# The Effect of Price Level on output Per Worker: Evidence from Asian Developing Countries

**Fatima Bibi, Tahir Mahmood, Muhammad Jamil**
Quaid-e-Azam University, Islamabad

**Eatzaz Ahmad**
International Islamic University, Islamabad

Using a sample of 20 developing Asian countries, this study analyzes how general price level affects output per worker through the channels of capital output ratio and total factor productivity (TFP). The main finding is that increase in general price level promotes capital accumulation but results in loss of TFP. The study concludes that increasing general price level distorts relative price signal and, hence results in inefficiency in resource allocation. The study also finds that increase in government expenditure adversely affects output mainly through the channel of TFP. Furthermore, the potential benefits of trade openness on output through increased competition are mostly offset by the harmful effects of increased competition on certain domestic industries. It is also observed that economic growth is the main factor through which overall productivity can be improved.

***Keywords:*** price level, output per worker TFP, GDP per worker
JEL Classification:O1; O4; E1; E2; J

Macroeconomic policies mainly target the realization of sustained economic growth, as approximated by growth rate of GDP. Some of the factors that are expected to promote economic growth include trade openness, financial development and improvement in education and skills of labor forces. On the other hand, rising general price level can affect economic activity on various accounts and some of these effects can be unfavorable. This relationship can be represented between GDP and price level or between GDP growth rate and inflation rate. Most of the empirical studies have found that rising price level adversely affects real sector of the economy (see, for example, Barro, 1995; Fisher, 1993; Bittencourt, 2012; Glyfason & Herbertsson, 2001). Two broad channels through which price increase can affect real economic activity are capital accumulation and productivity.

According to Al-Marhubi (1998), most investors in the society do not like risk. If there is uncertainty about future prices then they reduce the volume of investment contracts to minimize the potential losses, which leads to reduction in capital accumulation. During periods of rising price level, savings are used to purchase real asset such as gold, houses and precious metal rather than to purchase capital stock, which is not necessarily a desirable outcome (Freeman & Yerger, 1997). The real value of capital is reduced due to rising prices, which causes reduction in capital accumulation (Clark, 1982).

Due to rising prices purchasing power would be redistribution against lenders and in favor of borrowers if the borrowing/lending contracts are specified in nominal terms (Gylfason, 1999). Purchasing power of money held by economic agents also decreases due to continuous rise in prices. All these factors are expected to results in reduction in savings and ultimately in capital accumulation.

Rising price level distorts the relative price signals, which lead to inefficient allocation of resources (Freeman & Yerger, 1997). Agents do not fully comprehend whether increase in goods' prices are taking place due to change in demand and supply of goods or due to increase in aggregate price level, so they respond less to these

Correspondence concerning this article should be addressed to Dr. Eatzaz Ahmad, Professor of Economics, International Institute of Islamic Economics, International Islamic University, Islamabad, Email:eatzaz@qau.edu.pk

changes (Al-Marhubi, 1998). It means that incomplete information about relative prices adversely affects productivity.

Elaborating the effect of rising prices on the economy through trade, Gylfason (1999) explains that increase in price level makes the domestic goods more expensive, leading to reduction in demand for exports and thereby slowdown of production activity. Furthermore, the reduction in purchasing power and foreign exchange availability may cause reduction in imports as well. Trade facilitates the new ideas and technology and reduction in trade due to rising general price level in the economy leads to lower real economic activity.

Keeping in view the above observations, the present study analyzes the role of general price level along with other control variables in determining the size of real economic activity as measured by GDP per worker. The study is based on annual data for 31 years from 1980 to 2010 for a panel of 20 developing countries from Asia for 31 years from 1980 to 2010. The channels through which prices may affect real GDP include capital per worker (K/L) and Total Factor Productivity (TFP). The control variables considered are government consumption expenditure to GDP ratio, trade openness, growth rate of GDP and financial development and indicated by quantity of money to nominal GDP ratio.

The rest of the paper consists of five sections. Section 2is devoted to the review of existing literature. Sections 3 and 4 present methodology and data along with details on the construction of variables respectively. Section 5 presents and discusses the main results of the analysis, while section 6 consists of concluding remarks.

