micro credit has been successful in creating a positive impact on the employment. Further more,
studies show that microcredit has positively contributed in the social investment, school enrolment, social empowerment, girls schooling and women’s non land asset. Some studies (Choudhury and Bhuiya, 2001; Marcus, et al. 1999; Barnes et al. 2001; Chen and Snodgrass, 2001) have identified significantly positive effects of microfinance on the human resource development among the participants in various countries. Similarly Naveed (1994), Amin et al. (1994) and Hashemi et al. (1996) found positive impact of microfinance on the women empowerment and welfare. Many studies have been made on Grameen Bank from different perspectives. Studies conclude that Grameen Bank’s members have been better off in terms of wide range of economic and social indicators including increased income, improved nutrition, better food intake, better consumption of clothing, better housing, lower child mortality, lower birth rate, higher adoption of family-planning practices, better health care, better access to education for the children, empowerment of women participation in social and political activities (Yunus, 2004). Literature also highlight the beneficial role of microfinance for the poor by smoothing their consumption expenditure, increasing income and savings and diversify their income sources (see Dichter, 1999; Panjaitan et al. 1999; Remenyi and Quinones Jr., 2000; Mustafa, 1996; Morduch, 1998; Khandker, 2003; McKerman, 2002 and Simonwtz, 2002).

Although, the main objective of the microfinance is to make the funds available for investment in microenterprises and, thus uplift the poor people from poverty and promote growth. But Dichter (2007) casts doubt and says that “recent experience and the economic history of rich countries, however, suggest that these expectations are unrealistic. Most people, poor or otherwise, are not entrepreneurs, so there is little reason to think that mass credit would in general lead to viable business start-ups.” Despite the above doubts, some studies have quantified the return on investment in microenterprises and provided the successful evidences. Cynthia (2002) compared three groups: low-income microentrepreneurs who participated in one of seven U.S. microenterprise assistance programs, low income self-employed workers not attached to microenterprise assistance program, and low income wage workers not self-employed. His analyses suggest no significant gain for participants. Return from investment depends upon number of factors. The type of the enterprise in which investment is made also matters. Hossain (1984) reports that except few investment activities, returns to labor from many activities are high. The same view has been expressed by others also (see Rahman and Khandker, 1994). Moreover, Rahman (2004) concluded that the skill intensive activities give higher return and that the rural wage rates per hour for male workers were in the range of 4.8 to 5.5 Taka. He considers micro financed activities beneficial if these are not taken up at the cost of other activities with higher returns.

The studies reviewed by Suresh De Mel et al. (2008) reported positive return to capital in small scale enterprise. For example, McKenzie and Woodruff (2006) find 15 percent return to capital per month (or a simple rate of 180 percent per year) among the smallest urban microenterprises (having less than $200 investment) in
Mexico. Udry and Anagol (2006) estimated return to capital and found a return of 50 percent per year in a sample of small-scale agriculture producers, producing traditional crops on a medium-sized plot, in Ghana, while it was 250 percent per year for producers of non traditional crops. Suresh et al. (2008) used randomized grants to generate shocks to capital stock for Sri Lankan microenterprises and found the average real return to capital in the range of 4.6 percent to 5.3 percent. Furthermore, return varied with entrepreneurial ability and household wealth but risk aversion and uncertainty did not affect the return. However, they found significantly higher return for the enterprises owned by male and no positive return for the enterprises owned by female.

The general picture that emerges from the above reviewed literature is that opinion differs on the real impact of microfinance. Very few studies are available which have analyzed the return to capital in microenterprises. Most of the studies are related with the developing countries and specially Bangladesh. So far, there is hardly any study which focused on the return to capital in microenterprises in Pakistan. Therefore, this paper is devoted to fill this gap in literature.

III. Methodology and Data

1. The Data

The PPAF programs are rigorously evaluated. The PPAF unit conducts surveys using its own research department or commissions other agencies for the purpose of evaluating the effectiveness of its programs. The Gallup Pakistan was commissioned by the PPAF to conduct a survey, of a sample of more than 3000 households covering all provinces of the country. The survey covered more than 1500 borrowers’ households and about the same household as control group. In addition to other questions, borrowers were asked to summarize the profit earned, in monetary terms, on the amount of funds they borrowed. For this paper we have used the data collected by Gallup for PPAF.

2. Methodology

The estimation of the rate of returns on investment in microenterprises is very complicated. Most of the time household based enterprises do not keep the complete record of expenditures and revenues and thus makes the estimation difficult. Literature provides a number of ways to find out the net rate of return on particular investment (e.g. see De Mell et al. 2008). However, we are constrained by the available data. Keeping in view the available data we have calculated descriptive statistics i.e. the average rate of return, weighted average rate of return on invested capital after deducting the cost of capital. The cost of borrowing is 20 percent on average as reported in the Gallup survey.
IV. Empirical Findings

The overall rate of return (ROI) is depicted in table 1; Column 1 through column 3 of the table shows the range of return, average ROI and cost of capital, respectively. The net ROI, number and the percentage of borrowers are shown in the subsequent columns- 4 to 6. The last column of the table presents the calculation for the weighted average ROI.

After deducting cost of capital, about 21 percent of the borrowers experienced losses in their businesses. About 7 percent of the borrowers experienced 20 percent losses and 14 percent experienced on average 9.5 percent. Most of them may be the core poor and they might have taken loans for the purpose of smoothing their consumption rather for investment. The remaining borrowers were greatly benefited from the invested capital. About 20 percent of the borrowers earned ROI on average 15.5 percent, about 29 percent earned 55.5 percent and about 30 percent of the borrowers earned on average 81 percent. The weighted average rate of return for

<table>
<thead>
<tr>
<th>Table: 1. Overall Rate of Return on Invested Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROI</strong></td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Nil</td>
</tr>
<tr>
<td>1 to 20%</td>
</tr>
<tr>
<td>21 to 50%</td>
</tr>
<tr>
<td>51 to 100%</td>
</tr>
<tr>
<td>101 and above</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*the borrowers (35 in this case) who did not respond have been excluded from the analysis. Similarly borrowers who did not respond are also excluded from the analysis of the subsequent tables. ** Since upper limit is not known, therefore the lower limit is taken as the average rate of return. @ Weighted average is calculated on the basis of those borrowers who earned positive return, while the figures on the right hand side of the same column show weighted average ROI for all borrowers (irrespective of positive profits or negative return).
all those borrowers who earned positive profits, found to be 4.57 percent per month or an uncompounded rate of 54.89 percent per annum.\(^2\) Similarly, analysis has been extended by type of enterprises, region and gender. The following tables indicate results by types of enterprises.

1. **Results by Types of Enterprise**

The table 2 reveals that about 88 percent in the off farm enterprises, 76 percent in the livestock and about 73 percent in the agriculture sector were benefitted greatly form the borrowed capital. They earned on average ROI from 15.5 percent to 81 percent in different enterprises. However, about 27 percent of the borrowers were found to be the looser in the agriculture sector, followed by 24 percent in the livestock and about 12 percent of the borrowers in off farm enterprises. About 11 percent of these borrowers in the off farm enterprise had experienced 9.5 percent of the losses while 1.45 percent of the borrowers had to pay the cost of capital (on average 20 percent) which was their total loss. Similarly, about 17 percent of the borrowers in the livestock business and about 21 percent of the borrowers in the agriculture faced 9.5 percent of the losses, while about 6 percent in both enterprises had experienced 20 percent losses.

### Table: 2. ROI by Types of Enterprises

<table>
<thead>
<tr>
<th>ROI</th>
<th>Average ROI</th>
<th>Average Cost of capital</th>
<th>Net ROI</th>
<th>Enterprise (off farm)</th>
<th>Livestock</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>-</td>
<td>20</td>
<td>-20</td>
<td>1.45</td>
<td>6.33</td>
<td>6.25</td>
</tr>
<tr>
<td>1 to 20%</td>
<td>10.5</td>
<td>20</td>
<td>-9.5</td>
<td>10.54</td>
<td>17.41</td>
<td>20.55</td>
</tr>
<tr>
<td>21 to 50%</td>
<td>35.5</td>
<td>20</td>
<td>15.5</td>
<td>17.58</td>
<td>24.27</td>
<td>25.49</td>
</tr>
<tr>
<td>51 to 100%</td>
<td>75.5</td>
<td>20</td>
<td>55.5</td>
<td>30.06</td>
<td>29.55</td>
<td>27.63</td>
</tr>
<tr>
<td>101 and above</td>
<td>101</td>
<td>20</td>
<td>81.0</td>
<td>40.36</td>
<td>22.42</td>
<td>20.06</td>
</tr>
</tbody>
</table>

Total*        | 100.0 (825) | 100.0 (758)             | 100.0 (608) | 59.20 (4.93) | 50.27 (4.19) | 48.56 (4.05) |

Weighted Average** (borrowers who earned positive profit) | 50.80 (4.23) | 35.41 (2.95) | 32.34 (2.69) |

ROI, Rate of return on investment, * Number of borrowers is shown in parentheses. ** Figures in parentheses indicate return per month.

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\(^2\) *If we take the weighted average of all the borrowers who earned profit or loss on their capital then the weighted average rate of return comes to 3.38 percent per month or a simple rate of 40.53 percent per year.*
The weighted average rate of return was higher (4.93 percent per month or an uncompounded weighted average rate of 59.20 percent per year) for the borrowers in the enterprise sector, followed by livestock (weighted average of 4.19 percent per month or simple weighted average rate of 50.27 per year) and agriculture sector (weighted average of 4.04 per month or uncompounded weighted average rate of 48.56 per year). These results show that investment in off farm enterprises provided greater return than other enterprises.

2. ROI by Regions / Provinces

Results by provinces are shown in table 3. Table shows that majority of the borrowers (about 85 percent) in both the provinces of NWFP and Baluchistan earned return on average in the range of 15.5 percent to 81 percent, while about 15 percent of the borrowers in both the provinces experienced losses (on average from 9.5 percent to 20 percent) in their respective businesses. About 78 percent of the borrowers from Punjab and about 72 percent of the borrowers in case of Sindh benefitted, while the remaining borrowers made losses. The losses made by them were on average 9.5 percent to 20 percent.

Table: 3. ROI by Provinces

<table>
<thead>
<tr>
<th>ROI</th>
<th>Average ROI (%)</th>
<th>Average cost of capital (%)</th>
<th>Net Average ROI (%)</th>
<th>% of Borrowers ‘NWFP’</th>
<th>% of Borrowers ‘Sindh’</th>
<th>% of Borrowers ‘Baluchistan’</th>
<th>% of Borrowers ‘Punjab’</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nil</td>
<td>-</td>
<td>20</td>
<td>-20</td>
<td>1.49</td>
<td>21.28</td>
<td>2.06</td>
<td>2.85</td>
</tr>
<tr>
<td>1 to 20%</td>
<td>10.5</td>
<td>20</td>
<td>-9.5</td>
<td>13.73</td>
<td>7.17</td>
<td>13.63</td>
<td>19.07</td>
</tr>
<tr>
<td>21 to 50%</td>
<td>35.5</td>
<td>20</td>
<td>15.5</td>
<td>20.59</td>
<td>17.69</td>
<td>15.70</td>
<td>23.70</td>
</tr>
<tr>
<td>51 to 100%</td>
<td>75.5</td>
<td>20</td>
<td>55.5</td>
<td>25.97</td>
<td>33.84</td>
<td>30.57</td>
<td>26.20</td>
</tr>
<tr>
<td>101 and above</td>
<td>101</td>
<td>20</td>
<td>81.0</td>
<td>38.20</td>
<td>20.0</td>
<td>38.01</td>
<td>28.16</td>
</tr>
<tr>
<td>Total*</td>
<td>100.0 (335)</td>
<td>100.0 (390)</td>
<td>100.0 (242)</td>
<td>100.0 (561)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted^ Average**(borrowers who earned positive profit)</td>
<td>57.27 (4.77)</td>
<td>52.74 (4.39)</td>
<td>59.55 (4.96)</td>
<td>52.55 (4.38)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted Average** (All borrowers who earned positive profit or made losses)</td>
<td>46.95 (3.91)</td>
<td>32.79 (2.73)</td>
<td>48.49 (4.04)</td>
<td>38.65 (3.22)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Number of borrowers is shown in parentheses and ** Figures in parentheses indicate return per month.

^ The weighted average rate of return comes out to be in the range of 2.69 percent to 4.23 percent per month across enterprises if all borrowers who made profits or losses were included in computation.

^ If we include all borrowers who made profits or losses then weighted average ROI comes out to 4.04 percent per month for Baluchistan, 3.91 percent for NWFP, 2.73 percent for Sindh and 3.22 percent per month for Punjab.
The weighted average rate of return on investment was found to be the highest (4.96 percent per month or an uncompounded weighted average rate of 59.55 percent per year) in the province of Baluchistan, followed by NWFP (4.77 percent per month or an uncompounded weighted average rate of 57.27 percent per year). The borrowers from Punjab earned a weighted average rate of 4.38 percent per month or a simple weighted average rate of 52.55 percent per year. The borrowers from province of Sindh earned a weighted average rate of 4.39 percent per month or an uncompounded weighted average rate of 47.09 percent per year.

3. **ROI by Gender**

The table 4 reveals that about 80 percent of the female borrowers and about 78 percent of the male borrowers earned on average rate of 15.5 percent to 81 percent return on their invested loans. Nevertheless, about 20 percent of the female and about 22 percent of the male borrowers could not earn profit but made losses. About 14 percent of the male and female borrowers had experienced 9.5 percent of the losses while the remaining 7.55 percent of the male and 6.14 percent of the female borrowers had experienced, on average, 20 percent loss.

