

Relationship between Real GDP and Labour & Capital by Applying the Cobb-Douglas Production Function: A Comparative Analysis among Selected Asian Countries

Tahmina Khatun*
Sadia Afroze**

Abstract: *The paper makes an attempt to explore the relationship between real GDP (the dependent variable) and labour and capital (the independent variables) in case of Bangladesh, India, China, Malaysia and Thailand using the Cobb-Douglas production function and to make a comparison among Bangladesh and the selected countries. The study uses a time-series data covering the period of 1990-2014. Ordinary Least Square (OLS) is used to estimate the model. To test for autocorrelation, Newey-West test has been applied to obtain reliable parameter estimates. The results show that there is a strong positive and significant relationship between labour and capital and real GDP in case of all countries selected. The value of R^2 ranges between 0.930 to 0.988, indicating that most of the variations in real GDP in all these countries are explained by labour and capital alone. The results are statistically significant at 1% and 5% level of significance. The study also shows that there are increasing returns to scale in the production process in case of all the selected countries. It has been found that a 100% increase in labour will increase real GDP by 301% and a 100% increase in capital will increase real GDP by 40%. The contribution of both labour and capital is the highest in case of China followed by Bangladesh. The contribution of capital is lowest in case of Thailand (10%) and Malaysia (15%) because they both emphasized investing in human capital by giving importance to education, health and training of their labour force. The study concludes that investing in the huge labour force especially the female labour force in case of Bangladesh and India and proper use of capital by trained labour and management are essential to sustain the increasing growth process in these countries.*

Keywords: *Cobb-Douglas Production Function, Production efficiency, Marginal productivity, Returns to scale*

Introduction

The significance of productivity in increasing national welfare is now universally recognized. Both in developed and developing countries, the main source of economic growth is the increase in productivity. Productivity improvement therefore results in direct increases in the standard of

*Professor, Department of Accounting and Information Systems, University of Dhaka, Dhaka.

**Associate Professor, Department of Accounting and Information Systems, University of Dhaka, Dhaka.

living conditions, distribution of productivity gains according to contribution. It has also been felt that problems such as rapid population growth, reduction in export prices of raw materials, growing indebtedness and inflation in developing countries can be lessened to a great extent by increasing productivity. Efficient productivity is the efficient use of resources – labour, capital, land, materials, energy, information etc. in the production of various goods and services. Higher productivity means accomplishing more with same amount of resources or achieving higher output in terms of volume and quality for the same input (Dias, 1991).

Efficiency of any country is measured by Gross Domestic Product (GDP). In the past two decades, the story of the world economy belonged to Asia, featuring its steady rise in economic progress. The Asian economy is no longer defined by Japan alone. Asian growth has consistently been outperforming the West over the past two decades (APO, 2014). The study tries to depict the diverse developments in growth of selected Asian countries through a cross country level comparison of the GDP. This GDP is a function of labour and capital. When capital investment and labour are employed, it affects the production in a positive and satisfactory way, and here the GDP of a country will prosper. To keep pace with the world economy, it is more than necessary to enhance the GDP level.

Rationale of the Study

The surge of economic growth of East Asia since the 1950's is of economic importance in relation to the rest of the world. The Asian economies, particularly those in East Asia including Northeast Asia and Southeast Asia, have recorded impressive economic growth in the past two decades. Average annual growth rates of GDP in Asia 29 and East Asia at constant market prices in 1990-2012 reached 5.5% and 5.7%, which significantly exceeded those in the US (2.4%) or EU (1.7%) (APO, 2014). Asia's macro-economic performance has not only resulted in a growth in income per capita but also in terms of income distribution and poverty reduction.