**Literature Review**

The main objective of Macroeconomic policies is to obtain stable prices along with sustained level of aggregate economic activity. The relationship between these two variables is debatable. Structuralists' view is that rising price level makes expected real balances less productive and, hence less attractive. This promotes real economic activity through purchase of capital assets. Distortionists' view is that rising prices are unfavorable for real sector of the economy because inflation creates uncertainty in saving and investment decisions. Macro-rational expectationests' view is that rising prices have no effect on real economic activity because agents make their expectations rationally and, therefore, systematic changes in prices are already taken into account in their decision making (Darrat, 1988).

After the 1929 World Economic Crises, it was considered that expansionary policies could revive economic activity. This belief was followed by the development of Phillips Curve, suggesting a positive association between inflation and employment/output. This view was later revived when many countries experienced stagflation, that is, high inflation rate along with slow economic activity, during the 1970s. The macroeconomic models based on microeconomic underpinnings developed after 1980s suggested the possibility that in the long run inflation might have adverse consequences for economic growth because rising prices tend to discourage investors through distorted relative price signals and, hence, result in inefficient resource allocation (Erbaykal & Okuyan, 2008). Sharp increases in prices also compel economic agents to hedge their assets through purchase of real assets, especially the gold and other metals of high value.

A vast literature exists on the exploration of the role that inflation is expected to play in economic growth using time-series or panel data. The evidence on the basis of single country time-series data mostly support the proposition that inflation is detrimental to growth of an economy. Singh and Kalirajan (2003), for example, observed that the GDP growth rate has been adversely affected by inflation in India over the period 1971-98. Using the quarterly data from 1987:1 to 2006:2, Erbaykal and Okuyan (2008) found that in inflation and GDP growth are significantly related in short run, while there is no evidence of systematic permanent relationship between the two variables. Using the US data for the period 1947 to 1981, Clark (1982) found a negative effect of inflation on the productivity of labour. Bivariate Wiener-Granger tests of causality show that inflation Granger causes the productivity. Using quarterly data from 1957:Q4 to 2002:Q3, Wilson (2006) analyzed the relationship of uncertainty of inflation with realized inflation and output growth and found that the uncertainty of inflation ultimately leads to realization of inflation and retardation of output growth.

Using quarterly data over the period 1950:Q1-1994:Q2, Sbordone and Kuttner (1994) explored the possible presence of two-way causation between inflation and productivity in the USA on the basis of standard Granger

causality tests. The empirical results confirm that inflation causes productivity in case of bivariate VAR model and the relationship is found to be negative. However, the role of inflation in productivity becomes weak and insignificant by including common cyclical factors such as growth rate of GDP and federal fund rate in the bivariate VAR model. The study also found that in long run inflation has unfavorable effects on productivity in structural VAR model. Almost similar results are obtained in Papapetrou (2003) for Poland for the period 1991: I - 1998: IV. The study found no long-run association of productivity with price level in bivariate model. However, when interest rate is included in the model, inflation is found to be detrimental to productivity growth.

Freeman and Yerger (1997) observed adverse effect of inflation on productivity and, hence, GDP growth in case of Germany for the period 1951-1991. Using the data over the period 1964-1980 for Greece, Bitros and Panas (2001) found that inflation adversely affects the TFP growth and, hence GDP growth in manufacturing industries. Darrat (1988), on the other hand, observed that anticipated inflation has promoted economic growth in Malaysia, Philippines and Thailand during the period 1961-1985. Similarly McClain and Nichols (1994) found the existence of a positive link from inflation to investment for the US economy. Chimobi (2010) found that inflation in Nigeria does not form a permanent relationship with economic growth over the period 1970 to 2005. Using the data over the period 1965-2007, Kumar *et al.* (2009) explored the possible link from inflation to productivity in Australia and found the relationship between the two variables to be negative and weak. In long run inflation is found to Granger-cause productivity but in short run there is no evidence of such association.

The empirical literature based on panel data also provides similar evidence. Using the data for 23 OECD and 27 developing countries for the period 1962-93, Kim and Willet (2000) found that inflation adversely affected the growth and that the adverse influence of on growth has been more damaging in developed countries than in developing countries. Akinlo (2001) reported a negative association from inflation to TFP in panel data consisting of 34 countries and 23 years from 1980 to2002. Loungani and Sheets (1997) used panel regression for 25 transition economies over the period 1991-94 to analyze the effect of inflation on economic growth and investment and observed that inflation adversely effects economic growth and investment. Fisher (1993) investigated the transmission of inflation to economic growth and observed that one percentage point additional inflation rate results in about 0.04 percentage point reduction in capital accumulation. Furthermore, productivity growth is also adversely affected by inflation rate.