<table>
<thead>
<tr>
<th>ROI</th>
<th>Average ROI (%)</th>
<th>Average cost of capital (%)</th>
<th>Net Average ROI (%)</th>
<th>% of Male</th>
<th>% of Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>-</td>
<td>20</td>
<td>-20</td>
<td>7.55</td>
<td>6.14</td>
</tr>
<tr>
<td>1 to 20%</td>
<td>10.5</td>
<td>20</td>
<td>-9.5</td>
<td>14.08</td>
<td>13.81</td>
</tr>
<tr>
<td>21 to 50%</td>
<td>35.5</td>
<td>20</td>
<td>15.5</td>
<td>22.57</td>
<td>14.69</td>
</tr>
<tr>
<td>51 to 00%</td>
<td>75.5</td>
<td>20</td>
<td>55.5</td>
<td>28.54</td>
<td>29.38</td>
</tr>
<tr>
<td>101 and above</td>
<td>101</td>
<td>20</td>
<td>81.0</td>
<td>27.23</td>
<td>35.96</td>
</tr>
<tr>
<td>Total*</td>
<td></td>
<td></td>
<td></td>
<td>100.0 (1072)</td>
<td>100.0 (456)</td>
</tr>
<tr>
<td>Weighted Average** (borrowers who earned positive profit)</td>
<td></td>
<td></td>
<td></td>
<td>52.84 (4.40)</td>
<td>59.62 (4.97)</td>
</tr>
<tr>
<td>Weighted Average** (including all borrowers who earned positive profit or made losses)</td>
<td></td>
<td></td>
<td></td>
<td>38.56 (3.21)</td>
<td>45.18 (3.76)</td>
</tr>
</tbody>
</table>

The above table also shows that female borrowers proved to be more successful entrepreneurs than male borrowers. The female borrowers earned return at weighted average rate of 4.97 percent\(^5\) per month or an uncompounded weighted average rate of 59.62 percent per year compared to their male counterparts who earned at

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\(^5\) The weighted average ROI comes out to be 3.76 percent per month for female borrowers and 3.21 percent for the male borrowers including all borrowers irrespective they earned profits or made losses.
weighted average rate of 4.40 percent per month or uncompounded weighted average rate of 52.84 percent per year.

Keeping in view the above analysis, it can be concluded that PPAF’s loans through partner organizations and NGOs had greatly benefited the borrowers. They earned high return in their investment. The female borrowers experienced higher return compared to their male counterparts. Among the provinces, majority from NWFP and Baluchistan experienced high return compared to the two other provinces. Similarly, borrowers who invested in off farm enterprises earned high margin of return, followed by the investors in the livestock and agriculture sector. Our results are consistent with findings of other investigators who reported almost the same range of ROI as that of our findings regarding PPAF lending.

V. Conclusions

Microfinance institutions (MFIs) have been growing very rapidly in Pakistan. More than 18 different institutions are working for uplifting the poor masses by providing microfinance for small businesses. A special unit, Pakistan Poverty Alleviation Fund (PPAF) has been established in 2000 for development support to civil society organizations in the country. By now, PPAF has emerged as the major financier of microfinance market. The PPAF is playing an important role of developing financial market and whole sale financier for the sector. Up to June 2008, PPAF had a market share of 55 percent.

Our analysis shows that overall about 79 percent of the borrowers earned profit on an average per year of 15% to 81 percent. The weighted average rate of return found to be 4.57 percent per month or an uncompounded rate of 54.89 percent per annum. Female borrowers experienced higher return compared to their male counterparts. The borrowers who invested in off farm enterprises earned higher return (weighted average rate of 4.93 percent per month or simple rate of 59.20 percent per year) than the investors in the livestock (weighted average rate of 4.19 percent per month or 50.27 percent per year) and agriculture sector (weighted average rate of 4.05 percent per month or 48.56 percent per year).

The weighted average rate of return on investment was higher (4.96 percent per month or a simple rate of 59.55 percent per year) in the province of Baluchistan, followed by NWFP (4.77 percent per month or an uncompounded rate of 57.27 percent per year). The borrowers from Punjab earned a weighted average rate of 4.38 percent per month or a simple weighted average rate of 52.55 percent per year. The borrowers from province of Sindh earned a weighted average rate of 4.39 percent per month or an uncompounded weighted average rate of 52.74 percent per year.

In general borrowers become successful in earning a good rate of return on their investment that varied from 4.05 to 4.39 percent per month across various businesses. If we take the weighted average of all those borrowers who earned profits or made losses in the analysis, then the weighted average rate of return comes out to
2.69 percent per month to 4.23 per month across the various enterprises. Female proved themselves better entrepreneurs than male in terms of earning profits.

Keeping in view these findings, we would suggest that all microfinance institutions including NGOs and participatory organizations of the PPAF might also target the core poor of the society. It may be noted that now PPAF has expanded its coverage through its participatory organizations. It has been providing financial and non-financial services to the society, which needs a detailed study taking into account all aspects of PPAF in lending through its participatory organizations. In addition to this apex, a detailed analysis is needed for all other institutions working for uplifting of the society.

The study provides strong foundations to support micro enterprises, which could help to bring out the country from poverty and generate jobs at lowest possible investment. There is a little room in the public policies and development plans to support small enterprises, even, major financial institutes also do not like to lend to these enterprises. There is a need to shift and focus attention to support micro enterprises for up lifting the poor segment of the society.
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Output Growth and Employment Generation in Pakistan

Kalsoom Zulfiqar and M. Aslam Chaudhary

Abstract

Human resources have emerged as one of the most important sources of economic growth and development. However, Pakistan has ignored human development and the result is that it is facing high unemployment. Present study aims at exploring the employment generation capacity of the economy of Pakistan. The economy is divided into six distinct sectors and the contribution of each sector towards creation of employment opportunities is analyzed; both in short run and long run. Labor force imbalances and the resulting unemployment are pointed out by utilizing ARIMA methodology. The sectoral employment elasticities are low and decreasing over time. It may be so due to increasing trend of using capital intensive technology. The empirical projections indicated that Pakistan is suffering from high unemployment and it is expected to rise over 14 percent by the year 2020. Therefore, appropriate policies are needed not only to combat this issue but also for optimal utilization of human capital. Overall growth as well as employment generating sectors need to pay appropriate attention to tackle the issue.

I. Introduction

The output growth and employment generation are two important goals of any major economic policy. The provision of productive employment for continuously increasing labor force is an integral part of growth policy. The rate of employment growth in an economy is determined by many factors and GDP growth is one of these factors. The impact of GDP growth on employment growth is measured by employment elasticities. Internationally the range of growth and employment elasticity is between 0.1 - 0.7. However, high employment elasticities are generally considered healthy indicator for an economy; facing unemployment problem. The same may be expected low for some sectors, for example low employment elasticity for agriculture sector implies that the farm sector is unable to generate sufficient employment opportunities to absorb the growing labor force. So, employment elasticities provide us important information; including about structural changes taking place in an economy. The present study investigates the relationship between GDP growth and employment for Pakistan; both in short and long run. In

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Pakistan, since the year 2000, the economy grew at an average rate of 5% but unemployment rates hardly fell. This implies a rising trend in unemployment which increased from 6.3% in 1996 to 8.27% in 2004\(^2\). It is even higher for current period. The result is that, unemployment is expected double digit. This apparent divorce between output growth and employment growth is a matter of serious concern. Thus, there is a need not only to investigate the problem in detail but also analyze its severity.

There are several studies which have explored the relationship between output and employment by focusing on employment elasticities. Baqai (1979), Kemal (1990) and Chaudhary and Hamid (1994, 1997, and 1998) have all computed employment elasticities. These elasticities are computed directly from the data or on the basis of regression models. These regression models Chaudhary (1994) and (Chaudhary and Hamid 1997, 1998) do not take into account the non-stationarity of the time series data. Therefore, these results are hardly realistic. If a regression relationship among variables is explored, which are non-stationary and then the resultant regression is simply a spurious regression. Besides, that, none of these studies distinguishes between long run and short-run behavior of the problem. Present study utilized appropriate methodology to study this relationship and to find out long run and short run employment elasticities. The study also provides forecasts for unemployment and labor force imbalances in the coming years for Pakistan.

The rest of the study is organized as follows. Part II, consists of literature review. Part III, provides discussion pertaining to data and methodology. Empirical analysis is provided in part IV. Conclusion and policy implications are provided in part V.

II. Literature Review

There is ample literature on the subject matter which explored different aspects of unemployment. Seib (1970) carried out international comparison of man power to highlight long-term manpower requirements of Pakistan. The study projected man-power requirements for various sectors and occupational groups for the period 1961-85. But these projections were unrealistic as they were based on the average performance of the economy.\(^3\) Similarly, the study does not mention any specific techniques used to obtain these results.

Baqai (1979) made projections for population, labor force and employment. He also calculated employment elasticities for various sectors and for the economy as a whole. The projected employment elasticities for the period 1978-2000 were 0.30 for the agriculture, 0.35 for manufacturing, 0.64 for construction, 0.55 for services

\(^3\) It may be noted that the performance of Pakistan’s economy fluctuated a lot over time. Its’ growth rate was as high as 8% for one year while it fell to as low as 2% in other year. For details see: Pakistan Economic Survey, 2008-9.
and 0.33 for the economy as a whole. The study suffered from two major drawbacks: firstly, it followed major departure from prevailing trends and secondly, there is no mention of the methodology used to make these projections. In real terms, none of these forecasts turned out to be realistic. The projections were far from reality.

Pakistan/Netherlands project on human resources (1981) projected labor demand and supply according to occupations, sectors and education levels. This study used already available estimates, based on previous data for education to estimate imbalances and unemployment at different education levels. However, as the study used old estimates and completely ignored the changing pattern of employment and structural changes which reduced the validity of the study. Besides, GDP and sectoral elasticities used were also changed over time. Therefore, the validity of results of study is questioned. The results of the study did not match with the actual performance of the economy, which clearly indicates poor quality of the study.

Herman and Irfan (1989) projected employment and unemployment for Pakistan using simulations model. On the demand side, two types of demand were recognized, namely the labor demand for productive activities and labor demand by education sector. In this study for simulation purposes, the value addition of various sectors is assumed to be growing; as indicated in the 7th five year plan. On the supply side, the labor supply is determined by the behavior of individuals instead of technical factors. It is assumed that labor supply will grow by 5% to 5.5%. Thus, the labor absorption was 0.34%. The labor demand will increase only by 1.7% to 1.8%. The population is assumed to grow at the rate of 3.15%, which actually grew by 1.8% since 2001. On the basis of these assumptions, it was projected that unemployment will rise from 5% in 1989 to 15% in 2003. The study also concluded that crude activity rate will rise from 29.4% to 31% leading to severe unemployment. This study suffers from several drawbacks. The assumptions for population growth were much higher than reality and same was the case for other variables, thus the estimates could not reflect the real picture. Moreover, the demand for labor is divided into two categories, demand for production sector and demand for education sector. But education sector is a part of services sector, which was completely ignored in this study. Half of the Pakistan’s economy consists of services sector which has been ignored in the study. Besides, the simulation process in this study is based on the projected growth rates of seventh five year plan which were never actually met.

Ghayur (1990) provided a detailed account of unemployment among educated people in Pakistan. He highlighted that the labor force participation is very low and in spite of this, it is facing wide spread unemployment and under-employment. High levels of open unemployment are common to the urban areas and under-employment to the rural areas. He calculated demand and supply imbalances for educated manpower in Pakistan. According to him, unemployment rate for those having matriculation and above education is 46% for the year 1986-87. It is the highest for matriculation which is 49% and lowest for graduates which is 20%. For
post-graduated it is about 32%. He also highlighted the problems in obtaining reliable data for Pakistan and stressed the need for an effective and efficient labor market, information system to ensure accurate analysis of the labor force. The employment and underemployment levels pointed out in this study were never observed in Pakistan.

Gulbrandson (1990) analyzed human resource situation in Pakistan using integrated projection and planning tools, called Macbeth Human Resource Planning Laboratory using the data from 1981 to 1988. According to the projections made by the study, labor force unemployment would quadruple over the projection period and exceed 3 millions in 1998-99. The main deterioration in unemployment situation will hit those with primary education. As much as one quarter of this labor force would be unemployed in 1998-99. But those having secondary education will start feeling lack of job towards the end of 1990s’ and their unemployment rate will be about 12%. Only the situation of illiterates will not worsen. The study suggested that high unemployment could be checked only if the economic growth rate is accelerated to 7% per annum. However, it is difficult to believe that unemployment of illiterates will not increase. Similarly, an unrealistic population growth rate was assumed which never occurred in the history of Pakistan.

Kamal (1990) worked out sectoral balances and imbalances for the sixth five year plan. In order to measure the gap and imbalances, he estimated the demand and supply of labor force keeping in view the changes in investment, employment elasticity and past sectoral growth rates. As the study was limited to that period, its estimates were not very helpful for future periods. He projected 3% growth in the demand for professional and skilled manpower by using professional employment coefficients. Since the projected growth of manpower was biased upward so it exceeded the actual supply.4

Chaudhary (1994) analyzed labor market situation and made projections for the period 1992-93 to 2000-01. He divided the whole economy into three major sectors, i.e. agriculture, manufacturing and services and four educational levels. By assuming that GDP, population, labor force and other variables will grow at existing rate and trends, he projected labor demand, supply and imbalances. According to his findings, unemployment situation will worsen over time if the same trends continue. Unemployed labor force will rise from 2 million in 1993-94 to 4 million by 2000-01 and unemployment rate is expected to rise in the same period from 6% to 10%. As far as different educational levels are concerned, high unemployment rate was found for all educational levels; except for professional and technical education. The highest unemployment during this period will be for those having matric and above education. Those having professional and technical education will remain short in supply. This study is an improvement over previous studies as it seems much closer

4 This part of literature review is based on the M. Phil dissertation of Abdul Hameed, QAU, (1995) and Chaudhary and Hamid (1998).
to reality. However it also suffers from certain deficiencies as it does not provide a comprehensive analysis of various situations which can in the country over time. The most of its projections are based on previous trends and variables which can change over time.

Chaudhary, M. A. and Hamid, A. (1998) divided economy into nine sectors, seven occupations and four educational levels. It was pointed out that employment elasticity was the highest for construction sector and lowest for the manufacturing sector. The agriculture sector is not likely to absorb much of additional labor force in future. Thus, to promote employment opportunities, there is a need to focus on sector(s) with high employment elasticities. There is also a need for sound employment generation policy, which should induce labor intensive technologies. Similarly, as the share of agriculture and related occupations is decreasing over time, therefore, there is a need to look for employment generation opportunities in alternative sectors and in other occupations.