Bangladesh has been a part of this East Asian economic growth and development phenomena. In spite of having an abundance of human capital and raw material availability, Bangladesh has not been able to accomplish the same or similar economic growth and development as in the other Asian countries of comparison. To find the reasons behind this backwardness, it is important to analyze the productivity of the inputs (labour force and gross capital) that is already put in the production system and the study employs the Cobb-Douglas (C-D) model to estimate the production function of Bangladesh and the other selected Asian countries, namely India, China, Malaysia and Thailand. In this paper, the principal purpose has been made to find the impacts of labour force and capital on the real GDP for the selected Asian countries and to make a comparison between these countries to demonstrate the degree of economic efficiency among these countries. India and China have been selected on the basis of the fact they have a large population like Bangladesh and Malaysia and Thailand have been selected on the basis that they possess the same general characteristic as Bangladesh where they have transformed from an agricultural economy to an industrial one by emphasizing on investing in human capital. There are

significant similarities in the macro economic performance indicators of these countries of Asia but there is still a difference in economic development and performance among these nations. This can provide guidance to planning and development decisions for those that are lagging behind economically. The study also looks at the returns to scale and marginal productivity of labor and capital for the countries selected.

Many studies have been done so far based on Cobb-Douglas Production Model. For example, the study by Hossain et al. (2013) tried to detect the autocorrelation problem of C-D production model with additive error and the results show that autocorrelation is presented in some manufacturing industries in Bangladesh. A recent study by them (2015) shows that estimates of both capital and labour elasticity of C-D function with additive errors are more efficient than those estimate of C-D production function with multiplicative errors. The study by Chowdhury et al. (2013) also used C-D production functions in case of garments industries in Bangladesh which shows that both labour and capital contribute significantly to the total output in garment industries. But so far no such studies have been done covering the whole of Bangladesh.

The study has been based on secondary data sources. Data have been taken from World Development Indicators. The period chosen is from 1990 to 2014. The data includes GDP at constant US\$ (2005) which is the dependent variable and independent variables are gross capital formation (US\$) and total labor force. To estimate Cobb-Douglas production function econometrically in this study, SAS (Statistical Analytical System) has been employed.

A Brief Description of the Countries Selected

Labour intensive Asian countries are at different development stages, with diversified resource endowments and very different political situations. As a result the Asian economy is very dynamic with vigorous growth and these countries have had diverse development efforts and achievements. The traits of these countries and their commonalties being the basis for their comparison are discussed below.

Bangladesh

Bangladesh is regarded globally as an example of remarkable progress in poverty reduction and human development, despite daunting challenges. In 2014, Bangladesh reached Low Middle Income Country status. The World Bank Group's new Country Partnership Framework (CPF) 2016-2020 will support Bangladesh to achieve its vision of reaching middle income status by its 50th birthday in 2021. The country is at an important juncture, with the right policies and timely action, it can move up within the middle-income bracket. For that, Bangladesh will need to accelerate growth (World Bank, 2016). Bangladesh has succeeded in expanding its economy and income levels well beyond subsistence levels. Per capita incomes have risen from only US\$110 in 1974 to US\$780 in 2012. This correlates with substantial poverty reduction with the national head

count virtually halving from 56.6% in 1991 to 31.5% in 2010. Underpinning this has been sound economic growth averaging 6% per annum in recent years.

China

China a country of East Asia is one of the most populous country in the world with population over 1.364 billion. The country has a GDP of about 10.35 trillion and the income level of this country is in the upper middle income range. It was an agriculture based country until the 80's, but during the mid-80s the industrial reform brought some remarkable increases in output. It is now the second largest economy in the world in nominal basis. On a PPP basis, China was first in 2014. The growth rate of China was estimated at 7.38% in 2014 (IMF, 2015).

India

India is a South Asian country which is the second-most populous country in the world. But its economy is the world's ninth largest by nominal GDP. On a PPP basis, India is in third place in 2014. India's growth rate was at 7.17% in 2014 (IMF, 2015). It is one of the newly industrialized countries and is highly developed in textiles, telecommunication, chemicals, biotechnology, food-processing etc. It also has a large share in the world trade. The income level of this country is classified as lower middle income country.

Malaysia

Malaysia is a highly open, upper middle income economy with about \$7365 per capita GDP. It has population of over 30 million. But with respect to GDP growth it has one of the best records in Asia. It is a newly industrialized market economy which is ranked third largest in the Southeast Asia. From an economy dominated by the production of raw natural resources materials like tin and rubber it is now a diversified economy being the leading exporter of electrical appliances, parts and components, palm oil and natural gas. Malaysia was hit by the global financial crisis in 2009 but it has recovered rapidly by posting growth rates averaging 5.7% since 2010. Growth has also been accompanied by a dramatic reduction in poverty from 49.3% in 1970 to 1% in 2014 (World Bank, 2015).