On the basis of time series data for four Latin American economies over the period 1970 to 2007, Bittencourt (2012) investigated the nature of relationship link from Inflation to economic growth and observed that inflation adversely affects growth. On the basis of panel data analysis of 78 countries for the period 1965-85, Al-Marhubi (1998) observed that inflation volatility adversely affects the quality of investment though the relationship is not significant. Hondroyiannis and Papapetrou (1998) analyzed the relationship of productivity with the general price level using annual data from 1960 to 1995 in eight OECD countries characterized by low inflation rate. The results do not support co-integration in bivariate model. Then real GDP and interest rate are added in bivariate model to find the influence of real and monetary activities on the price-productivity relationship. A long-run relationship is found among these variables across all the sampled countries. The results of Vector Error Correction Model show that inflation causes productivity growth but there is negative link from price level to productivity. Bleaney (1996) investigated the effect of inflation on investment and, hence, on economic growth in developing countries. The study found that inflation does not affect investment and growth in case of the developing countries under consideration.

Quite a few studies also investigated whether the relationship between inflation and GDP growth is unique for all ranges of inflation rate. A number of studies have explored the presence of one or more threshold levels of inflation at which the strength of relationship between inflation and GDP growth undergoes structural shifts. Considering the channel of capital accumulations Sarel (1996) estimated structural break in the inflation-growth relationship at 8% rate of inflation for the mixed sample of countries and found that the relationship was positive but insignificant below the structural break and negative and significant above structural break. Burdekin*et al*. (2004) analyzed the inflation-growth relationship for developing and industrial countries. The inflation thresholds were found to be at 3%, 50% and 102% inflation rate in the developing countries and at 8% and 25% inflation rate for the developed countries. The inflation-growth relationship turned out to be positive at inflation rate below 3% threshold level, became negative between 3% and 50% threshold and was insignificant after 50% for the developing countries. For the developed countries, the effect of inflation on economic growth appeared

negative and insignificant at inflation rate below 8% threshold and negative and significant after this threshold level.

Using a large data set for 140 countries and 39 years from 1960 to 1998, Khan and Senhandji (2001) found that the threshold inflation rate was not the same between developed and developing countries; at 11 to 12 percent in case of developing countries but only 1 to 3 percent in case of developed countries. In a similar study López-Villavicencio and Mignon (2011) found that the thresholds levels of inflation were at 2.74 and 17.54 percent for developed and developing countries respectively. For developed countries, inflation was found to be favorable for growth below the estimated threshold level but unfavorable above the threshold level. In case of emerging countries, the inflation was found to be neutral for economic growth below the threshold level but significantly unfavorable above the threshold level.

Bruno and Easterly (1998) found the threshold at 40% annual CPI inflation and observed that the relationship becomes insignificant when high inflation observations are omitted. Barro (1995) estimated the negative effect of inflation on economic growth and investment for 100 countries during the years 1960 to 1990. The study found that one percentage points additional inflation reduces the rate of growth in per capita GDP by 0.02-0.03 percent and reduces the investment ratio by 0.04-0.06 percent. The adverse effects of inflation on economic investment and growth become statistically significant when the sample is restricted to the observations of high inflation rate.

Some other studies, on the other hand, have found that the significant inflation-growth relationship remains more-or-less the same during the periods of high as well as low inflation rates. Ghosh and Phillip (1998) found the turning point in the inflation-growth relationship at 2.5% inflation rate. The inflation coefficient remains statistically significant when high inflation observations are excluded. Similar result was verified by Guerrero (2006) in a much larger sample of 138 countries for the period 1949-2002.

It appears from the above literature review that quite a few studies have been undertaken to analyze the inflation-growth relationship but only few attempts are made to explore the channels through which inflation affects growth. A useful framework through which this task can be accomplished is the growth accounting framework according to which output per worker is the weighted sum of total factor productivity and capital per worker, where the relative weight assigned to capital per worker is the share of capital in output. The present study follows this framework as explained below.