Noman (1998) analyzed various dimensions of the problem of unemployment in Pakistan; for International Labor Organization (ILO). The objective of the study was to analyze labor market trends in the country and to develop possible elements of an unemployment strategy during Pakistan’s ninth five year plan period (1997-98 to 2001-02). In this report, two central issues were taken into account. Firstly, the key to employment growth is the revival of manufacturing sector. Secondly, the linkages with other sectors and certain policy tools required for this revival were needed.

Mueen (2001) reviewed the labor market in the 1990s and discussed the deteriorating condition of labor market. The unprecedented rise in the unemployment rate, especially in the late 1990s was alarming for the economy. Underemployment rates also showed a rising trend during the period under consideration. The study particularly points out the worsening conditions for new entrants. The division of population according to their poverty status and labor market activity suggests that most of the poor were either unemployed or underemployed. The study suggests that policy intervention was necessary to alleviate poverty by focusing on labor market. The expenditure on social sector development needs to be increased and by providing training facilities that lost their jobs in the process of privatization and down sizing; need to be readdressed.

Burki (1990), Kemal and Mehmood (1993), and Sher (1995) have examined the structure of the informal sector by conducting surveys in different cities at different time periods. These studies highlight the main features of the informal sector and pointed out the growth constraints faced by this sector. These studies categorize the informal sector workforce as consisting of self-employed, regular workers, family helpers and apprentices. A substantially low capital labor ratio has been observed in the production process of informal sector. Kemal and Mehmood (1993) estimated that the informal sector can create fourteen times the number of jobs that the rest of the economy can with the same level of investment. All these studies
have consistently found lower wages prevailing in the informal sector as compared to formal sector because the informal sector faces problems in obtaining raw material at lower cost and in marketing its output.

In the light of above studies and non-reliability of their results, there is a need to carry out a comprehensive study which must utilize appropriate methodology and address the issue so the results could provide foundations for policy formulation. Thus, this study is focused to identify short-run and long run employment elasticities for the economy as a whole and for major sectors of the economy. Moreover, projections will be carried out for overall labor force imbalances and unemployment rate for various sectors.

III. Methodology and Data Sources

We have utilized the Johansen’s test for co-integration and error correction methodology. The co-integration test requires that the concerned data series should have the same order of integration. The order of integration of a series is the number of differencing required for making a series stationary. The study uses Augmented Dicky Fuller (1979) test for unit root, to determine the order of integration. After determining the order of integration of all series, co-integration test is applied. Co-integration is a statistical tool describing the long run behavior of economic data series. The co-integration test reveals the existence or absence of any long run relationship among variables. To study the long run relationship between growth and employment following Error Correction Model has been estimated.

\[ D \log (E_t) = D \log E(t-1) + D \log Y_t + D \log Y(t-1) + \lambda \log E(t-1) - \lambda c - \lambda \log Y(t-1) + vt \]

Where, \( E_t \) denotes employment in time period \( t \) and \( Y_t \) refers to output in time period \( t \). Similarly, Error Correction model is estimated for the major sectors of the economy in which employment of each sector is regressed upon output of that sector. For forecasting the labor force imbalances and unemployment rate, moving average (ARIMA) modeling approach is used. The Box–Jenkins methodology or ARIMA modeling technique is a class of linear time-series forecasting techniques that captures the linear dependency of the future value on the past. An ARIMA model includes three parameters. These are the autoregressive parameter (p), the number of times the series is differenced (d) and the moving average parameter (q).

The data series for 1975 to 2007 has been taken from the Pakistan Economic Survey, Labor Force Survey of Pakistan and other related official publications for empirical analysis.

IV. Empirical Results

The time series data have been tested for stationarity by using ADF test and it was found stationary in the first difference form. The Johanson’s co-integration test shows that output and employment are co-integrated because hypothesis of no co-
integrating equation is rejected both at 1% and 5% level of significance. The results of both ADF test and cointegration test are reported in appendix.

Following error correction models are estimated for the overall economy and for its’ various sectors.

\[
D \log (E_t) = 4.876 + 0.352D \log E(t-1) + 0.129 D \log Y_t + 0.1815D \log Y(t-1) -0.233 \log E(t-1) - 0.0273 Y(t-1) \quad \text{Adj } R^2 = 0.639
\]

**Agriculture sector**

\[
D \log (E_t) = -0.1484 + 0.1137D \log E(t-1) + 0.0936 D \log Y_t + 0.1235D \log Y(t-1) -0.2825 \log E(t-1) - 0.0387 Y(t-1) \quad \text{Adj } R^2 = 0.5543
\]

**Mining and Manufacturing sector**

\[
D \log (E_t) = 11.6488 + 0.2098D \log E(t-1) + 0.1732 D \log Y_t - 0.2768D \log Y(t-1) -0.3704 \log E(t-1) - 0.0752 Y(t-1) \quad \text{Adj } R^2 = 0.5822
\]

**Trade sector**

\[
D \log (E_t) = 1.1106 + 0.0675D \log E(t-1) + 0.1854 D \log Y_t + 0.20675D \log Y(t-1) -0.4274 \log E(t-1) - 0.1392 Y(t-1) \quad \text{Adj } R^2 = 0.506
\]

**Construction sector**

\[
D \log (E_t) = -5.5353 + 0.4511D \log E(t-1) + 0.3972 D \log Y_t - 0.13375D \log Y(t-1) -1.0608 \log E(t-1) - 0.6380 Y(t-1) \quad \text{Adj } R^2 = 0.5296
\]

**Electricity Gas & Distribution sector**

\[
D \log (E_t) = -2.9153 - 0.02361D \log E(t-1) + 0.1739 D \log Y_t - 0.2393D \log Y(t-1) -0.5121 \log E(t-1) - 0.1226 Y(t-1) \quad \text{Adj } R^2 = 0.5196
\]

**Transport& Communication sector**

\[
D \log (E_t) = -6.3244 + 0.1897D \log E(t-1) + 0.2635 D \log Y_t + 0.1189D \log Y(t-1) -0.6495 \log E(t-1) - 0.1438 Y(t-1) \quad \text{Adj } R^2 = 0.6907
\]

1. **Overall Employment Generation Capacity**

On the basis of above estimated models for the economy as a whole and for six major sectors of the economy of Pakistan, short-run and long-run employment elasticities are calculated. The table 1 shows short run and long run employment elasticities for Pakistan. Overall for the economy, the short run and long run elasticities are 0.13 and 0.11, respectively. It means that ten percent increase in GDP leads to generate 1.3% jobs in the short run and only 1.1 % jobs, in the long run. The elasticity is very low, if we compare the growing labor force; which grew about 2.5% per annum, during this period, it appeared that, on average, about one percent of the labor is added to unemployed reservoir every year.
Table: 1. Sectoral Employment Elasticities

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Short-run employment elasticities</th>
<th>Long-run employment elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>0.13</td>
<td>0.11</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.09</td>
<td>0.13</td>
</tr>
<tr>
<td>Mining &amp; Manufacturing</td>
<td>0.17</td>
<td>0.20</td>
</tr>
<tr>
<td>Trade</td>
<td>0.18</td>
<td>0.32</td>
</tr>
<tr>
<td>Construction</td>
<td>0.39</td>
<td>0.60</td>
</tr>
<tr>
<td>Electricity, gas &amp; Dist.</td>
<td>0.17</td>
<td>0.24</td>
</tr>
<tr>
<td>Transport &amp; communication</td>
<td>0.26</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Source: computed by the authors

The low employment elasticity and backlog of unemployed labor is an alarming signal which requires immediate attention of the policy makers. There is a need to formulate employment policies which can ensure both GDP and employment growth in the long run, which absorb the growing labor force.

In the Agriculture sector, the employment elasticity is even lower than the overall capacity of job creation. It is the largest sector in Pakistan in terms of employed labor force. It provides livelihood to almost two-third of population. The key fact about agriculture is that about 65% of the population relies upon agriculture. The employment elasticity of agriculture sector is 0.13 in the long run and 0.09 in the short run. In the long run, for every ten percent increase in agricultural output, employment increases by 1.3 percent. This elasticity is falling overtime; it was 0.3 before 1980.5 The agriculture-GDP share is low; as compared to other sectors. One of the possible options is to reduce the number of dependent on agriculture sector by creating non-farm employment opportunities. For this, the policies in the long run should focus on enhancing productivity per worker and productivity per hectare.

The employment elasticity for mining & manufacturing sector is 0.20 and 0.17 in the long-run and short-run, respectively. It may be noted that it is one of the growing and promising sector which is expected to absorb growing labor force, since as the country grows, this sector flourishes more than the other sectors. The low again employment elasticity of manufacturing sector can be attributed to neglect of small scale industry, use of more capital-intensive techniques, high costs of production and non-availability of skilled and trained manpower. There is a need to further improve the employment generation ability of this sector by establishing small scale and agro based industries as well as encouraging labor-intensive

technology. Another important aspect is that a job can be created at a low cost, as compared to large scale industry. For the trade sector the long-run employment elasticity is 0.32 and short run employment elasticity is 0.18. There is a need to analyze how far services sector is able to absorb the labor force displaced from other sectors of the economy. Services sector has to play a vital role in employment generation particularly when employment elasticities in commodity producing sectors are either stagnant or declining.

The construction sector has a long run employment elasticity of 0.60 and 0.39 in the short run. It is also a growing sector and large employment can be enhanced. The analysis by Jehangir & Nazli (2000) shows that, although, this sector has the highest employment elasticity but overall its size and growth is very low; rather, it is one of the lowest as compared to other sectors. Although, the employment elasticity is reasonably high for this sector but a question also arises about the quality of labor, absorbed is poor.

The long run employment elasticity for Electricity, Gas & Distribution sector is 0.24, and short-run employment elasticity is 0.17. Electricity, gas & distribution sector is capital intensive in nature and employment generation depends upon installed capacity. There is a need to enhance the installed capacity of capital, so that the demand for labor can be enhanced.

Table 1 also provides long run elasticity of 0.22 and 0.26 for the short run for Transport & Communication sector, respectively. It may be noted that this sector is not also able to absorb much of the growing labor force. In the long run, if this sector grows at 10%, it will create 2.6% jobs. The services sector is large but again the elasticity is not satisfactory. However, there is still a scope for its expansion particularly for the communication sector.

The above discussion pertaining to employment elasticities of major sectors of the economy indicated that there is a need for a shift in public policies focused on employment generation. The main sectors like manufacturing and agriculture are not absorbing the additional labor. This is mainly due to the increased use of capital-intensive technology in both these sectors. But unfortunately the effects of these declining employment elasticities are not properly countered by increase in employment elasticities of other sectors like services sector. As discussed above, only construction sector has a relatively higher employment elasticity of 0.60, and then comes Electricity, Gas & Distribution. An important dimension of the problem is that, on the one hand the share of construction sector is small in employment, besides it absorbs mostly unskilled and semi-skilled labor. All these factors taken together have aggravated the problem of unemployment in Pakistan.

2. Labor’s Demand and Supply Imbalances

Table 2 provides projections for demand and supply of labor force for the future period up to the year 2020. The details of ARIMA models’ application are provided in the appendix. The last column of the table 2 shows expected
unemployment rates. It clearly indicates a rising trend in unemployment rates in the coming decade. This rate is expected to be as high as 14.69% in 2020. These forecasts can be rationalized on many grounds, particularly, if we keep in mind the low employment elasticity with respect to output in the long run, as provided in the last table. Besides that, increasing participation rates of females in economic activity, low employment elasticities of major sectors, mechanization of agricultural sector, and the uses of more capital-intensive techniques are some of the sources for such high unemployment rates.

Another very important factor, which should be taken into account, is that although various government documents claim a low population growth rate of around 2.0%. It may be noted that about 28.69% of the total population is in the age group of (5-15) years. These 28.69% people, assuming labor force participation rate (LFPR) of 35% implies that 12931.45 thousands persons will be entering in the labor market.

<table>
<thead>
<tr>
<th>Year</th>
<th>Labor force (Millions)</th>
<th>Employment (Millions)</th>
<th>Imbalance (Millions)</th>
<th>Unemployment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>38.82</td>
<td>36.23</td>
<td>2.59</td>
<td>6.67</td>
</tr>
<tr>
<td>2001</td>
<td>39.68</td>
<td>36.80</td>
<td>2.88</td>
<td>7.25</td>
</tr>
<tr>
<td>2002</td>
<td>40.52</td>
<td>37.38</td>
<td>3.14</td>
<td>7.74</td>
</tr>
<tr>
<td>2003</td>
<td>41.37</td>
<td>37.96</td>
<td>3.41</td>
<td>8.24</td>
</tr>
<tr>
<td>2004</td>
<td>42.22</td>
<td>38.53</td>
<td>3.69</td>
<td>8.73</td>
</tr>
<tr>
<td>2005</td>
<td>43.09</td>
<td>39.11</td>
<td>3.98</td>
<td>9.23</td>
</tr>
<tr>
<td>2006</td>
<td>43.95</td>
<td>39.69</td>
<td>4.26</td>
<td>9.69</td>
</tr>
<tr>
<td>2007</td>
<td>44.81</td>
<td>40.26</td>
<td>4.55</td>
<td>10.15</td>
</tr>
<tr>
<td>2008</td>
<td>45.66</td>
<td>40.84</td>
<td>4.82</td>
<td>10.55</td>
</tr>
<tr>
<td>2009</td>
<td>46.51</td>
<td>41.42</td>
<td>5.09</td>
<td>10.94</td>
</tr>
<tr>
<td>2010</td>
<td>47.37</td>
<td>41.99</td>
<td>5.38</td>
<td>11.35</td>
</tr>
<tr>
<td>2011</td>
<td>48.23</td>
<td>42.57</td>
<td>5.66</td>
<td>11.73</td>
</tr>
<tr>
<td>2012</td>
<td>49.09</td>
<td>43.15</td>
<td>5.94</td>
<td>12.10</td>
</tr>
<tr>
<td>2013</td>
<td>49.94</td>
<td>43.73</td>
<td>6.21</td>
<td>12.43</td>
</tr>
<tr>
<td>2014</td>
<td>50.80</td>
<td>44.30</td>
<td>6.50</td>
<td>12.79</td>
</tr>
<tr>
<td>2015</td>
<td>51.65</td>
<td>44.88</td>
<td>6.77</td>
<td>13.10</td>
</tr>
<tr>
<td>2016</td>
<td>52.51</td>
<td>45.46</td>
<td>7.05</td>
<td>13.42</td>
</tr>
<tr>
<td>2017</td>
<td>53.36</td>
<td>46.03</td>
<td>7.33</td>
<td>13.73</td>
</tr>
<tr>
<td>2018</td>
<td>54.22</td>
<td>46.61</td>
<td>7.61</td>
<td>14.03</td>
</tr>
<tr>
<td>2019</td>
<td>55.08</td>
<td>47.19</td>
<td>7.89</td>
<td>14.32</td>
</tr>
<tr>
<td>2020</td>
<td>55.93</td>
<td>47.76</td>
<td>8.17</td>
<td>14.69</td>
</tr>
</tbody>
</table>

Source: Calculated by the authors
market looking for the job. While there is only 8.89% of the total population in the age group (45-59) years; about 4020.8 thousand will be leaving the labor market. Again an increasing pressures on the supply of labor, on the face of limited capacity of the economy to generate jobs. So, the unemployment rates are expected to further aggravate when these baby-boom generations will enter the labor market.