Thailand

Thailand has been one of the fastest growing countries of the world. From 1951-2001, the average annual growth of GDP has been increasing substantially during the last 50 years (Manprasert, 2002). Five decades ago, Thailand was still a primitive economy whose main output was agriculture. However there have been significant changes in the economy. The share of GDP accounted for industry has doubled from 21% in 1970 to 44% in 2003. In contrast, the share coming from agriculture sector fell from 23% to 10%. The general picture is one of resources moving out of agriculture and into industry (Bosworth, 2003). Thailand is a newly industrialized country with its economy heavily depended upon exports which accounts for more than two-third of GDP. The country is a upper middle income economy.

Literature Review

Hossain (1987) detected that industries in Bangladesh have potential allocation efficiency as they are using some capital. By estimating the marginal productivity of labour and capital, he explained that allocation efficiency is achievable through appropriate pricing of capital and its proper disbursement among firms.

Research by Feroz, Rashid and Hossain (2009) analyzed the profitability of Bagda farming in some areas of Satkhira using the Cobb-Douglas production model. The study was based on 60 Bagda farms. The research concluded by drawing attention toward the contribution of training and transportation facilities to enhance the productivity of farming.

Raihana (2012) studied on factor substitution and technical change in the agriculture system of Bangladesh using trans-log cost function. The study made the suggestion that if agricultural production of the country simultaneously used both labour and lands (capital) it could lead to an increase in the agricultural output. Emphasis of any singular factor will put the output trend downward.

Hossain and Islam (2013) conducted a research on the productivity of manufacturing firms in the South-West region of Bangladesh. They included five manufacturing sectors (cement, jute, textiles, sea food processing and fertilizers) in their study. This paper suggests that manufacturing firms can reduce their production cost by shifting resources from capital intensive technique to labour intensive techniques and so firms need to invest more in the development of their labour force.

In China, Yuan (2011) used the Cobb-Douglas production function to analyze the relation between agricultural output and input factors in Hebei province. As input cultivated area, agricultural manpower, effective irrigation area, chemical fertilizer usage, agricultural machinery usage and electricity consumption were taken. The research showed cultivated area and manpower have least impact on the output while effectiveness of irrigation area, chemical fertilizer, machinery and electricity usage influence the agricultural output in positive way. This report shed light on the fact that machine power can increase the productivity more than manpower.

Lui and Li (2010) investigated the characteristics of total factor productivity and its influencing factors in China's soybean. Cobb-Douglas production function model was used in the study. Data for the study was based on time-series data from 1990 to 2007. To exclude the impact of price changes in different years, the quantitative indicators that were adopted include the total output, capital, labour and land. The results of this study indicate that total factor productivity grows at 0.42% annually, the changes fluctuate apparently. Through analysis, the pattern of cultivation, imports and exports policy and technical achievement may contribute to the fluctuation of total factor productivity in China's soybean. This study showed that planting area and material cost influences the soybean production significantly whereas elasticity of labour is negative on the

production output. Conclusions indicated that technical achievement, pattern of production and policy making are the influencing factors in the production system.

Research has also been done on the industrial growth of China. Ozyurt (2007) conducted a study on industrial productivity performances over the period of 1952-2005. Total factor productivity (TFP) growth estimates were based on a Cobb-Douglas specification with aggregated annual data set. The major finding of the paper was that capital accumulation was the major driving force of the Chinese industry. It also found, human capital, R & D, improvement in allocation efficiency and technology transfer contributed to a great extent to the economic growth of China.

Loh (1978) worked on block rubber processing plants, the major sector of Malaysia. This study drew attention to the fact that management, planning and policy making of the supply of raw materials are necessary to maintain undisturbed flow of processing.