## Method

The above review of the past literature shows that most of the studies using conventional econometric methodology tend to consider rates of inflation and GDP growth while analyzing the possible effects of inflation on growth. However, realizing that inflation rate and GDP growth rate are almost invariable found to be stationary and, hence, cannot form an unconditional long-run relationship, a number of recent studies have also considered price level and GDP in the proposed relationship. If the price level and GDP are taken in logarithmic form, their first difference will approximate inflation rate and GDP growth rate respectively, both of which are expected to be stationary. Thus, the use of variables in logarithmic form to explore the relationship between price level and GDP can be justified as an alternative to the use of variables in the form of growth rates to explore the inflation-growth relationship.

Following the neo-classical framework and denoting output, capital, labor and total factor productivity (TFP) by Y, K, L and A respectively, we specify the following production technology in intensive form assuming constant returns to scale.

$$Y/L = A(K/L)^{\alpha} \quad (1)$$

Or, in natural log form:

$$log(Y/L) = log(A) + \alpha\, log(K/L) \quad (2)$$

The channels or mechanism through which price level can affect the output per worker are total factor productivity (TFP) and capital per worker (K/L). The other variables that can affect the TFP are general government final consumption expenditure as a ratio to GDP (both variables taken in nominal terms),trade openness, that is, exports plus imports as ratio to GDP (all measured in nominal terms),growth rate of GDP and trend. The others possible variables that can affect the capital per worker include government consumption spending as a ratio to GDP, trade openness, growth rate of GDP and financial development(quantity of money to GDP ratio, both measured in nominal terms).Panel data over the period 1980-2010 and for 20 developing Asian countries are used in this study. Fixed Effects Model (FEM) is the econometric technique that is used in the study.

In FEM individuality of each country is studied by allowing the intercept term to vary across the cross-sectional units. Denoting the country and year by i and t respectively, the fixed effects model is given by the following two equations.

$$log(A_{it}) = \beta_{1i} + \beta_2 log P_{it} + \beta_3 log G_{it} + \beta_4 log TO_{it} + \beta_5 GY_{it} + \beta_6 t + u_{it} \quad (3)$$

$$log(K/L)_{it} = \gamma_{1i} + \gamma_2 log P_{it} + \gamma_3 log G_{it} + \gamma_4 log TO_{it} + \gamma_5 GY_{it} + \gamma_6 log M_{it} + v_{it} \quad (4)$$

Substituting the right hand sides of equations (3) and (4) on the right hand side of equation (2), yields:

$$\begin{aligned} log(Y/L)_{it} = {} & (\beta_{1i} + \alpha\gamma_{1i}) + (\beta_2 + \alpha\gamma_2) log P_{it} + (\beta_3 + \alpha\gamma_3) log G_{it} \\ & + (\beta_4 + \alpha\gamma_4) log TO_{it} + (\beta_5 + \alpha\gamma_5) GY_{it} + \alpha\gamma_6 log M_{it} + \beta_6 t + u_{it} + \alpha v_{it} \end{aligned} \quad (5)$$

Or, in compact form;

$$log(Y/L)_{it} = \theta_{1i} + \theta_2 log P_{it} + \theta_3 log G_{it} + \theta_4 log TO_{it} + \theta_5 GY_{it} + \theta_6 log M_{it} + \theta_7 t + \varepsilon_{it} \quad (6)$$

Where

$$\theta_{1i} = \beta_{1i} + \alpha\gamma_{1i} \quad (7)$$

$$\theta_2 = \beta_2 + \alpha\gamma_2 \quad (8)$$

$$\theta_3 = \beta_3 + \alpha\gamma_3 \quad (9)$$

$$\theta_4 = \beta_4 + \alpha\gamma_4 \quad (10)$$

$$\theta_5 = \beta_5 + \alpha\gamma_5 \quad (11)$$

$$\theta_6 = \alpha\gamma_6 \quad (12)$$

$$\theta_7 = \beta_6 \quad (13)$$

Although intercept is different for each country but it does not change over time. This model is called the FEM due to this reason. This model assumes that the slope of each explanatory variable is common across all countries. Dummy variable technique is used to represent the intercept for each country as follows.

$$\begin{aligned} log(Y/L)_{it} = {} & \theta_{1,1} D_{1,i} + \theta_{1,2} D_{2i} + \ldots\ldots\ldots + \theta_{1,20} D_{20i} \\ & + \theta_2 log P_{it} + \theta_3 log G_{it} + \theta_4 log TO_{it} + \theta_5 GY_{it} + \theta_6 log M_{it} + \theta_7 t + \varepsilon_{it} \end{aligned} \quad (14)$$

FEM is also called Least-Squares Dummy Variables(LSDV) model due to this reason.