3. **Employment Generation by Sectors**

Table 3 provides projections of employment levels for the major sectors of the economy by 2020. Here, it is expected that agriculture sector will absorb 3.79 million additional workers between 2005 and 2020; while providing employment to 23.13 million workers by 2020. During the same period the manufacturing sector is expected to employ additional 2.11 million workers. Similarly, 1.9 million, 0.82 million, 0.039 million and 0.75 million workers are expected to be absorbed in Trade, Transport, Electricity, Gas & Distribution and Construction sector, respectively. Overall, 45.5 million workers will be absorbed against the total labor supply of over 56 million people. Thus, unemployment could rise to as high as 18% of the labor force. It is an alarming figure of expected unemployment for the policy makers and for the government to draw its’ immediate attention towards this problem. It is not only important that a large segment of the labor force will be unemployed but it also deserve attention due to waste of human resources as well as loss of output.

Table: 3. Employment Generation by Sectors

<table>
<thead>
<tr>
<th>Year</th>
<th>Agriculture (Millions)</th>
<th>Mining &amp; Manufact. (Millions)</th>
<th>Trade (Millions)</th>
<th>Transport (Millions)</th>
<th>Electricity Gas&amp;Dist. (Millions)</th>
<th>Construction (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>19.34</td>
<td>5.44</td>
<td>6.09</td>
<td>2.45</td>
<td>0.326</td>
<td>2.42</td>
</tr>
<tr>
<td>2006</td>
<td>19.62</td>
<td>5.65</td>
<td>6.20</td>
<td>2.51</td>
<td>0.329</td>
<td>2.47</td>
</tr>
<tr>
<td>2007</td>
<td>19.84</td>
<td>5.76</td>
<td>6.30</td>
<td>2.56</td>
<td>0.330</td>
<td>2.52</td>
</tr>
<tr>
<td>2008</td>
<td>20.12</td>
<td>5.86</td>
<td>6.41</td>
<td>2.62</td>
<td>0.331</td>
<td>2.57</td>
</tr>
<tr>
<td>2009</td>
<td>20.35</td>
<td>6.08</td>
<td>6.51</td>
<td>2.67</td>
<td>0.333</td>
<td>2.62</td>
</tr>
<tr>
<td>2010</td>
<td>20.62</td>
<td>6.18</td>
<td>6.62</td>
<td>2.72</td>
<td>0.336</td>
<td>2.67</td>
</tr>
<tr>
<td>2011</td>
<td>20.85</td>
<td>6.29</td>
<td>6.72</td>
<td>2.78</td>
<td>0.338</td>
<td>2.72</td>
</tr>
<tr>
<td>2012</td>
<td>21.12</td>
<td>6.50</td>
<td>6.83</td>
<td>2.83</td>
<td>0.341</td>
<td>2.77</td>
</tr>
<tr>
<td>2013</td>
<td>21.35</td>
<td>6.61</td>
<td>6.93</td>
<td>2.89</td>
<td>0.345</td>
<td>2.82</td>
</tr>
<tr>
<td>2014</td>
<td>21.62</td>
<td>6.82</td>
<td>7.04</td>
<td>2.94</td>
<td>0.348</td>
<td>2.87</td>
</tr>
<tr>
<td>2015</td>
<td>21.85</td>
<td>6.93</td>
<td>7.46</td>
<td>3.00</td>
<td>0.350</td>
<td>2.92</td>
</tr>
<tr>
<td>2016</td>
<td>22.12</td>
<td>7.03</td>
<td>7.57</td>
<td>3.05</td>
<td>0.353</td>
<td>2.97</td>
</tr>
<tr>
<td>2017</td>
<td>22.36</td>
<td>7.16</td>
<td>7.67</td>
<td>3.10</td>
<td>0.355</td>
<td>3.02</td>
</tr>
<tr>
<td>2018</td>
<td>22.63</td>
<td>7.29</td>
<td>7.78</td>
<td>3.16</td>
<td>0.358</td>
<td>3.07</td>
</tr>
<tr>
<td>2019</td>
<td>22.86</td>
<td>7.42</td>
<td>7.89</td>
<td>3.21</td>
<td>0.362</td>
<td>3.12</td>
</tr>
<tr>
<td>2020</td>
<td>23.13</td>
<td>7.55</td>
<td>7.99</td>
<td>3.27</td>
<td>0.365</td>
<td>3.17</td>
</tr>
</tbody>
</table>

Projected by the authors.
IV. Conclusions and Policy Implications

The main focus of this study was to find out short run and long run employment elasticities for the economy as a whole and also the same was to be identified for major sectors of the economy. Based upon these empirical foundations expected absorption of growing labor force for these sectors was to be identified. Moreover, unemployment up to the year 2020 was to be highlighted.

Based upon the estimated employment elasticities and absorption capacity of the economy, imbalance in the labor market has been identified. The results show that the growth process in Pakistan is unable to generate sufficient needed employment opportunities, which could absorb the growing labor force. Overall, as well as, sectoral low employment elasticities led to create high unemployment rate in Pakistan. The growing trend of unemployment is expected to continue in the next decade. The major finding is that Pakistan is suffering from double digit unemployment which is expected to grow further by the year 2020. It is expected that unemployment may be as high as over 14 percent in future. The high rate of unemployment is mainly attributed to the use of capital-intensive techniques by major sectors of the economy, slow growth and mismanagement of human resources. It may be argued that low employment elasticities may be desirable for some sectors i.e. agriculture, but this decline in employment elasticities has to be balanced by a rise in employment elasticities of other sectors. It may be noted that it is not happening; rather it is declining in all sectors. This study also indicated that in the past most of the studies had estimated higher employment elasticities; as compared to this study. The employment elasticities have been declining over time both for all the sectors and for the economy as a whole. It is an alarming signal for the policy makers and for the labor force.

The study suggests that there is an urgent need; not only to encourage the application of labor-intensive techniques, developing small-scale agro based industries but also to accelerate the overall growth of the economy to match with the growing labor force. Besides that, there is a need to focus on the development of the sectors having high employment elasticities to further enhance their employment generation capacity. It is a need of the hour to realize the gravity of the situation and to take necessary steps in the right direction to tackle the unemployment problem.
Appendix Tables

### Table: A.1 ADF – Statistic

<table>
<thead>
<tr>
<th>Variable</th>
<th>level</th>
<th>Conclusion</th>
<th>First difference</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loge</td>
<td>-1.8801</td>
<td>I(1)</td>
<td>-3.7689</td>
<td>I(0)</td>
</tr>
<tr>
<td>Logy</td>
<td>-0.0714</td>
<td>I(1)</td>
<td>-3.8312</td>
<td>I(0)</td>
</tr>
<tr>
<td>logEa</td>
<td>-1.3620</td>
<td>I(1)</td>
<td>-3.4523</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYa</td>
<td>-2.0577</td>
<td>I(1)</td>
<td>-5.2108</td>
<td>I(0)</td>
</tr>
<tr>
<td>logEm</td>
<td>-0.9004</td>
<td>I(1)</td>
<td>-3.3060</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYm</td>
<td>-1.5634</td>
<td>I(1)</td>
<td>-3.6630</td>
<td>I(0)</td>
</tr>
<tr>
<td>logEt</td>
<td>-1.7123</td>
<td>I(1)</td>
<td>-3.6651</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYt</td>
<td>-3.1105</td>
<td>I(1)</td>
<td>-7.0384</td>
<td>I(0)</td>
</tr>
<tr>
<td>logEc</td>
<td>-1.6571</td>
<td>I(1)</td>
<td>-4.9773</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYc</td>
<td>-1.0526</td>
<td>I(1)</td>
<td>-3.3435</td>
<td>I(0)</td>
</tr>
<tr>
<td>Logged</td>
<td>-2.5715</td>
<td>I(1)</td>
<td>-4.8572</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYgd</td>
<td>-2.4140</td>
<td>I(1)</td>
<td>-3.3523</td>
<td>I(0)</td>
</tr>
<tr>
<td>logEtc</td>
<td>-2.5715</td>
<td>I(1)</td>
<td>-4.8572</td>
<td>I(0)</td>
</tr>
<tr>
<td>logYtc</td>
<td>-2.4140</td>
<td>I(1)</td>
<td>-3.3523</td>
<td>I(0)</td>
</tr>
</tbody>
</table>

* Significant at 1%. ** Significant at 5%.

### Table: A.2 Johansen’s Co-integration Results

<table>
<thead>
<tr>
<th>Series</th>
<th>Null Hypotheses</th>
<th>Alternative Hypotheses</th>
<th>Eigen value</th>
<th>λ. max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(E) and log(Y)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.6850</td>
<td>30.66*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.1629</td>
<td>4.09</td>
</tr>
<tr>
<td>Log(Ea) and log(Ya)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.6891</td>
<td>26.88*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.2188</td>
<td>4.69</td>
</tr>
<tr>
<td>Log(Em) and log(Ym)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.6853</td>
<td>27.01*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.0692</td>
<td>1.578</td>
</tr>
<tr>
<td>Log(Et) and log(Yt)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.9981</td>
<td>32.318*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.1558</td>
<td>3.728</td>
</tr>
<tr>
<td>Log(Ec) and log(Yc)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.4479</td>
<td>25.055*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.2405</td>
<td>7.388</td>
</tr>
<tr>
<td>Log(Egd) and log(Ygd)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.6630</td>
<td>28.543*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.2877</td>
<td>6.748</td>
</tr>
<tr>
<td>Log(Etc) and log(Ytc)</td>
<td>r = 0</td>
<td>r &gt; 0</td>
<td>0.6891</td>
<td>26.88*</td>
</tr>
<tr>
<td></td>
<td>r ≤ 1</td>
<td>r &gt; 1</td>
<td>0.2188</td>
<td>4.69</td>
</tr>
</tbody>
</table>

* Denotes rejection of hypotheses both at 1% and 5% level of significance.
Table: A. 3: The ARIMA Model: 1, Dependent Variable is D log (F)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficients</th>
<th>Std. Error</th>
<th>t- ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.0265</td>
<td>0.00375</td>
<td>7.0641</td>
</tr>
<tr>
<td>AR (1)</td>
<td>0.7245</td>
<td>0.1360</td>
<td>5.3266</td>
</tr>
<tr>
<td>MA (1)</td>
<td>-1.5201</td>
<td>0.3538</td>
<td>-4.2912</td>
</tr>
</tbody>
</table>

$R^2 = 0.5765$  
Adj. $R^2 = 0.5362$  
RSS = 0.00216  
$DW = 2.09$

Table: A.4: The ARIMA Model: 2, Dependent Variable is D log (E)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficients</th>
<th>Std. Error</th>
<th>t- ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.020</td>
<td>0.0010</td>
<td>19.460</td>
</tr>
<tr>
<td>AR (1)</td>
<td>0.5084</td>
<td>0.2378</td>
<td>2.1377</td>
</tr>
<tr>
<td>AR (2)</td>
<td>0.1321</td>
<td>0.2659</td>
<td>0.4968</td>
</tr>
<tr>
<td>AR (3)</td>
<td>-0.1343</td>
<td>0.2476</td>
<td>-0.5423</td>
</tr>
<tr>
<td>MA (1)</td>
<td>-1.8901</td>
<td>0.4329</td>
<td>-4.3652</td>
</tr>
</tbody>
</table>

$R^2 = 0.7291$  
Adj. $R^2 = 0.6562$  
RSS = 0.0034  
$DW = 1.97$
References


Holger, & Strobl, (2002). The incidence of visible underemployment: evidence for Trinidad and Tobago. *Credit Research papers No 01/10*.


Simulation Analysis of Short and Long Run Shocks on the Macroeconomy of Pakistan

Syed Kashif Saeed and Eatzaz Ahmad

Abstract
This paper traces the effects of temporary and permanent changes in price level, GDP, money supply, interest rate, exchange rate and foreign exchange reserves by using a six-variable VAR model. The main findings are that; GDP growth in the long run pressurizes prices due to which inflation keeps on increasing along with GDP. An exogenous increase in prices results an increase in GDP in short run but in long run it depresses the output. Therefore, there is an evidence of optimum rate of inflation with respect to output growth and targeted inflation rate is not necessary to become zero.

I. Introduction
The economists, sociologists and politicians condemn the inflation because it takes away purchasing power from the individuals, reduces real cash balances, increases the nominal interest rate and creates unwarranted effects on the distribution of economic well-being. Inflation is usually considered or treated as a single macro variable but it is a natural response to a variety of disturbances in the economy. According to the framework of aggregate demand and supply, inflation is a result of excess demand or deficient supply in goods market. Therefore, any particular level of prices during a specific time period is the result of multiple economic forces, so it is almost impossible for the economists or econometricians to specify each of them in this dynamic world.

The role of inflation in economic growth and efficiency is also a matter of controversial debate. The Classical economists are of the belief that; in the long run, money is neutral in the sense that an increase in money supply increases the prices without affecting the real variables, output and employment. The well-known empirical relationship between inflation and unemployment was discovered by Philip (1958); known as Philips curve that has negative slope. Later on, Phelps and Friedman (1967) raised serious observations on the validity of the curve and contended that in the long run correlation between inflation and unemployment is

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1 The authors are Assistant Professor at the Institute of Management Sciences, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi and Professor, Department of Economics, Quaid-i-Azam University, Islamabad.
zero. But today economists are in agreement that inflation is helpful in increasing employment and growth at least in short run.