Wulan (2014) utilized the Cobb-Douglas production function in its classical form for analysing Indonesia's and Malaysia's economic growth in relation to the intensity of using capital and labour as determinants of production. This research concluded that advanced technology has a great impact on economic growth.

In an Asian perspective, Lim (1994) examined the developing countries of Asia. He found that the contribution of capital in economic growth was about 65%, and that of labor was 23%. The contribution of technical progress remained low at 14%.

Lau and Kim (1996) also carried out an empirical analysis of the source of growth for the Asia Pacific countries and the Industrialized Western Countries (IWC) and found that capital accumulation was the major source of growth in the Asian region while technical progress was the major source of growth for the IWCs. They predicted that sustainable growth is not possible with capital accumulation due to diminishing returns to the factor of production. This analysis concluded that the future growth of Asian countries will be contingent on development work within the Asian region.

Zamanand Zizi (2007) in his study, applied classical form of the production function with a view to analyzing Romania's and Moldova's economic growth in relation to the intensity of using capital and labour as the determinants of the production function and GDP level. They found a significant positive contribution of labour to the economic growth but its magnitude was comparatively lower than that of the ratio of the investments to fixed assets of the countries.

Bosworth (2003) in his study of Thailand, used an econometric approach of estimating parameters of an aggregate production function and those that rely on growth accounting to decompose the growth output into the contributions of increased quantities of the factor inputs and a residual measure of improvements in total factor productivity(TFP). The constructed growth accounts confirm that the bulk of Thailand's growth can be traced to increases in labour and capital inputs. The study also identified notable changes in the nature of Thailand's growth in recent years that it

no longer has a high rate of capital accumulation and is faced with problems in the financial sector which limit the potential for output and productivity gain.

The study by Tripathi in 2008 examined the performance of agricultural productivity in India during the last 37 years. The estimation showed that between 1969 and 2005, agricultural growth relied almost entirely on increased conventional factors while growth in productivity was negative. For only initial periods of reforms, agricultural total factor productivity (TFP) growth is positive. Further, the study suggested that the relative decline in public investments in the agricultural sector is one of the prominent causes of slowdown of agricultural productivity growth.

Kui-WaiLi (2003), in his paper constructs China's capital stock, which is used in conjunction with a labour variable to estimate a Cobb-Douglas production function for the Chinese economy. Two panels of data are used – one for capital formation and one for sources of investment finance. Both national and provincial data are used for these two panels, thus giving a total of four capital-stock series. The Cobb-Douglas estimates show that China's total factor productivity was about 3.4 per cent in the post-reform years.

Afzal and Manni (2013), in their paper, tried to uncover the nature and extent of productivity changes in Cobb-Douglas production function components and the growth of the knowledge economy of selected ASEAN countries, namely, Malaysia, Indonesia, Philippines, Thailand, Singapore plus South Korea which were analysed over the period 2005 to 2010. The study was conducted to understand the varying levels of economic development in these countries. Utilising non-parametric Data Envelopment Analysis (DEA) and the Malmquist total factor productivity (TFP) index, individual country's efficiency and productivity changes which took place within this period were estimated. Their results indicate that the Philippines and Singapore reported the highest increase in TFP within the referred years, and this growth in productivity is derived from both technical efficiency gains and technological progress. On the other hand, for the knowledge economy model, there is a remarkable growth in TFP for Thailand and Philippines.

Miller and Upadhyay (2002) examined the Cobb-Douglas production function specifications for a 30-year panel of 83 countries representing all regions of the world and all income groups. They estimated and compared labour and capital elasticity of output per worker across each of several income and geographic groups, and found significant differences in production technology. Then the total factor productivity series for each classification was estimated. Using determinants of total factor productivity that include, among many others, human capital, openness, and distortion of domestic prices relative to world prices, and significant differences in results were found between the overall sample and sub-samples of countries. Their findings concluded that a policy of outward orientation may or may not promote growth in specific country groups, even if geared to reducing price distortion and increasing openness. Human capital played a smaller role in enhancing growth through total factor productivity.