**Justification of Variables**

***Consumer Price Index (P)***: Continuous increase in general price level can create uncertainty about future prices and may also distort relative prices, which can adversely affect TFP by reducing trade and by confounding the relative price signal. Rising prices can reduce investment by reducing saving and creating price uncertainty. Increase in price level can also have positive affect on investment due to decrease in real wages.

***Government Consumption Expenditure (G)***: Resources are transferred from private sector to government due to high government consumption expenditure. If government uses these resources less efficiently, it will translate into lower total factor productivity. In addition, capital accumulation may is also be discouraged due to squeezing of capital market for the private sector as government expenditure increases. In panel data context wherein economies differ in size, it is necessary to normalize the size of government by the size of the economy. This justifies why government expenditure is divided by GDP.

***Trade Openness (TO)***: Trade openness is expected to positively affect the real GDP. According to endogenous growth literature, there is positive relationship between trade openness and economic activity because technology transfers from one country to another and economies of scale are created due to trade openness. According to neoclassical approach, each country produces and exports those goods in which it has comparative advantage. By doing so, it can produce those goods more efficiently and cheaply (Villavicencio and Mignon, 2011). This explains the possible positive relationship of TFP with trade openness. In addition, products of new technology are produced in the domestic market because of competition among the domestic and foreigner producers. In this way, openness increases the rate of investment (Ciftcioglue and Begovic, 2007). On the other hand, there is also a possibility of adverse effect of trade openness on the economy because the increased level of competition due to trade openness may be detrimental to such domestic industries, which are at infant stage and need to grow to benefit from the economies of scale.

***Growth rate of GDP (GY)***: Increase in growth rate of GDP indicates that the standard of living of people is increasing and they are able to earn and spend more on education and skill development. Higher DGP growth rate also encourages entrepreneurs to invest in R$D activities. For these reasons it is expected increase in GDP growth rate results in increased TFP. Increase in the growth rate of GDP stimulates more investment and creates employment opportunities. Although the net effect on capital-labor ratio can be in either direction, in less-developing countries where there is abundance of labor and shortage of resources for investment, the effect of decrease in unemployment due to economic growth may dominate the effect of increase in capital stock and, hence, capital-labor ratio may decline.

***Financial Development (M)***: Financial development is expected to be favorable forthe economy because in the presence of financial development it becomes easier to adopt new technologies and allocate capital efficiently (Huang *et al*, 2010). Credit rationing reduces due to financial development and financial system provides more funds for investment. Due to financial development, both savers and investors increase the use of financial intermediation and financial resources flow efficiently among agents, which encourages investment and, hence, capital accumulation. Moreover, financial system collects information about the investment project which can enhance productivity. Financial sector development is usually indicated by an aggregate of money like M2 or M3 as a ratio of nominal GDP (see Anga and McKibbin, 2005). This ratio indicates the amount of liquid liability available in relation to size of the economy. A country with greater liquidity in relation to nominal GDP is considered to be financially more developed.

***Trend (t)***: In addition to other variables, time trend is considered as a possible tracker of TFP to capture the effect of other variables that tend to improve productivity with time.

## Data

The econometric analysis in this study is conducted on the basis of annual data for 20 Asian developing countries over the period 1980 to 2010. CPI is taken as the measure of general price level because it is the most commonly used indicator of price level and it is important to focus this indicator to analyze how it can affects capital per worker and TFP. To measure financial sector development we can use M3 or M2 aggregates of money. But due to limited data availability we use M2 rather than M3 as a measure of liquidity.

Data on the nominal values of goods and services trade - exports as well as imports – ((percentages of GDP),gross fixed capital formation, GDP (constant 2005 international US dollar), consumer price index (CPI),quantity of money, M2 (percentages of GDP),government consumption expenditure (percentage of GDP) and labor forceare taken from *World Development Indicator (WDI).* From these data it is straightforward to

derive all the variables used in the above model except for the capital stock and TFP series, which are constructed as follows. For the first year of data the capital stock is estimated as:

$$K_1 = I_1/(g+\delta), \quad (15)$$

where g is the compound growth rate of real GDP and $\delta$ is the depreciation rate. The capital stock for periods 2 onward is calculated as follows.

$$K_t = (1-\delta)K_{t-1} + I_{t-1}, \quad (16)$$

where $K_t$ is the capital stock at the beginning of the year t and $I_{t-1}$ is the gross fixed investment during the previous year (t-1).