As far as Pakistan is concerned, most of the past empirical studies focused the issue with respect to causes and contributory factors of inflation and its redistribution effects. Khan and Senhadji (2001) examined the relationship of high and low inflation with economic growth using panel data for 140 developing and industrialized countries for the period of 1960-98. This study suggested the threshold level of inflation for both industrialized and developing countries; because after that it exerts a negative effect on economic growth. The threshold levels are 1% to 3 percent for the industrialized and 7% to 11 percent for developing countries. Mubarik (2005) estimated the effects of inflation over GDP growth rate for Pakistan using annual data 1973-2000, and also included population and investment as control variables in the model. The results of this study indicate that an inflation rate of 9% and above adversely affected the GDP growth rate and below that, it is statistically insignificant.

Kamal (2006) examined the joint relationship among money supply, output and inflation for Pakistan in both short run and long run. This study used impulse response function in order to find out time path of variations of the variables; along with co-integration and error correction mechanism for long and short period analysis. The results indicated that a negative relation exists between inflation and output in the short run and becomes positive in the long run. It implied that an increase in output reduces the price level in the short run but increases in the long run. Abbas (2009) also estimated the determinants of inflation for Pakistan using a number of nominal and real variables in the analysis. The most important finding was that an increase in GDP increases the inflation rate as well; very surprising result, which was not supported by theory.

All these studies check the relationship but none has tried to explore the interrelationship between inflation and economic growth. The present study is an attempt to evaluate the nature of relationship between price level, GDP and other
macro variables like money supply, interest rate, exchange rate and foreign exchange reserves in case of Pakistan’s economy. All these variables are policy instruments as well and their interactive analysis will provide a comprehensive and precise guideline to the policy makers. Therefore, this study focuses on the following questions.

- Is there any evidence of relationship between inflation and GDP growth?
- What are the long run and short run responses of inflation and output growth to each other?

Since price is a nominal variable and it is influenced by other nominal variables. Therefore, money supply, interest rate, exchange rate and foreign exchange reserves are also included in the study. In order to broaden the scope of the study, further investigation has also been made in order to find out:

- What is the contribution of other nominal variables in influencing GDP and price level?
- How do all variables affect one another during the short run, as well as long run?

II. Framework of Analysis, Data and Estimation

1. The Model

Although, the study aims to determine the nature of relationship between price level and output, many other macroeconomic variables cannot be ignored. These variables are important not only in determining one or both of the price level and output, but also in influencing the nature of relationship between the two variables. The nature of relationship among these variables can be analyzed by estimating a VAR model, which is simple in structure and does not impose any a priori restrictions on empirical structure of the economy on the basis of rigid economic theory, though some of the principles of economic theory can still be incorporated in the structure. This advantage becomes especially important if one is interesting in empirical outcomes of research without committing to any particular theory. Simplicity of the construction and estimation procedure is the additional advantages. Following the spirit of simplicity, we choose a medium-sized VAR model containing the following variables.

- **Y**: Output, measured by GDP at constant market prices
- **P**: Price level, measured by GDP deflator
- **M**: Money supply, measured by M2
- **E**: Exchange rate, measured as rupees per US dollar
- **R**: Foreign exchange reserves held by the State Bank of Pakistan, measured in rupees and deflated by the GDP deflator
- **I**: Money market interest rate, represented by the nominal inter-bank call money rate
Indicating the six variables by $X_{it}$ ($i = 1, \ldots, 6$), we specify following six-variables, three lags VAR model consisting of the following six equations:

$$\Delta \log(X_{it}) = \alpha_0 + \sum_{j=1}^{6} \sum_{k=1}^{3} \alpha_{ijk} X_{j,it-k} + \epsilon_{it}$$

(1)

2. The Data

The analysis is performed on the basis of quarterly data for a period of 84 quarters: 1983-I to 2003-IV. Quarterly data on national income accounts have become recently available in Arbi and Kemal (2004). The reason for choosing the quarterly data is that a quarter appears the right time interval at which short period responses, especially in nominal variables, are observed and one can meaningfully analyze the timings of the cause and effect relationships taking into account the possible feedbacks. The terminating point of data 2003-IV is the last data point available on GDP and related variables. The other terminating point 1983-I is chosen leaving three quarters of adjustment following the de-linking of Pak rupee from the US dollar.

Data of GDP at constant market prices and the GDP deflator are taken from Arbi and Kemal (2004), while the data on all other variables are taken from various issues of International Financial Statistics (publication of IMF) and various annual reports of the State Bank of Pakistan.

3. The Estimation Procedure

Although VAR model consists of a set of Seemingly Unrelated Regression (SUR) equations, yet the estimation technique in practice is Ordinary Least Squares (OLS), unless there is any specific econometric problem such as autocorrelation. The reason for the application of OLS technique lies in a well-known result that if each equation in the SUR model contains the same set of explanatory variables, GLS collapses to OLS (Green (2004). To tackle autocorrelation, sufficient lag structure has to be considered in the specification of the VAR model. However, to preserve parsimony, lag length also need to be justified on the basis of proper tests or performance criteria.

In this study we shall start with a lag of eight periods and then follow ‘general to specific’ diagnostic/specification procedure. In particular, we applied Wald test on the restriction that all the coefficients at eight-period lag are equal to zero. If this restriction is accepted, the model will be re-estimated with seven-period lag and Wald test will be applied on the restriction that all the coefficients at seven-period lag are equal to zero. This testing procedure will continue till the Wald test results support the rejection of the null hypothesis.

---

2 The three-period lag structure is specified on the basis of ‘general to specific’ diagnostic/specification procedure.
Once the VAR model is estimated, it needs to be interpreted for economic analysis. Unfortunately parameter estimates of the VAR model are most likely to be contaminated by severe multi-collinearity and, hence their direct interpretation is not much useful. Instead the cause and effect relationships are analyzed with the help of Impulse Response Functions (hereafter IRF). An IRF simulates the effect of shock in a specific variable of the model on the same or any other variable of the model. The magnitude of the shock is set equal to one standard deviation of the variable in the first period of simulation and equal to zero in the remaining periods. The responses in the variables are traced over a set of periods such as 10, 50, 100, etc.

In this paper, we deviate from this practice and instead set the magnitude of the shock equal to one percent of the value of the variable in the terminal period of data that is 2003-IV. Furthermore, in addition to temporary shocks we also consider the effects of permanent changes in each variable on all variables of the model.

III. Empirical Analysis

As discussed earlier, we have taken one real and five nominal variables in our model. The shock of one percentage point is introduced in each variable one by one and response of each variable is obtained through the process of simulation. This practice makes a total of 36 results for temporary shocks and another 36 results for the permanent shocks. The response functions are then converted into a graphic form for visual comprehension.

1. Temporary Shocks

Temporary shocks are represented by one percentage point increase in period 1 of simulation above the actual value of each variable of the model. The responses of various variables to these temporary shocks, shown in figure 1 to figure 6, are discussed as follows.

The time paths of the responses in various variables to temporary output shock are presented in various panels of figure 1. The output shock seems to be harmful for output itself, which declines as a result of the shock below the normal level after third period and then takes about 20 quarters (or 5 years) to get back to the normal level. The reason is that the shock results in piling up of inventories, which discourages investment and growth in the later periods. The price response to output shock is cyclical; initially there is a rise in prices because of the higher input demand, then declining trend is observed during the next 6 periods as more goods and services are available in the economy. Finally, inflationary pressures are observed again later in time path. This reappearance of price increase can be associated with the decline in the level of GDP as shown in panel (a) of figure 1. The normalization of price level takes a long time.

There is an increase of 0.8 percentage points in money supply in order to accommodate the output growth and it also takes fairly long period of time for the money supply to return to its normal path. The output shock also increases the
demand for import, therefore exchange rate deteriorates along with an increase in output but it converges in short time of 10 periods. Along with the import pressure, the foreign exchange reserves also decline very sharply up to -19 percentage points but convergence occurs soon after 5 quarters. Finally, the response of interest rate is just according to the economic theory; because of the increase in money demand accompanying GDP, interest rate increases by 1.3 percentage points within five periods and then it takes a very long time for convergence.

Figure 2 shows that the response of variables to price shock. The response of prices to price shock is not for a long time period, inflationary effects of price shock dies down within eight quarters. In short time, price shock does not seem to be harmful to output, GDP growth increases to 0.08 percentage points in 8 periods, then decline to -0.07 in the next few quarters. In the early periods higher prices motivate producers to increase output but later on with the normalization of prices businesses considerably reduce investments and then it takes a long time period for output to convergence to its normal time path. Money supply response to price shock is cyclical; initially it reduces to -0.1 percentage points in order to stabilize the price level and then increases to stimulate GDP growth and then the process of convergence sets in.

Price shock encourages imports and discourages exports, therefore exchange rate deteriorates and foreign exchange reserves deplete in the initial periods. Deterioration in exchange rate normalizes in 20 quarters and, hence, the reserves start increasing. Nominal interest rates always increases with the increase in prices, the same has been observed in our simulation, but it takes a very long period of time for market rate of interest to settle back to its original level. The crucial result is that inflationary shock results in positive real effect in terms of GDP in the short run. But in the long run inflationary shock is detrimental to GDP growth.

The analysis of one period money supply shock is presented graphically in figure 3. It shows that money supply is quite responsive to its own shocks and it takes quite a long period of time to achieve convergence. The response of GDP growth to money supply shock is almost the same as to price shock, initially it rises, then fall and finally convergence but its intensity is relatively lower as compared to price shock. It is very well established that the expansionary monetary policy generates inflationary pressures and the same is observed in this experiment. There is a rise in prices of 0.07 percentage point up to fifth period. Thereafter, the price level continues to decline till convergence occurs.

The exchange rate deteriorates with the increase in prices. Therefore money supply shock also results in local currency depreciation but the initial response of exchange rate is appreciation of 0.3 percentage points in the first period. However, foreign exchange reserves increase to 4 percentage points in the initial period as a result of the shock. Intervention in foreign exchange market by the central bank is also a channel of monetary expansion. Besides that, foreign currency accounts are one of the components of money supply in Pakistan. Therefore the reserves also
increase with the increase in money supply. As far as interest rate is concerned, it always follows the inflation rate. Monetary shock stimulates prices and therefore, interest rate keeps on increasing up to 8th period and converges in the long run.

Figure 4 shows that response of variables to exchange rate shock. The response of exchange rate to exchange rate shock is not much persistent; exchange rate normalizes to its normal path in the very next period after the shock. Similarly the output level is also not much affected by the exchange rate shock. The price level and money supply are not very responsive as well. There is a little rise in both variables that settle down very early in the next few periods. All these indicators suggest that openness of our economy is not very high and depreciation does not affect economic activities by a significant margin. However, the level of foreign exchange reserves increases by 1.8 percentage points, which indicates that depreciation of currency, is helpful in boosting the foreign reserves. Interest rate is also responsive to the exchange rate shock; it increases by 0.27 percentage points in the next period and converges after a long time. Financial investors are highly sensitive to gains and losses to their saving. Therefore, depreciation of local currency motivates domestic savers to divert their savings to assets denominated in foreign currency and this shortage of supply in savings results in an increase of interest rate.

The foreign exchange reserves of a country are mainly used to counter speculation and market imperfection. A sizable amount of the reserves enhances the element of stability in the economy. Therefore, there is an overall positive impact of increase in foreign exchange reserves on the economy that is shown by figure 5. Foreign exchange reserves decline to 0.2 percentage points in the third period but converge very early to the normal level. Output and price level also do not respond to this shock; their level remains almost undisturbed. However, there is a small increase in money supply by 0.01 percentage points with the increase in monetary base as a result of the shock. There is a slight appreciation in the exchange rate as well. The market interest rate declines by 0.15 percentage points because of the positive sentiments in money market developed by the increase in foreign exchange reserves.

The time paths of the responses in various variables to the interest rate shock are shown in various panels of figure 6. The response of interest rate to a shock in itself is long lasting and takes 50 periods for convergence. There is a little decline in GDP growth by -0.1 percentage points and it converges after 20 periods in response of the shock. The reason for this decline is that with the increase in interest rate borrowings become expensive, which discourage investment and growth. Prices also increases to 0.1 percentage points but settle back very early. There is a decline in money supply by 0.25 percentage points that could be the outcome of tightened monetary policy to counter the inflationary pressures resulting from the interest rate shock.

Economic theory suggests that an increase in domestic interest rate attracts foreign capital, which in turn results in appreciation of exchange rate and improvement in foreign exchange reserves. The increase in interest rate also
adversely affects private investment and, hence slows down economic activity. As a result, balance of payments deteriorates, exerting adverse pressures on exchange rate and reserves position. Thus, the changes in interest rate can affect exchange rate and foreign exchange reserves in either direction. Our results show that as a result of one percentage point increase in interest rate, exchange rate depreciates by 0.3 percentage points and the reserves decline by 3.2 percentage points.

2. Permanent Shocks

This section covers short-run as well as long-run response of macro variables due to an increase of one percentage point growth in each variable in every period. Due to permanent change, dependent variables do not converge to normality as in case of temporary shocks. This implies that we can observe the long run behavior resulting from permanent changes in various variables. The permanent change in each variable is set equal to one percent and its effects on all the variables are simulated for 100 periods. The results are presented in various panels of figure 7 to figure 12.

The relationship between output and prices is straightforward in terms of quantity of money in circulation and goods and services available in the economy. A relative increase in money supply or decrease in output will push the prices upward and vice versa. According to the simulation results, there is a decline in prices with the increase in GDP but this trend is of a short period of time. After ten periods, prices begin to rise and this trend continues till the end. The decline in prices in the early periods is due to availability of more goods and services than before, but excess demand for factor inputs in order to produce more will increase the levels of wages, rent and interest rate, and consequently results in a permanent price hike.