Hari Sharma (2007) tried to address the factors that were responsible for the high growth rate of the Chinese economy, whether it was the increase in labor or capital that was the driving force of China's growth, or was it Total Factor Productivity (TFP) growth. The paper tried to explain the economic growth of China in terms of labor, capital and total factor productivity. The paper estimates a Cobb-Douglas production function along with a time trend to capture the effect of technological progress after the reforms in 1978 for China within a cointegration and Error-Correction modeling framework for the 1952-1998 periods. An Error Correction Model (ECM) was used because there was a strong presence of cointegration. His results indicate that capital was the most important source of growth in China. The contribution of capital, productivity, and labor's share of growth for the period after 1978 until 1998 was estimated and found that capital contributed about 62% of the total growth in GDP. The role of productivity was also high for the same period and accounted for about 28% of the total growth in GDP. Labor contributed the least among the three variables with a share of about 11%. In addition, ECM indicated that if the growth rate in labor productivity deviates from its long run equilibrium due to positive or negative shocks in one period, it will move back toward its equilibrium in the next period with a speed of adjustment of about -0.79. Despite legislations to curb excess population growth, China still has an abundant labor supply. So, the labor input will continue to play a significant role in production.

Lim (1994) examined the developing countries of Asia, and found that the contribution of capital in economic growth was about 65%, and that of labor was 23%. The contribution of technical progress remained low at 14%. This result is somewhat similar to the one obtained by Hossain (2006) for Indonesia in which capital's contribution was about 60%, labor's share was 32%, and that of technological progress was about 8%. However, as we mentioned earlier, these results are in contrast to those obtained by many other researchers. Chow and Li (2002) found that the role of productivity growth was much greater than that of labor, accounting for almost 32% of the growth of China for the period from 1978 to 1998. The contribution of capital was still significantly high at 54%, while that of labor was only about 13% (cited by Hari Sharma, 2007).

Limam and Miller (2004) examined cross-country patterns of economic growth by estimating a stochastic frontier production function for 80 developed and developing countries and decomposing output change into factor accumulation, total factor productivity growth, and production efficiency improvement. The paper incorporates the quality of inputs in analyzing output growth, where the productivity of capital depends on its average age, while the productivity of labor depends on its average level of education. Growth decomposition involved five geographic regions - Africa, East Asian, Latin America, South Asia, and the West. They found that Factor growth, especially capital accumulation, generally proves much more important than either the improved quality of factors or total factor productivity growth in explaining output growth. The quality of capital positively and significantly affects output growth in all groups. The quality of labor, however, only possesses a positive and significant effect on output growth in Africa, East Asia, and the West. Labor quality owns a negative and significant effect in Latin America and South Asia.

Model Specification and Data Analysis

Cobb-Douglas Production Function is one of the most widely used production function in Economics and Management research. This production function not only satisfies the basic economic law but also easy in its computation and interpretation of the estimated parameters. The objectives of applying Cobb-Douglas production function are to estimate the coefficient of inputs, their marginal productivities, factor shares in total output and degree of returns to scale. This production function has been widely applied in empirical studies. Jesus Felipe and F. Gerard Adams refers that the Cobb-Douglas production function is still today the most ubiquitous form in theoretical and empirical analyses of growth and productivity. The estimation of the parameters of aggregate production functions is central to much of today's work on growth, technological change, productivity, and labour. Empirical estimates of aggregate production functions are a tool of analysis essential in macroeconomics, and important theoretical constructs, such as potential output, technical change, or the demand for labour, are based on them (Chowdhury & Islam, 2015).

The following model was applied to data on output for estimating Cobb-Douglas production function:

$$Y = AL^{\alpha}K^{\beta}$$

where, Y=output

L= labor force

K= gross capital formation

A=efficiency parameter

α =Coefficient of labor

β =Coefficient of capital

The logarithm of both sides of the above model is taken to convert the equation into linear form; its log transformation is specified below:

$$\text{Log } Y = \text{Log } A + \alpha \text{Log } L + \beta \text{Log } K + U_i$$

The efficiency parameter (A) and coefficients of the inputs were estimated by applying the above equation. Parameters ' α ' and ' β ' represent individually the proportionate change in output for a proportionate change in labour and capital and U_i is the error term. The three coefficients taken together measure aggregate proportionate change in output for a given proportionate change in labour and capital. This implies that $\alpha+\beta$ shows the degree of returns to scale.