To estimate the series of TFP, the value of unknown parameter α, the capital share in the value of output, is needed. The standard practice is to assume constant returns to scale (CRS), fix the value of αin the production function and, hence, to derive TFP using the formula:

$$A_t = Y_t/\left(K_t^{\alpha} L_t^{1-\alpha}\right), \quad (17)$$

The World Bank (2000) has proposed maintain the assumption of CRS and fix the value of α somewhere between 0.3 and 0.5 and we have chosen the value 0.4. Conditional on this parameter, the rest of the parameters are estimated using appropriate econometric technique.

## Results

The parameter estimates of the relationship of capital per worker and TFP with price level and other explanatory variables are presented in the second and third columns of Table 1 respectively. The parameter estimates of the output per worker equation are presented in the last column of the same table. The t-statistics associated with the estimated parameters are presented in parentheses.

The estimation results show that the effect of price level on capital per worker is significantly positive, which supports the argument that investment increases during the periods of rising prices because it is profitable for the investors to invest due to reduction in real wages. The coefficient of price level is estimated to be 0.012, which suggest that 1 percent increase in the price level tends to cause 0.012 percent increase in capital per worker. In contrast, the effect of price level on TFP is negative and statistically significant which supports the expectation that rising general price level adversely affects efficient allocation of resources because rising general price level distorts the relative price signal. The result shows that TFP reduces by 0.016 percent due to 1 percent increase in price level.

If we combine the two effects to determine how price level affects output per worker, we observe from the fourth columns of Table 1 that the negative effect of price level on TFP dominates the positive effect on capital per worker to yield the overall negative and significant effect on output per worker. The result shows that one percent increase in price level tends to reduce the output per worker by about 0.11 percent. Thus, the main conclusion of this paper is that on net basis, rising price level is detrimental to real sector of the economy and this adverse effect is due to loss of productivity rather than lack of capital accumulation.

Government consumption expenditure is found to have adverse but statistically insignificant effect on capital per worker. This result is consistent with the theoretical expectation that government expenditure tends to crowd out private investment, which may result in slow capital accumulation in relation to labor. The impact of government consumption expenditure on TFP is significantly negative which is consistent with the expectation that government does not always use its resources on productive activities and even the expenditure on productive activities is marred with allocative and managerial inefficiencies. The result is that increase in government consumption expenditure by one percent leads to 0.033 percent reduction in TFP.

Since the effects of government expenditure on both the capital per worker and TFP are negative, the overall effect on output per worker is also negative and it is statistically significant. The table shows that increase in government expenditure by one percent causes about 0.04 percent reduction in output per worker.

The relationship between trade openness and capital per worker is significantly positive. In particular, capital per worker increases by 0.018 percent due to one percent increase in trade openness. The trade openness is also favorable for TFP but the relationship is statistically quite insignificant. The combined effect of trade openness on output per worker is positive through the channel of capital per worker. However, the relationship is statistically insignificant. It follows, therefore, that the benefits of trade openness through increased competition is partially offset by the adverse effect brought about by squeezing of certain domestic industries in face of the increased competition.

The growth rate of GDP has negative and significant effect on capital per worker. As mentioned in section 3, GDP growth stimulates investment as well as creates employment opportunities. Since the countries analyzed in this study consists of Asian developing countries, the most of which have abundance of labor, the increase in employment due to economic growth is observed to dominate the increase in capital stock and, hence, capital-labor ratio is adversely affected by increase in GDP growth. The GDP growth rate has positive and highly significant effect on TFP. The coefficient of GDP growth rate shows that one percentage point additional GDP growth rate GDP results in 0.52 percent increase in TFP. This means that increase in the pace of economic growth is instrumental in raising productivity through investment in human capital and stock of knowledge through R$D activities.

Since the positive effect of GDP growth rate on TFP is very large and highly significant, whereas the negative effect on capital per worker is quite small, the net effect of additional GDP growth rate on output per worker remains positive and highly significant. The coefficient of GDP growth rate is estimated to be quite large, 0.496, which means that every one percent increase in growth rate of GDP is associated 0.496 percent increase in output per worker.