The immediate response of monetary authorities to output shock is expansionary monetary policy in order to accelerate GDP growth but very soon declining trends in money supply are observed in order to neutralize inflationary pressures. An increase in GDP growth stimulates imports, therefore exchange rate depreciates and foreign exchange reserves deplete very sharply during the first 10 periods. However, exchange rate stabilizes after some periods and the foreign exchange reserves position also improves. The response of interest rate is straightforward as it keeps on increasing because of the ever-increasing demand for capital.

The simulation results show that the Price level is quite responsive to the shock in itself; it increases at the decreasing rate and stabilize at 3.5 percentage points in about 50 periods. It is probably because initially the effects of repeating exogenous shocks continue to accumulate but the effects of past shocks tend to be eliminated in the long run. Therefore, in the long run the accumulated effect of the price shocks stabilizes to a certain level, which is about 3.5 percentage points. There is a rise in GDP growth during initial ten periods then a declining trend sets in, which continues over a long period of time. During the early stages higher price level generates higher
profits and attracts investments but in the later stages inflationary pressures disturb the economy through high rate of interest and unstable environment, therefore there is a persistent decline in the GDP.

The response of money supply to permanent price increase is quite informative. During the first 25 periods money supply increases, however, as the price shocks accumulate further, the money supply starts decreasing until its growth rate settles at about 0.4 percentage points. Therefore, in short run, central bank follows an accommodating monetary policy to meet the money demand in the light of increased nominal volume of transactions but in the long run, it attempts to fight inflation by tight monetary policy. Exchange rate keeps on deteriorating with increase in prices as it discourages exports and encourages imports. The deterioration is very sharp during the first 15 periods and then marginal in the later periods. In short run there is a sharp depletion of foreign exchange reserves along with depreciation of exchange rate but later on foreign exchange reserves start improving because of the improvement in trade balance following the exchange rate depreciation.

Money supply is very responsive to the shock in itself; it grows at a rapid pace during the first 25 periods, however a declining tendency is observed during the later part of simulations. This is because central bank restricts the money supply in order to control the inflationary pressures. The permanent increase in money supply affects other variables very significantly. During the initial periods output increases by 0.15 percent but soon after it starts declining at diminishing rate and this pattern continues in the long run. The behavior of GDP in response to money supply is similar to that caused by price shock because permanent monetary expansion results in a permanent rise in prices. As far as foreign exchange rate is concerned, it appreciates in the short run but depreciates in the long run. Foreign exchange reserves continue to increase throughout the period of simulations. The initial response of exchange rate follows positive short-run effect of monetary expansion on output. However, the rising price level soon offsets this short-term effect and exchange rate starts depreciating. Foreign exchange reserves increase in short run because of increase in nominal interest rate combined with appreciation of home currency. The reserve position continues to improve even after exchange rate starts depreciation, which is the likely result of improvement in trade balance following the exchange rate depreciation.

Historically Pakistan is a trade deficit country and due to uncertain political environment it has never been an attractive place for foreign direct investment. Therefore rupee has always been under pressure especially during the decade of 1990’s. Economic theory suggests that depreciation of currency is helpful in improving trade balance, although it may aggravate the problems of trade balance in the short-run (mechanics of J-Curve). The effects of permanent increase in exchange rate are shown by figure 10. This shows that a permanent increase in exchange rate by one percentage point does not have any substantial feedback effect from rest of
the economy because on net basis the change remains close to one percentage point and quickly adjusts to its slightly higher long run level. Initially it appreciates a little and then starts depreciation with a gentle pace in the later periods. It is because exchange rate is mainly affected by the international capital flows and insufficient foreign exchange reserves; if the trade is smooth and the reserves are healthy then exchange rate remains stable over a long period of time.

The GDP is not affected during first few periods and then it starts declining marginally during later periods. This can be because the increase in the prices of imported inputs, like oil and capital goods, discourage investment and growth. Depreciation of exchange rate results in inflation as imports become expensive and if some of the imports have low price elasticities such as petroleum products then inflationary pressure cannot be avoided. That is why; prices keep on increasing with the depreciation of exchange rate.

The response in money supply is marginal; it increases to 0.25 percentage points during the initial 25 periods and then stabilizes around this level. The increase in money supply could have been the result of central bank’s monetary policy by which it seeks to meet the expected increase in model demand resulting from the price inflation triggered by exchange rate depreciation. Foreign exchange reserves keep on increasing with the depreciation of exchange rate and this could be the result of improvement in balance of trade following the depreciation. But the main factor appears to be significant is the increase in interest rate, which results an improvement in balance of payments (capital account) through capital inflows. The nominal rate of interest keeps on increasing for quite some time due to inflationary effect of exchange rate depreciation.

The figure 11 shows the response of variables to the permanent shock of foreign exchange reserves. This indicates that a permanent increase in foreign exchange reserves is not sustainable; only about 70% of the exogenous increase in foreign exchange reserves sustains in the long run. It is so because data of the reserves follow a cyclical pattern, increase in the reserves is followed by a decrease in next period/periods with the exception of periods 2001 and onward, and especially during 1984 to 1992 the reserves remained under extreme pressure. As discussed earlier, an increase in foreign exchange reserves creates a stable economic environment and all variables response positively to the increase in foreign exchange reserve. There is a slight increase in GDP and money supply but prices remain stable over time (an economist’s dream). There is an appreciation of 0.06 percentage points in exchange rate, which is helpful in maintaining the price stability. And interest rate declines to 0.02 percentage points, which is supportive for investment.

The central bank plays an important role in the determination of interest rate. Normally, State Bank of Pakistan increases the prime rate of interest under inflationary pressure and reduces it when economy is in recession. Apart from that, government also influences the central bank, indirectly if not directly, to increase the rate of interest for domestic borrowings when it is under fiscal pressure. This was
happened during late 1990’s after nuclear explosions of May 1998. The responses of various economic variables to changes in interest rate are analyzed in figure 12. The rate of interest is highly responsive to the permanent increase in itself; it increases sharply during the first 25 periods or so, and then stabilizes at 6 percentage points. This is so, because financial markets are quite sensitive and if any kind of disturbance or shock is observed, then interest rate is settled at a different equilibrium position.

According to the economic theory high rate of interest discourage investment and reduces economic growth. Interestingly, simulation results confirm this theory as the GDP declines in the long run by 0.7 percentage points in response of permanent shock. Similarly prices are also influenced by the interest rate, as there is an increase of 0.4 percentage points in general price level. Thus, interest rate plays a moderate role in the determination of GDP and prices level. Since the percentage increase in price level is less than the increase in interest rate, real interest rate increases. As a result monetary growth is reduced to check the increased in interest rate. Increase in price level also results in exchange rate depreciation. Foreign exchange reserves are also influenced by the increase in interest rate. Although in the short run foreign exchange reserves declines by 0.8 percentage points, there is a visible improvement in the growth of foreign exchange reserves in the long run.
Figure: 1. Responses to Output Growth Shock

Fig. 1a: Response of Output to Shock in Output

Fig. 1b: Price response to Shock in Output

Fig. 1c: Monetary response to Shock in Output

Fig. 1d: Exchange Rate Response to Shock in Output

Fig. 1e: Response of FOREX to Shock in Output

Fig. 1f: Interest Rate Response to Shock in Output
**Figure: 2. Responses to Price Shock**

**Fig. 2a:** Response of Prices to Price Shock

**Fig. 2b:** Response of Output to Price Shock

**Fig. 2c:** Monetary response to price shock

**Fig. 2d:** Exchange Rate Response to Price Shock

**Fig. 2e:** Response of FOREX to Price Shock

**Fig. 2f:** Interest Rate Response to Price Shock
Figure: 3. Responses to Money Supply Shock

Fig. 3a: Response of Money Supply to Monetary Shock

Fig. 3b: Output Response Money to Supply Shock

Fig. 3c: Price Response to Money Supply Shock

Fig. 3d: Exchange Rate Response to Money Supply Shock

Fig. 3e: Response of FOREX to Monetary Shocks

Fig. 3f: Interest Rate Response to Monetary Shocks
Figure: 4. Responses to Exchange Rate Shock

Fig.4a: Response of Exchange Rate to Exchange Rate Shock

Growth rate

Fig.4b: Response of Output to Exchange Rate Shock

Growth rate

Fig.4c: Response of Prices to Exchange Rate Shock

Growth rate

Fig.4d: Response of Money Supply to Exchange Rate Shock

Growth rate

Fig.4e: Response of FOREX to Exchange Rate Shock

Growth Rate

Fig.4f: Response of Interest Rate to Exchange Rate Shock

Growth Rate

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Figure: 5. Responses to Foreign Exchange Reserve Shock

Fig.5a: Response of FOREX to Shock in FOREX

Growth rate

Fig.5b: Response of Output to Shock in FOREX

Growth rate

Fig.5c: Response of Prices to Shock in FOREX

Growth rate

Fig.5d: Response of Money Supply to Shock in FOREX

Growth rate

Fig.5e: Response of Exchange Rate to Shock in FOREX

Growth rate

Fig.5f: Response of Interest Rate to Shock in FOREX

Growth Rate
Figure: 6. Responses to Interest Rate Shock

Fig. 6a: Response of Interest Rate to Interest Rate Shock

Fig. 6b: Response of Output to Interest Rate Shock

Fig. 6c: Response of Exchange Rate to Interest Rate Shock

Fig. 6d: Response of Money Supply to Interest Rate Shock

Fig. 6e: Response of Prices to Interest Rate Shock

Fig. 6f: Response FOREX to Interest Rate Shock
Figure: 7. Responses to Permanent Increase in Output

**Fig. 7a:** Response of Output to Permanent Increases in Output

**Fig. 7b:** Response of Prices to Permanent Increase in Output

**Fig. 7c:** Response of Money Supply to Permanent Increase in Output

**Fig. 7d:** Response of Exchange Rate to Permanent Increase in Output

**Fig. 7e:** Response of FOREX to Permanent Increase in Output

**Fig. 7f:** Response of Interest Rate to Permanent Increase in Output
Figure: 8. Responses to Permanent Increase in Price Level

Fig. 8a: Response of Price level to Permanent Increase in Price Level

Fig. 8b: Response of Output to Permanent Increase in Price Level

Fig. 8c: Response in Money Supply to Permanent Increase in Price Level

Fig. 8d: Response of Exchange Rate to Permanent Increase in Price Level

Fig. 8e: Response of FOREX to Permanent Increase in Price Level

Fig. 8f: Response of Interest Rate to Permanent Increase in Price Level
Figure: 9. Responses to Permanent Increase in Money Supply

Fig. 9a: Response of Money Supply to Permanent Increase in Money Supply

Fig. 9b: Response of Output to Permanent Increase in Money Supply

Fig. 9c: Response of prices to Permanent Increase in Money Supply

Fig. 9d: Response of Exchange Rate to Permanent Increase in Money Supply

Fig. 9e: Response of FOREX to Permanent Increase in Money Supply

Fig. 9f: Response of Interest Rate to Permanent Increase in Money Supply
Figure: 10. Responses to Permanent Depreciation in Exchange Rate

Fig. 10a: Response of Exchange Rate to Permanent Depreciation in Exchange Rate

Fig. 10b: Response of Output to Permanent Depreciation in Exchange Rate

Fig. 10c: Response of Prices to Permanent Depreciation in Exchange Rate

Fig. 10d: Response of Money Supply to Permanent Depreciation in Exchange Rate

Fig. 10e: Response of FOREX to Permanent Depreciation in Exchange Rate

Fig. 10f: Response of Interest Rate to Permanent Depreciation in Exchange Rate
Figure: 11. Responses to Permanent Increase in Foreign Exchange Reserves

Fig. 11a: Response of FOREX to Permanent Increase in FOREX

Growth rate

Fig. 11b: Response of Output to Permanent Increase in FOREX

Growth rate

Fig. 11c: Response of Prices to Permanent Increase in FOREX

Growth rate

Fig. 11d: Response of Money Supply to Permanent Increase in FOREX

Growth rate

Fig. 11e: Response of Exchange Rate to Permanent Increase in FOREX

Growth rate

Fig. 11f: Response of Interest Rate to Permanent Increase in FOREX

Growth rate
Figure: 12. Responses to Permanent Increase in Interest Rate

Fig. 12a: Response of Interest Rate to Permanent Increase in Interest Rate

Fig. 12b: Response of Output to Permanent Increase in Interest Rate

Fig. 12c: Response of Prices to Permanent Increase in Interest Rate

Fig. 12d: Response of Money Supply to Permanent Increase in Interest Rate

Fig. 12e: Response of Exchange Rate to Permanent Increase in Interest Rate

Fig. 12f: Response of FOREX to Permanent Increase in Interest Rate
IV. Conclusions and Policy Implications

The main findings of this study are that GDP growth in the long run; pressurizes prices. Therefore, inflation keeps on increasing along with GDP. If there is an increase in prices in the short run, it will cause an increase in GDP as well. However, in the long run, inflationary pressure depresses the output. Therefore, there is an evidence of optimum rate of inflation with respect to output growth and targeted inflation rate is not necessarily zero. As far as money supply is concerned, it is helpful in boosting output in the short run but during the long period it is also harmful for the economy. Furthermore, uncontrolled money supply generates inflationary pressure as well. The deterioration of exchange rate depresses the level of output and results in price escalation. The accumulation of foreign exchange reserves is helpful both for stabilization of prices and output growth. Finally, stable rate of interest over a long period of time is an ultimate necessity for stable prices and higher level of output.

Authorities at the policy making need to control the high rate of inflation but should not target to zero percent inflation as it could have depressing effects on economic growth. At the same time, interest rate should not be allowed to escalate because it is harmful for both prices and output growth. It means that a moderate level of inflation is the desirable target in order to achieve stable growth in output without high inflation.