If $\alpha+\beta>1$, it would imply that the output increase would be more than proportionate to the increase in inputs, if $\alpha+\beta<1$, it would imply that output increase would be less than proportionate to the increase in inputs and if $\alpha+\beta=1$, the output would just increase proportionately to the rate of increase of inputs. Therefore there will be economies of scale, constant returns to scale or

diseconomies of scale depending on whether $\alpha+\beta$ is greater than 1, equal to 1 or less than 1 respectively. This implies that Cobb-Douglas production function can represent any degree of returns to scale. Theoretically, we expect that all the input coefficients shall have a positive sign and greater than zero i.e. $\alpha>0, \beta>0$.

Estimated Production Function and its Interpretation

The estimated production functions with their coefficients and coefficient of determination for the selected countries are shown in the following table:

Table 1: Estimation of the Production Function

Country	logA	α	B	Production Function	R ²
Bangladesh	-3.8922	1.2719	.2533	GDP=.0204L ^{1.2719} K ^{.2533}	.998
India	-8.1190	1.2777	.3873	GDP=.00029L ^{1.2777} K ^{.3873}	.981
China	-44.4137	3.0123	.4086	GDP=5.144e-020L ^{3.0123} K ^{.4086}	.999
Malaysia	-5.5640	1.7719	.1047	GDP=3.8332e-020L ^{1.772} K ^{.1047}	.993
Thailand	-25.3695	2.7225	.1564	GDP=9.5968e-012L ^{2.7225} K ^{.1564}	.936

The main objective of the study was to predict whether both labour and capital could contribute significantly to the growth of production and the empirical result using Cobb-Douglas production function confirm these results. Here the estimated coefficient of determination of Cobb-Douglas production function for Bangladesh, India, China, Malaysia and Thailand are .998, .981, .999, .993 and .936 respectively which indicate that for each country the fit is very good. The following section analyses the table country by country;

Bangladesh

From the estimated results in Table 1, it is found that the elasticity of GDP with respect to labour is 1.2719 and with respect to capital is 0.2533 in case of Bangladesh which means that for 100% increase in labour force, the real GDP will be increased by 127.19%, on the other hand for increasing in 100% capital the real GDP of Bangladesh will be increased by 25.33%.

India

In case of India, the elasticity of GDP with respect to labour is 1.277 and with respect to capital is 0.387. This means that for 100% increase in labour force the real GDP will be increased by 127.7% and on the other hand, a 100% increase in capital will increase real GDP by 38.7%.

China

The case of China shows that the elasticity of GDP with respect to labour is 3.0123 and with respect to capital is 0.4086 implying that a 100% increase in labour force will increase real GDP by 301.23% while a 100% increase in capital will cause real GDP to increase by 40.86%.

Malaysia

The case of Malaysia and Thailand also shows a similar pattern. In Malaysia, the output elasticity with respect to labour is 1.7719 and with respect to capital is .1047 indicating that a 100% increase in labour force will cause real GDP to increase by 177.19% while a 100% increase in capital will increase real GDP by 10.47%.

Thailand

Finally, in Thailand, the output elasticity with respect to labour is 2.7225 and with respect to capital it is 0.1564. This indicates that a 100% in labour force will increase real GDP by 272.25%. On the other hand, a 100% increase in capital will increase real GDP by 15.64% only.

The analysis and discussion of results in Table 1 confirm the conclusion that real GDP in all those countries selected is influenced significantly by labour and capital alone. This is true because Bangladesh, China and India are labour intensive countries and that labour is cheap and widely used in the production process of these countries. In case of Malaysia, it can be said that every year a huge amount of labour is exported to Malaysia from Bangladesh where labour is also extensively used in the production process. Bosworth (2003) also shows a similar result. He confirms that the bulk of Thailand's growth can be traced to increases in labour and capital inputs.