The effect of financial development on capital per worker and, hence, on output per worker is positive. This is consistent with the theoretical expectation that with financial development investors have greater access to credit, which is likely to result in increased capital per worker. The relationship is, however, statistically insignificant, indicating that financial development as indicated by money to GDP ratio has limited role in encouraging investment.

The estimated coefficient of time trend in the TFP and output-per-worker equations is highly significant and indicates that TFP and output per worker tend to increase at 2.1 percent rate annually due to the factors not explicitly considered in the estimated equation.

**Table 1**
*Parameter Estimates of the Capital Per Worker and TFP Equations*

| Independent variables | Capital Per Worker Equation | TFP Equation | Output per Worker Equation |
|---|---|---|---|
| $log\,P$ | 0.012<br>(1.69***) | -0.016<br>(-3.64*) | -0.0112<br>(-2.14**) |
| $log\,G$ | -0.017<br>(-1.42) | -0.033<br>(-2.70*) | -0.0398<br>(-3.03*) |
| $log\,TO$ | 0.018<br>(1.96**) | 0.006<br>(0.52) | 0.0132<br>(1.09) |
| $GY$ | -0.060 | 0.520 | 0.496 |

| | | | |
|---|---|---|---|
| | (-3.04*) | (19.97*) | (18.24*) |
| $log M$ | 0.015 | | 0.006 |
| | (1.44) | | (1.44) |
| *Trend* | | 0.021 | 0.021 |
| | | (13.65*) | (13.65*) |

Note: The values in parentheses are the computed t-statistics, where *, ** and *** indicate significance at 1%, 5% and 10% levels respectively.

**Conclusion**

The study has analyzed how general price level affects output per worker through the channels of capital output ratio and total factor productivity (TFP). The analysis is based on time series data over the period 1980-2010for a panel of 20 developing Asian countries and the application of country fixed-effects model on the panel data. A number of additional (control) variables are included while estimating the relationship of capital per worker and TFP with general price level.

The results show increase in general price level results in increase in capital per worker and decrease in TFP. This means that while rising prices tend to promote capital accumulation, it also results in loss of TFP. A plausible interpretation of the adverse effect of rising price level on TFP is that rising general price level distorts relative price signal and, hence results in inefficiency in resource allocation. The combined (net) effect of rising price on output per worker through the two channels is estimated to be negative and shows that one percent increase in price level tends to reduce the output per worker by about 0.11 percent. Thus, the main conclusion of this paper is that on net basis, rising price level is detrimental to real sector of the economy and this adverse effect is due to loss of productivity rather than lack of capital accumulation.

The study also finds that increase in consumption expenditure in public sector is found to have adverse effect on output per worker mainly through the channel of TFP. One percent increase in government expenditure is found to lead to 0.04 percent reduction in output per worker. The relationship between trade openness and output per worker is found to rather weak; indicating that the potential benefits of trade openness through increased competition are mostly offset by the adverse effect brought about by squeezing of certain domestic industries in face of the increased competition. Increase in the growth rate of GDP results in reduced capital-labor ratio but it has a strong positive effect on TFP to yield a sizable net positive effect on output per worker. Thus, economic growth seems to be the main factor through which overall productivity can be improved. Finally, the role of financial sector development in promoting capital accumulation appears to be limited.

**References**

Akinlo, A.E. (2011), "Macroeconomic Factors and Total Factor Productivity in Sub-Saharan African Countries," *Journal of African Economics and Finance*, Issue.1, ISSN 1986-4582

Al-Marhubi, F. (1998), "Cross-country evidence on the link between inflation volatility and growth," *Applied Economics,* Vol. 30, pp. 1317-1326

Barro, R.J. (1995), *Inflation and Economic Growth*, NBER Working Paper No. 5326

Bitros, G. C., & Panas, E.E. (2001), "Is there an inflation-productivity trade-off?Some evidence from the manufacturing sector in Greece," *Applied Economics*, Vol. 33, pp. 1961-1969

Bittencourt, M. (2012), "Inflation and economic growth in Latin America: Some panel time-series evidence," *Economic Modelling*, Vol. 29, pp. 333-340

Bleaney, M.F. (1996), "Macroeconomic stability, Investment and growth in developing countries,"*Journal of Development Economics*, Vol. 48, pp. 461-477

Bruno, M., & Easterly, W. (1998), "Inflation crises and long-term growth," *Journal of Monetary Economics*, Vol. 41, pp. 3-26