The level of foreign exchange reserves need to be maintained at a standard position but not to the extent that it produces high inflation through exchange rate depreciation. The reserves are very helpful for stable economic environment. Authorities need to try to stabilize exchange rate over a long period of time because its depreciation inflates prices and depresses output growth. All in all it appears that a controlled and sustained growth in money supply, which may be slightly higher than the output growth, could be the key for the stability of economic growth, price, exchange rate and foreign exchange reserves.
References


Purchasing Power Parity and Black Market Exchange Rate Nexus

Ghulam Shabbir and Amjad Naveed

Abstract
The main purpose of this study is to test the purchasing power parity for selected Asian countries using black market exchange rates. Though in previous studies the primary attention was given to the official exchange rate rather than the black market exchange rate, its importance cannot be ignored due to volume of transactions carried out in black market, which remained much larger than that in the official market. Therefore, an effort has been made to highlight the importance of black market exchange rates in testing the purchasing power parity (PPP) hypothesis. We used monthly data from ten selected Asian countries and the bound-testing approach to test the long run relationship between the black market exchange rate and relative prices. The study concluded that PPP hypothesis gets more support when the black market exchange rate and production price index are used instead of consumer price index. It appears that the official exchange rate is still managed, which is different than the actual market clearing exchange rate. In other words, the black market exchange rate is closer to market rates as compared to managed exchange rates.

I. Introduction
The purchasing power parity (PPP) theory has a long history in economic literature, but this specific terminology was introduced after the First World War. Initially, this concept was propounded by the scholars of the University of Salamanca in the sixteenth century and was revived in the context of debate concerning the appropriate level for nominal exchange rates among the major industrialized countries after the large-scale inflations during and after the world war (Cassel, 1916; 1918). The PPP theory claims that a unit value of currency has the same purchasing power in trading nations. It involves a relationship between the nominal exchange rate and the ratio of two prices; domestic to foreign country. In its absolute version,
the equilibrium exchange rate should be equal to the price ratio of domestic to foreign country, whereas in its relative version it states that changes in the nominal exchange rate over a period of time are equal to the inflation differential between the domestic and foreign country.

The PPP theory is based on the law of one price (LOP), according to which identical goods have the same prices in different markets when transportation cost and other trade barriers are ignored. This implies that the PPP theory plays an important role in the determination of exchange rate between two nation’s currencies\(^3\), and equilibrium exchange rate implies that each country’s currency has same purchasing power in each of the two countries. This means that exchange rate between two countries is just equal to the ratio of their prices for a similar basket of goods and services. This implies that relative prices move proportionally to the changes in the nominal exchange rate in the long run. Therefore, exchange rate reverts to its long run equilibrium position\(^4\) (Bhatti, 1996; Lothain & Taylor, 1996). If it does not revert, then either arbitrageur are not going to respond to profitable opportunities or transaction costs and other trade barrier hamper the trade (Davutyan & Pippinger, 1985). This entails that exchange rate has a unit root and PPP does not hold. Therefore, it is important to test the empirical validity of PPP for any country.

Formal tests for the evidence of PPP are based on an empirical examination of the exchange rate. If the exchange rate is to settle down at any level then it shows reversion towards its own mean. Therefore, mean reversion is the necessary condition for PPP to hold in the long-run and for Absolute PPP it means the real exchange rate. Roll (1979) tested the null hypothesis that the real exchange rate does not mean reverting. He concluded that it is a non-mean reverting time series process and changes in each period are purely random and independent.

However, this early strand of the empirical literature suffered from logical and econometric weaknesses. These studies used standard econometrics techniques like Two Stage Least Squares (TSLS) to test the different versions of PPP and provided mixed results (Frenkel 1978, 1981; Davutyan & Pippenger 1985). These studies used the conventional tests that overlook the problem of non-stationary data series which makes the standard critical values inappropriate (Corbae & Ouliaris 1988). Therefore, recent developments in time series econometrics; unit root tests,

\(^3\)Dornbush (1976), Nelson (1990), Wu (1996), and Parikh and Williams (1998); all are based on the PPP assumption.

\(^4\)There are conceptual and empirical issues about what will be the value of the long-run equilibrium exchange rate. In the literature we have three criteria. First is a Price-based criterion, such as purchasing power parity (PPP) and its variants. Second are model-based criteria which based on the formal models of nominal exchange rates. Third are sustainability-based criteria, which make reference to trends in the current account and the external debts to GDP ratio. Out of all these, a price-based criterion is easy to implement and has strong operational advantages, so we used this one in this study. For detail, see Qayyum A. et al. (2004).
cointegration analysis and their extensions have provided more appropriate tools for testing the PPP hypothesis. These techniques put emphasis on the analysis of residuals of the model instead of the level of the variables in the model.

Taylor (1988) examined the PPP theory for five major industrial countries’ currencies against the U.S. dollar using bilateral exchange rates and the cointegration procedure. He concluded that PPP does not hold in all five cases. These findings are supported by Corbae and Ouiliaris (1988), Layton and Stark (1990), Nachane and Chrissanthaki (1991), Crowder (1992) and Moosa and Bhatti (1996). However, Kim (1990) used cointegration technique for the annual data series of exchange rates between the U.S. dollar and currencies of five industrial countries. This study provided some support for the PPP hypothesis that was further supported by Lothain and Taylor (1996), Wu (1996), Bahmani-Oskooee and Barry (1997), Bahmani-Oskooee (1998), Sarno (2000), Taylor, et al. (2001), Liew et al. (2004) and Sarno et al. (2004).

As concerns the less developed countries (LDCs), McNown and Wallace (1989) tested the PPP hypothesis by using the bilateral exchange rates of four high inflation LDCs; Chile, Argentina, Brazil, and Israel. The PPP hypothesis received some support when it was based on Wholesale Price Indices (WPI) but cointegration technique failed to support the PPP hypothesis in case of Consumer Price Indices (CPI). Moreover, it also failed to get support in the light of Karfakis and Moschos (1989). For Pakistan, Bhatti (1996), Liew et al. (2004), and Ahmed and Khan (2002) tested the PPP postulate and their results support the evidence of the PPP hypothesis, whereas Chishti and Hasan (1993) have the opposite view that PPP does not hold in case of Pakistan. Saeed and Eatzaz (2006) also tested the PPP hypothesis for South Asian Countries by using monthly data on CPI, Wholesale Price Index (WPI) and nominal exchange rates for the period 1984-2002. The findings of this study indicate that PPP holds in the weaker form for Pakistan, evidence for India and Sri Lanka is weak and there is strong indication of the lack of PPP for Bangladesh.

A common characteristic of all the above mentioned studies is that each has used official exchange rates in testing the PPP theory, whereas almost all developing countries have a black market for foreign exchange. The black market exchange rates have a long tradition and in many countries these are supported by governments. Moreover, the volume of transactions in black markets has remained much larger than that in the official market. Therefore, a number of studies were carried out, which used the black market exchange rate to test PPP instead of the official exchange rate. These include Phillip (1988), Bahmani-Oskooee (1993), El-Sakka and McNabb (1994), Baghestani (1997), Sanchez-Fung (1999), Luintel (2000), Kouretas and Zarangas (2001), and Bahmani-Oskooee and Goswami (2005). All these concluded that PPP receives relatively more support when black market exchange rates are used in testing the PPP theory as compared to official exchange rates.

Therefore, in this study we once again put the case of the PPP hypothesis for Asian countries using black market exchange rates and the recently developed econometrics technique; Auto Regressive Distributed Lags model (Bound Testing Approach). The rest of the study is designed as follows: section II provides theoretical background and model specification, section III contains empirical findings and conclusion of the study is provided in section IV.

II. Theoretical Background and Model Specification

The purchasing power parity theory is considered an equilibrium condition for the determination of exchange rates and policies concerning them. The PPP theory is based on the law of one price which states that, in the absence of transportation costs and trade barriers, effective arbitrage in the goods market makes prices identical for the traded good across countries. This implies that

\[ P_i = E \cdot P^*_i \]  \hspace{1cm} (1)

Where \( P_i \) is the price of good \( i \) shown in the domestic country’s currency, \( P^*_i \) is the price of good \( i \) expressed in the foreign country’s currency unit and \( E \) is the nominal exchange rate. On aggregate level, the law of one price yields the purchasing power parity formulation as below.\(^6\)

\[ P_t = E \cdot P^*_t \]  \hspace{1cm} (2)

Equation (2) can be written as:

\[ E = \frac{P_t}{P^*_t} \]  \hspace{1cm} (3)

This absolute version of purchasing power parity states that nominal exchange rate is equal to the ratio between the domestic price level and foreign price level. The log-linear form of the testable version of absolute PPP\(^7\) is:

\[ \log E_{i,t} = \alpha_0 + \alpha_1 \log \left( \frac{P_i}{P^*_i} \right)_t + \epsilon_{i,t} \]  \hspace{1cm} (4)

Where \( E_{i,t} \) shows the units of country \( i \)’s currency per foreign country currency in time period \( t \), \( P_i \) is the price level of country \( i \), \( P^*_i \) is the price level of the foreign country and \( \epsilon_{i,t} \) is the error term. The constant term \( (\alpha_0) \) is included in equation (4) due to non-inclusion of transportation costs, tariff and non-tariff barriers in the model.\(^8\) Normally, we test the restrictions \([\alpha_0 = 0 \text{ and } \alpha_1 = 1]\) to check the long run relationship between variables and to hold PPP this must not be rejected. Moreover,

\(^6\) This formulation is the absolute version of PPP.

\(^7\) The relative version of PPP refers to the relationship between relative changes in nominal exchange rate and differential of relative changes in price levels.

\(^8\) For detail see: Krichene (1998).
for equilibrium relationship between the exchange rate and relative prices, both must be cointegrated. According to Engle and Granger (1987), there are two ways to establish cointegration between variables: (i) variables in the equation are non-stationary but their residuals are stationary and (ii) we incorporate an adjustment mechanism in the equation by which the gap between two sides declines as variables adjust to their long run equilibrium values.\(^9\) This second approach makes equation (4) in the form of Error Correction Model as below:

\[
\Delta \log E_{i,t} = \beta_0 + \sum_{k=1}^{n_1} \beta_1 k \Delta \log E_{i,t-k} + \sum_{k=0}^{n_2} \beta_2 k \Delta \log \left( \frac{P_i}{P^*_i} \right)_{t-k} + \lambda \varepsilon_{i,t-1} + \nu_{i,t} \quad (5)
\]

This equation shows that deviation between the exchange rate and relative prices is measured by the lagged value of \(\varepsilon\) and it should decline for the adjustment towards long run equilibrium values of these variables. This implies that an estimate of \(\lambda\) should be negative and significant, whereas its magnitude indicates the speed of adjustment. For the cointegration test all data series should have the same cointegrating order and if they do not, then the Engle and Granger (1987) method cannot be applied. This implies that both variables must have the same integrating order one. But if one variable is integrated of order one I(1) and the other is of zero I(0), then we use another technique, Bounds Testing Approach, in which we replace the lagged value of \(\varepsilon\), \((\varepsilon_{t-1})\) with the lagged linear combination of variables.\(^{10}\) For this we first calculate the \(\varepsilon_i\) from equation (4) and take its lag by one period, as shown below:

\[
\varepsilon_{i,t-1} = \log E_{i,t-1} - \alpha_1 \log \left( \frac{P_i}{P^*_i} \right)_{t-1} \quad (6)
\]

By substituting equation (6) in equation (5), we get the following equation:

\[
\Delta \log E_{i,t} = \beta_0 + \sum_{k=1}^{n_1} \beta_1 k \Delta \log E_{i,t-k} + \sum_{k=0}^{n_2} \beta_2 k \Delta \log \left( \frac{P_i}{P^*_i} \right)_{t-k} + \lambda_1 \log E_{i,t-1} + \lambda_2 \log \left( \frac{P_i}{P^*_i} \right)_{t-1} + \nu_{i,t} \quad (7)
\]

The formulation of error correction model (7) is preferred to the previous one (5) due to: (i) variables used in equation (7) can be integrated of order one or zero; (ii) long run equilibrium relation among variables can be established by testing for joint significance of \(\lambda_1\) and \(\lambda_2\) by using F test with new critical values given by Pesaran et al. (2001); (iii) by assumption, if all variables are integrated of order one I(1) and I(0), they provide an upper bound and lower bound critical values for these


\(^{10}\) For detail see: Pesaran et al. (2001).
bounds respectively; (iv) for the long run equilibrium relationship, the calculated F statistic should be greater than the upper bound critical value.

Moreover, equation (7) can be used to estimate short run as well as long run effects. The estimated coefficient of $\beta_2 k$ indicates the short run effects between the exchange rate and relative prices, whereas for the long run we see the estimated value of $\lambda_2$ that is normalized on estimate of $\lambda_1$. To check whether PPP holds or not, we set the estimated values of this lagged linear combination equal to zero and solve for $\log E_{i,t-1}$ in the following:

\[
\hat{\lambda}_1 \log E_{i,t-1} + \hat{\lambda}_2 \log \left( \frac{P_i}{P^*} \right)_{t-1} = 0
\]

and

\[
\log E_{i,t-1} = -\frac{\hat{\lambda}_2}{\hat{\lambda}_1} \log \left( \frac{P_i}{P^*} \right)_{t-1} \tag{9}
\]

Equation (9) states that the value of $\hat{\lambda}_2/\hat{\lambda}_1$ must be unity for holding the PPP.

III. Empirical Findings

We estimated equation (7) using black market exchange rates with Consumer Price Index (CPI) and Production Price Index (PPI) as prices. The monthly data series for CPI and PPI for 10 Asian countries are collected from the International Financial Statistics (IFS) publication of IMF, and the black market exchange rate data series are from Reinhart and Rogoff (2004). The study period for each country is different depending on the availability of the data. The results of the F test for cointegration depends on the number of lags imposed on each first-differenced data series. We used Akaike’s Information Criterion and Schwarz Criterion for the selection of optimal lag length. After the selection of optimum lag length, we estimated the equation (7), calculated $\hat{\lambda}_2/\hat{\lambda}_1$, and the required results are presented in table 1.