The study by Herd and Dougherty (2007) argues that the bulk growth in GDP per capita in China is associated with the growth of labour productivity. Their study also shows that due to greater capital accumulation, incomes per head in China rose more rapidly than in India. They suggested that the growth of labour productivity is the key long-term determinant of economic performances in China. However, over a period spanning four decades, it can be observed that labour productivity growth in the two fastest growing emerging Asian economies (China and India) is accelerating. China has clearly leapt from a growth rate of around 4% in 1970 to a rate of 8-10% in 2000 with its transition period in early 1990s. India's passage to accelerating labour productivity growth is more gradual than China's from around 1% in 1970 to 7.0% in 2005-2012. Both total factor productivity and capital deepening took a leap in 2005-2012 to reinforce the positive trend.

Returns to Scale and its Interpretation**Table 2: Returns to Scale for the Selected Countries**

Country	$\alpha+\beta$	Returns to scale
Bangladesh	$1.2719+0.2533=1.5252$	Increasing
India	$1.277+0.387=1.664$	Increasing
China	$3.0123+0.4086=3.4209$	Increasing
Malaysia	$1.7719+0.1047=1.7886$	Increasing
Thailand	$2.7225+0.1563=2.8788$	Increasing

Regarding the second objective, it can be said that in case of all countries the sum of the coefficient of labour and capital ($\alpha+\beta$) shows increasing returns to scale (see Table 2). This implies that over time as both labour and capital are increased by some proportion, real GDP would grow more than proportionately.

The study by Chowdhury and Islam (2015) shows that there are decreasing returns to scale in the ready-made garments production of Bangladesh. This can be true because the study is based on only garments industry where 90 percent of production is done by labour. The present study is a time series analysis (covering the period from 1990 to 2014) representing whole Bangladesh and therefore increasing returns to scale is more plausible than decreasing returns to scale. The same conclusion applies to all other countries where the data cover the whole country rather than a specific sector.

Estimated Marginal Productivity of Labor and Capital and Their Interpretation

Table 3: Marginal productivity of labour and capital for selected countries

Country	MPL	MPK
Bangladesh	1303.8604	1.1189
India	2290.1023	1.6119
China	8672.2428	1.2222
Malaysia	22040.9012	0.3882
Thailand	12881.0560	0.5212

The analysis of marginal productivity of labour (MPL) and MPK capital has been done separately for each country in the following section.

Bangladesh

For Bangladesh, the estimated MPL is 1303.8604 while the estimated MPK is 1.1189 which implies that on the average, for additional 1 person investment in labour the return will be \$1303.8604. On the other hand, on the average, every \$1 investment in capital will increase output by \$1.1189.

India

For India, the estimated MPL and MPK are 2290.1023 and 1.6119 respectively indicating that on the average, for 1 person additional investment in labour, output will increase by \$2290.1023 and on the average, for every \$1 investment in capital, output will increase by \$1.6119.

China

According to the estimated result, the MPL and MPK for China are 8672.2428 and 1.2222 respectively. This implies that on the average, for 1 person additional investment in labour, the

total output will increase by \$8672.2428 and on the average, every \$1 investment in capital will bring return by \$1.2222.

Malaysia

The estimated MPL and MPK are 22040.9013 and 0.3882 respectively implying that on the average, for 1 person additional investment in labour, the return will be \$22040.9013 while on the average, each dollar of additional investment in capital will increase the return by \$0.3882.

Thailand

The case of Thailand shows that on the average, for 1 person additional investment in labour, the output will increase by \$12881.0560 while on the average, each dollar additional investment in capital will increase output by \$0.5210, the MPL and MPK being 12881.0560 and 0.5210 respectively.

From Table 3 it is seen that MPL is higher in Malaysia and Thailand compared to other countries being lowest for Bangladesh. The study by Rompraset (2015) shows that higher saving rate and higher gross fixed capital formation per worker in Malaysia and Thailand led to higher investment per person and pulled up the steady-state level of capital.

In Bangladesh since most of the workers are unskilled and less educated MPL is lower compared to other countries. The study by Page (1994) argued that education policies that stressed broadly primary and secondary education contributed directly to output growth and also indirectly through the interaction of educational shocks and export orientation to total factor productivity growth.