Burdekin, R.C.K., Denzau, A.T., Keil, M.W., Sitthiyot, T., & Willet T.D. (2004), "When does inflation hurt economic growth? Different nonlinearities for different economies," *Journal of Macroeconomics*, Vol. 26, pp. 519-532

Chimobi, O.P. (2010), "Inflation and Economic Growth in Nigeria," *Journal of Sustainable Development*, Vol. 3, No. 2, pp. 159-166

Clark, P.K. (1982), "Inflation and the productivity decline," *The American Economic Review*, Vol. 72, No. 2, pp. 149-154

Darrat, A.F. (1988), "Does Inflation Inhibit or Promote Growth: Some time-series evidence," *Quarterly Journal of Business and Economics*, Vol. 27, No. 4, pp. 113-134

Erbaykal, E., & Okuyan,H.A. (2008), "Does Inflation Depress Economic Growth? Evidence from Turkey," *International Research Journal of Finance and Economics*, Issue.17, ISSN1450-2887

Fisher, S. (1993) *The Role of Macroeconomic factors in Growth*,NBER Working Paper No. 4565

Freeman, D.G., & Yerger, D. (1997), "Inflation and Total Factor Productivity in Germany: A Response to Symth," *WeltwirtschaftlichesArchiv*, Bd. 133, H. 1, pp. 158-163

Ghosh, A., & Phillips, S. (1998), "Warning: InflationMay Be Harmful ToYour Growth,"*IMF staff paper, International Monetary Fund*, Vol. 45,No. 4,pp. 672-710

Guerrero, F. (2006) "Does inflation cause poor long-term growth performance?," *Japan and World Economy*, Vol. 18, pp. 72-89

Gylfason, T. (1999), "Exports, Inflation and Growth," *World Development*, Vol. 27, No.6, pp.1031-1057

Hondroyiannis, G., & Papapetrou, E. (1998), "Temporal Causality and the Inflation-Productivity Relationship: Evidence from Eight Low Inflation OECD Countries," *International Review of Economics and Finance*, Vol. 7, No. 1, pp. 117-135

Khan, M.S., & Senhadji, A.S. (2001), "Threshold Effect in the Relationship between Inflation and Growth," *IMF staff papers*, Vol. 48, No.1, pp.1-21

Kim, S., & Willett, T.D. (2000), "Is the negative correlation between inflation and growth real? An analysis of the effects of the oil supply shock," *Applied Econometric Letters,* Vol.7, pp. 141-147

Kumar, Saten, Webber, Don J., & Geoff P. (2009),*Real wages, inflation and labour productivity in Australia*, Munich Personal RePEc Archive, MPRA Paper No.19293

López-Villavicencio, A., & Mignon, V. (2011), "On the impact of inflation on output growth: Does the level of inflation matter?," *Journal of Macroeconomics*, Vol. 33, pp. 455-464

Loungani, P., & Sheets, N. (1997), "Central Bank Independence, Inflation, and Growth in Transition Economies," *Journal of Money, Credit and Banking*, Vol. 29, No. 3, pp. 381-399

McClain, K., & Nichols, L.M. (1994), "On the Relation between Investment and Inflation: Some Results from Cointegration, Causation and Sign Tests," *Journal of Post Keynesian Economics*, Vol. 16, No. 2, pp. 205-220

Papapetrou, E. (2003), "The Inflation and Productivity Relationship in Poland," *Journal of Economics and business*, Vol. 6, No. 2, pp. 11-33

Sarel, M. (1996), "Nonlinear Effect of Inflation on Economic Growth," *Staff Papers, International Monetary Fund*, Vol. 43 (March), pp. 199-215

Sbordone, A., & Kuttner, K. (1994), "Does Inflation Reduce Productivity?," *Economic Perspectives*, Vol. 18, No. 2, pp. 2-14

Singh, K., & Kalirajan, K. (2003), "The inflation-growth nexus in India: an empirical analysis," *Journal of policy modeling*, Vol. 25, pp. 377-396

The World Bank (2000), *Measuring growth in total factor productivity*, Prem Notes, number 42

Wilson, B.K. (2006), "The link between inflation, inflation uncertainty and output growth: New time-series evidence from Japan," *Journal of Macroeconomics*, Vol. 28, pp. 609-620

Received: December 1st, 2015
Revisions Received: August 8th, 2016