The estimated F statistic is used to determine the co-integration among variables. The estimated results indicate that the calculated F statistic is greater than its upper bound critical value of 4.14 for the countries, Indonesia, Pakistan and Malaysia (PPI as prices) and Thailand and Singapore (CPI as prices). Furthermore,

---

11 www.puaf.umd.edu/faculty/papers/reinhart/reinhart.htm
13 For detailed results see: tables A-1 and A-2, in Appendix.
Table: 1. Estimated Results for the Long Run Coefficients (Effects)

<table>
<thead>
<tr>
<th>Country</th>
<th>Price</th>
<th>Constant</th>
<th>Log (E)</th>
<th>Log (P/P*)</th>
<th>(-\lambda_2 / \lambda_1)</th>
<th>F- Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>CPI</td>
<td>-0.0002</td>
<td>0.0001</td>
<td>-0.0096</td>
<td>-54.912</td>
<td>0.9712</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.0608 (1.2211)</td>
<td>-0.0146 (-1.3206)</td>
<td>0.0320 (1.4103)</td>
<td>-2.1838</td>
<td>0.6577</td>
</tr>
<tr>
<td>Indonesia</td>
<td>CPI</td>
<td>-0.0096 (1.8407)**</td>
<td>0.0038 (0.3548)</td>
<td>0.0061 (0.3638)</td>
<td>1.5952</td>
<td>1.18106</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.3323 (1.4103)</td>
<td>-0.0341 (1.7208)**</td>
<td>0.0542 (2.0937)**</td>
<td>-1.5870</td>
<td>19.7623</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>CPI</td>
<td>0.0088 (0.5160)</td>
<td>-0.0011 (-0.2788)</td>
<td>-0.00004 (-0.0076)</td>
<td>0.0416</td>
<td>1.2264</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.2888 (1.0904)</td>
<td>-0.0393 (-0.9973)</td>
<td>0.1074 (0.9626)</td>
<td>-2.7299</td>
<td>0.4323</td>
</tr>
<tr>
<td>Pakistan</td>
<td>CPI</td>
<td>0.11761 (2.3593)*</td>
<td>-0.0281 (-2.1746)**</td>
<td>0.0460 (2.4598)*</td>
<td>-1.6364</td>
<td>2.6283</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.5477 (5.7099)**</td>
<td>-0.1549 (-5.6020)*</td>
<td>0.1337 (5.7485)*</td>
<td>-0.8633</td>
<td>7.0314</td>
</tr>
<tr>
<td>Korea</td>
<td>CPI</td>
<td>0.4925 (3.5121)*</td>
<td>-0.0715 (-3.4905)*</td>
<td>0.0597 (3.2947)*</td>
<td>-0.8349</td>
<td>2.9854</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.2309 (3.3955)*</td>
<td>-0.0335 (-3.4003)*</td>
<td>0.0383 (3.1236)*</td>
<td>-1.1424</td>
<td>2.9854</td>
</tr>
<tr>
<td>Malaysia</td>
<td>CPI</td>
<td>-0.0214 (-0.6512)</td>
<td>0.0373 (1.2273)</td>
<td>0.2491 (1.6736)***</td>
<td>6.6722</td>
<td>3.0063</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>-0.0103 (-0.2684)</td>
<td>0.0260 (0.7675)</td>
<td>0.1041 (1.5999)***</td>
<td>3.9995</td>
<td>6.2217</td>
</tr>
<tr>
<td>India</td>
<td>CPI</td>
<td>0.0906 (2.0750)**</td>
<td>-0.0217 (-1.9267)**</td>
<td>0.0377 (2.0246)**</td>
<td>-1.7398</td>
<td>1.0853</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.1139 (2.2537)**</td>
<td>-0.0292 (-2.1592)**</td>
<td>0.0392 (2.1992)**</td>
<td>-1.3434</td>
<td>1.1660</td>
</tr>
<tr>
<td>Thailand</td>
<td>CPI</td>
<td>0.1254 (2.0909)**</td>
<td>-0.0377 (-2.0129)**</td>
<td>0.0403 (1.3893)</td>
<td>-1.0707</td>
<td>6.6317</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.1139 (2.2537)**</td>
<td>-0.0292 (-2.1592)**</td>
<td>0.0392 (2.1992)**</td>
<td>-1.3431</td>
<td>1.16604</td>
</tr>
<tr>
<td>Singapore</td>
<td>CPI</td>
<td>0.0941 (2.6835)*</td>
<td>-0.1424 (-2.6972)*</td>
<td>0.0523 (2.0791)**</td>
<td>-0.3677</td>
<td>5.3896</td>
</tr>
<tr>
<td></td>
<td>PPI</td>
<td>0.0456 (1.7707)***</td>
<td>-0.063519 (-1.6460)***</td>
<td>0.0085 (0.3463)</td>
<td>-0.1336</td>
<td>1.9482</td>
</tr>
<tr>
<td>Philippines</td>
<td>CPI</td>
<td>0.0193 (0.3247)</td>
<td>-0.0025 (-0.1539)</td>
<td>0.0047 (0.2647)</td>
<td>-1.8553</td>
<td>1.5395</td>
</tr>
</tbody>
</table>

The critical value for the upper bound of F test at 10% level of significance is 4.14. This is taken from the Pesaran et al. (2001, Table CI: Case III, page 300).
the value of \( \frac{\lambda_2}{\lambda_1} \) is closer to unity that confirms the PPP hypothesis except for Malaysia and Singapore. This test also provides support in favor of PPP for Korea, India and Thailand (with PPI). These results imply that a PPP hypothesis gets more support when PPI is used instead of CPI. These results also support the earlier findings of McNown and Wallace (1989), Bhatti (1996), Liew et al. (2004), Tang and Butiong (1994), Ahmed and Khan (2002), and Saeed and Eatzaz (2006). The performance of the PPP postulate is further improved due to use of black market exchange rates in the estimation process. This performance also supports the previous views presented by Bahmani-Oskooee (1993), El-Sakka and McNabb (1994), Baghestani (1997), Sanchez-Fung (1999), Luintel (2000), Kouretas and Zarangas (2001) and Bahmani-Oskooee and Goswami (2005).

IV. Conclusions

This study is carried out to test the Purchasing Power Parity for selected Asian countries. We have used the black market exchange rate with Consumer Price Index (CPI) and Production Price Index (PPI) to investigate the long run relationship between the exchange rate and relative prices using monthly data series. For estimation, we used the bounds testing approach. The estimated results indicate that calculated F statistic is greater than its upper bound critical value of 4.14 for three countries; Indonesia, Pakistan and Malaysia when PPI is used as prices and it becomes true only for two countries, Thailand and Singapore with CPI as prices. Furthermore, the PPP hypothesis is also supported by the value of the ratio between long run coefficients of price ratio to exchange rate \( - \frac{\lambda_2}{\lambda_1} \) that is close to unity for India (PPI), Korea (PPI) and Thailand (PPI, CPI). This confirms that a PPP hypothesis gets more support when PPI is used for prices instead of CPI.
References


### Table: A.1. Estimated Coefficients (Effects) for Short and Long Run

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Japan CPI (57 to 98) PPI (68-98)</th>
<th>Indonesia CPI (68 to 98) PPI (71-98)</th>
<th>Sri Lanka CPI (57-98) PPI (76-98)</th>
<th>Pakistan CPI (57-98) PPI (61:6-98)</th>
<th>Korea CPI (70-98) PPI (57-98)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0002 (-0.0182)</td>
<td>-0.0096 (-0.1018)</td>
<td>0.3323 (1.8407)***</td>
<td>0.0088 (0.5160)</td>
<td>0.11761 (2.3593)*</td>
</tr>
<tr>
<td>LER (-1)</td>
<td>0.0001 (0.0604)</td>
<td>-0.0146 (-1.3206)</td>
<td>0.0038 (0.3548)</td>
<td>-0.0011 (-0.2788)</td>
<td>-0.0281 (-2.1746)**</td>
</tr>
<tr>
<td>LPR (-1)</td>
<td>0.0096 (-1.1851)</td>
<td>0.0320 (1.4103)</td>
<td>0.0616 (0.3638)</td>
<td>-0.0004 (-0.076)</td>
<td>0.0460 (2.4598)*</td>
</tr>
<tr>
<td>DLER(-1)</td>
<td>0.0486 (1.0719)</td>
<td>0.0688 (1.3964)</td>
<td>0.0393 (0.6962)</td>
<td>0.0486 (-1.0798)</td>
<td>-0.0804 (-1.7634)**</td>
</tr>
<tr>
<td>DLER(-2)</td>
<td>0.0283 (0.6385)</td>
<td>0.0415 (0.8415)</td>
<td>0.0743 (-1.3461)</td>
<td>-0.0927 (-1.6480)***</td>
<td>-0.0906 (-2.0033)**</td>
</tr>
<tr>
<td>DLPR</td>
<td>-0.1172 (-0.6781)</td>
<td>0.0719 (0.3681)</td>
<td>0.1907 (1.0146)</td>
<td>1.5571 (11.2297)*</td>
<td>0.1156 (-2.5673)*</td>
</tr>
<tr>
<td>DLPR(-1)</td>
<td>-0.2594 (-1.5114)</td>
<td>-0.1064 (-0.5468)</td>
<td>-0.0413 (-0.2238)</td>
<td>-0.3634 (-2.2607)***</td>
<td>0.0222 (-0.5133)</td>
</tr>
<tr>
<td>DLPR(-2)</td>
<td>-0.0505 (-0.2934)</td>
<td>-0.0867 (-0.4493)</td>
<td>0.2209 (1.2551)</td>
<td>-0.0513 (-0.3471)</td>
<td>0.0869 (0.5683)</td>
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<tr>
<td>L2/L1</td>
<td>54.9120 (-2.1838)</td>
<td>1.5952 (-1.5870)</td>
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<td>-1.6364 (-0.8633)</td>
<td>0.8349 (-0.8349)</td>
</tr>
<tr>
<td>F Stat</td>
<td>0.9712 0.6577</td>
<td>1.18106 19.7623</td>
<td>1.2264 0.4323</td>
<td>2.6283 7.0314</td>
<td>2.9854 2.9854</td>
</tr>
</tbody>
</table>
### Table: A.2. Estimated Coefficients (Effects) for Short and Long Run

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Malaysia CPI (90 to 98)</th>
<th>PPI (68-98)</th>
<th>India CPI (57 to 98)</th>
<th>PPI (57-98)</th>
<th>Thailand CPI (65-98)</th>
<th>PPI (57-98)</th>
<th>Singapore CPI (73-98)</th>
<th>PPI (74-98)</th>
<th>Philippines CPI (75-98)</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0214 (-0.6512)</td>
<td>-0.0103 (-0.2684)</td>
<td>0.0906 (2.0750)**</td>
<td>0.1139 (2.2537)**</td>
<td>0.1254 (2.0909)**</td>
<td>0.1139 (2.2537)**</td>
<td>0.0941 (2.6835)*</td>
<td>0.0456 (1.7707)**</td>
<td>0.0193 (0.3247)</td>
<td></td>
</tr>
<tr>
<td>LER (-1)</td>
<td>0.0373 (1.2273)</td>
<td>0.0260 (0.7675)</td>
<td>-0.0217 (-1.9267)**</td>
<td>-0.0292 (-2.1592)**</td>
<td>-0.0377 (-2.0129)**</td>
<td>-0.0292 (-2.1592)**</td>
<td>-0.1424 (-2.6972)*</td>
<td>-0.063519 (-1.6460)**</td>
<td>-0.0025 (-0.1539)</td>
<td></td>
</tr>
<tr>
<td>LPR (-1)</td>
<td>0.2491 (1.6736)***</td>
<td>0.1041 (1.5999)***</td>
<td>0.0377 (2.0246)**</td>
<td>0.0392 (2.1992)**</td>
<td>0.0403 (1.3893)</td>
<td>0.0392 (2.1992)**</td>
<td>0.0523 (2.0791)**</td>
<td>0.0085 (0.3463)</td>
<td>0.0047 (0.2647)</td>
<td></td>
</tr>
<tr>
<td>DLER(-1)</td>
<td>0.3057 (2.7033)*</td>
<td>0.2358 (1.9145)**</td>
<td>-0.0265 (-0.5820)</td>
<td>-0.0239 (-0.5215)</td>
<td>-0.3128 (-5.3662)*</td>
<td>-0.0239 (-0.5215)</td>
<td>-0.3047 (-3.5785)*</td>
<td>-0.3674 (-4.2158)*</td>
<td>-0.1145 (-2.4091)*</td>
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<tr>
<td>DLER(-2)</td>
<td>-0.0564 (-0.4913)</td>
<td>0.0550 (0.4514)</td>
<td>0.0138 (0.3044)</td>
<td>0.0156 (0.3423)</td>
<td>-0.0489 (-0.8516)</td>
<td>0.0156 (0.3423)</td>
<td>0.0256 (0.3175)</td>
<td>-0.0103 (-0.1223)</td>
<td>-0.0396 (-0.8431)</td>
<td></td>
</tr>
<tr>
<td>DLPR</td>
<td>-0.7803 (-1.0124)</td>
<td>0.9429 (3.3698)*</td>
<td>0.2471 (1.2549)</td>
<td>0.0953 (0.6155)</td>
<td>-0.1376 (-0.5664)</td>
<td>0.0953 (0.6155)</td>
<td>0.2062 (0.9255)</td>
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<td>-0.0451 (-0.2232)</td>
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<tr>
<td>DLPR(-1)</td>
<td>0.0084 (0.0105)</td>
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<td>0.1190 (0.5417)</td>
<td>0.1213 (0.7550)</td>
<td>0.4400 (1.7780)***</td>
<td>0.1213 (0.7550)</td>
<td>0.0224 (0.1091)</td>
<td>0.1433 (0.6338)</td>
<td>-0.0341 (-0.1611)</td>
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<tr>
<td>DLPR(-2)</td>
<td>-0.7734 (-1.0020)</td>
<td>-0.2841 (-0.9657)</td>
<td>-0.2465 (-1.2450)</td>
<td>0.1388 (0.9073)</td>
<td>-0.3453 (-1.4157)</td>
<td>0.1388 (0.9073)</td>
<td>-0.0939 (-0.4742)</td>
<td>-0.1693 (-0.8042)</td>
<td>-0.2986 (-1.5284)</td>
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<tr>
<td>L2/L1</td>
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<td>-1.7398 -1.3434</td>
<td>-1.0707 -1.3431</td>
<td>-0.3677 -0.1336</td>
<td>-1.8553</td>
<td></td>
<td></td>
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<tr>
<td>F Stat</td>
<td>3.0063 6.2217</td>
<td>1.0853 1.1660</td>
<td>6.6317 1.16604</td>
<td>5.3896 1.9482</td>
<td>1.5395</td>
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<td>71</td>
</tr>
</tbody>
</table>
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