Conclusion

The main objective of the paper is to find the impact of labour force and capital on the real GDP for some Asian countries namely, Bangladesh, India, China, Malaysia and Thailand using time series data from 1990-2014 based on Cobb-Douglas production model. The study also measures returns to scale and marginal productivity of labor and capital for these selected countries. The results confirmed that both labor and capital contribute significantly to the productivity as measured by real GDP in all the countries selected. The results also show that contribution of labour in each country is much higher than capital. This is because India, China and Bangladesh are labour intensive countries and that Malaysia and Thailand invested heavily on their human capital by emphasizing on the education, health and training of their labour force. The estimated marginal productivity of labor and capital for countries concerned also confirms this fact showing that marginal productivity of labor is higher in Malaysia and Thailand compared to Bangladesh, China and India. The study also shows that there are increasing returns to scale in the production process of all the countries selected implying that if capital and labour are increased by some proportion, output (real GDP) will increase more than proportionately. This can be true because the study found that both labor and capital contribute significantly to real GDP.

The study by Mahmud et al (2009) argued that despite adverse governance factors, the acceleration of growth of Bangladesh's economy since the early 1990s has been underpinned by strong export growth, led almost entirely by the growth in readymade garment export. It is to be noted that garments sectors in Bangladesh are female labour intensive and therefore huge investment in the form of female school enrolment, decline in child mortality and increase in contraceptive adoption rate contributed significantly to improve human development. The study therefore concludes that although there are differences in productivity growth, the pattern of growth is similar as all these countries rely mostly on their labour force and gross capital formation. With a population of 1.3 billion, China recently became the second largest economy and is increasingly playing an important role in the global economy. Yet China remains a developing country as its per capita income is still a fraction of that in advanced countries. According to China's current poverty standard, there were 70.17 million poor in rural areas in 2014. China also faces demographic pressure related to an aging population and an internal migration of labor. Significant policy adjustments including improving access to education and healthcare are required in order for China's growth to be sustainable. Experience shows that transitioning from middle-income to high-income status can be more difficult than moving up from low to middle income (World Bank, 2016). The present study shows that although higher than Bangladesh and India, marginal productivity of labor in China is lower compared to that in Malaysia and Thailand.

Therefore to sustain the increased productivity in these countries especially Bangladesh and India, these countries should invest heavily in the education, health and training taking example from Malaysia and Thailand. Focus should be placed on the female labour force as their participation can boost growth by mitigating the impact of a shrinking workforce growth rate (World Bank, 2015). It is to be noted that macroeconomic stability and the capacity to respond effectively to macroeconomic shocks can help accelerate economic growth (quality growth) if the country has an educated and well trained labour force and increased accumulation of capital.

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APPENDIX : 1**Table 1: Newey-West Test for Bangladesh**

Variable	Coefficient	Standard Error	t-value	P> t
constant	-3.8922	0.5999	-0.70	0.494
capital	0.2533	0.1089	2.32	0.030
Labor	1.2719	0.4522	2.81	0.010

Table 2: Newey-West for India

Constant	Coefficient	Standard Error	t -value	P > t
Constant	-8.1190	4.8607	-1.6703	0.0948
Capital	0.3873	0.0482	8.0283	0.0000
Labor	1.2777	0.2973	4.2971	0.0000

Table 3: Newey-West test for China

Variable	Coefficient	Standard Error	t-value	P > t
Constant	-44.4138	3.3279	-13.3457	0.0000
Capital	0.4086	0.0084	48.1294	0.0000
Labor	3.0123	0.1738	17.3351	0.0000

Table 4: Newey-West for Malaysia

Variable	Coefficient	Standard Error	t-value	P>t
Constant	-5.5640	0.9580	-5.8075	0.0000
Capital	0.1047	0.0243	4.2952	0.0000
Labor	1.7719	0.0758	23.363	0.0000

Table 5: Newey-West for Thailand

Variable	Coefficient	Standard Error	t-value	P > t
Constant	-25.2696	4.8941	0-.1837	0.0000
Capital	0.1564	0.0408	3.8351	0.0001
Labor	2.7225	0.3038	8.9614	0.0000