



IMPACT OF HUMAN DEVELOPMENT FACTORS ON INFLATION RATE IN SOUTH ASIAN COUNTRIES

Kethmi, G.A.P.

Assistant Lecturer, Department of Finance, University of Kelaniya, Sri Lanka.

Wikramasinghe, K.G.M.U.

Lecturer(Prob), Department of Mathematics, University of Kelaniya, Sri Lanka.

Abstract

This study aims to investigate the relationship between the Inflation rate and Human Development Indicators in South Asian countries. The annual data for the period of 2000 to 2019 of 8 South Asian countries namely Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka are used. Correlation techniques, Johansen's cointegration test and Granger causality test are employed to achieve the objective of the study. The study reveals that the Inflation rate has a significant positive relationship with the Education index and insignificant positive relation with the Life expectancy index while GDP per capita has a negative relationship. Through the findings of the Granger causality test, it is revealed that the Inflation rate cannot be forecasted using the Human development factors in the Asian countries. Further, the findings reveal that there is a long-run relationship between the Inflation rate and Human development factors in South Asian countries.

Keywords : Inflation, Human Development Factors, Cointegration, Correlation

Introduction

By the definition, Inflation is the decrease of purchasing power of a given currency over time. That is an increase in the cost of living as the price of goods and services increase. Inflation is one of the genuine issues throughout some undefined time frame. This is mainly because inflation can have a negative effect on the composition of production costs and people's well-being. Many studies argued that low inflation is good for the economy and higher inflation causes an unfavourable impact. Howitt (1990) claims that when inflation is low economy can hold the cost required to attain price stability is better. The findings of Roncaglia (2018) argues that undeveloped countries endure higher average inflation than developed economies implying



that there is an inverse and low correlation between inflation persistence and economic development.

Stabilization of the price level has now become a core objective of many other countries including Sri Lanka. South Asian countries are more into developing countries rather than developed countries. Mallik (2001) revealed that moderate inflation is helpful to growth, but faster economic growth feeds back into inflation by using the data for Bangladesh, India, Pakistan, and Sri Lanka. Further, it was revealed that there is a long-run positive relationship between GDP growth rate and inflation for all four countries and significant feedback between inflation and economic growth. Since controlling the rate of inflation is mandatory for a stable macroeconomic environment, it requires that its causes, both internal and external, be correctly identified. Hence investigating the effect of key macroeconomic variables on inflation in most countries in South Asia might be challenging and important for the respective economy to adopt more viable economic policies. However, according to the vast number of theories of inflation as well as empirical studies, inflation is caused by numerous determinants, thus making it difficult to ascertain which variable or determinant to control to maintain a desirable level of inflation. Economic growth, exchange rate, real GNP, government expenditure, money supply, GDP (Gross Domestic Product) per capita and oil supply are some of the key factors that affect the inflation of a country.

Human development factors also an important macroeconomic variable. As people carry on with living their wellbeing and prosperity is influenced by various variables that will influence a person's development and improvement, decidedly and adversely. These incorporate physical, passionate, social, monetary and natural elements. The Human Development Index is an index that measures major dimensions of human development (McGillivray,1993). The three key dimensions are A long and healthy life – measured by life expectancy, Access to education – measured by the Education index and a decent standard of living – measured by Gross National Income per capita adjusted for the price level of the country (Roser, 2014).

The linkage between Human development factors and the inflation rate is a research area that very important but few studies are present. Although there are many studies to identify the relation between Economic growth and the Inflation rate, studies for any relationship with Human development factor are very few. The results of the past investigations are discussed in the next section.



Literature review

Inflation plays a vital role among macroeconomic variables as it can cause serious implications on the structure of production costs, the level of welfare and the income distribution. Although there are several studies on inflation dynamics in several countries, there is scope for a fresh look at the determinants of inflation. Sattarov (2011) assess the relationship between inflation and economic growth by examining their co-integrated connection using the error correction model. The study revealed that there exists a positive long-run relationship between inflation and economic growth in Finland and by thinking that such a relationship is non-linear, it was revealed that the Finnish economy grows at its highest rate when inflation is at 4 per cent. Ratnasiri (2009) carried a VAR base analysis to identify the determinants of inflation in Sri Lanka, covering the period of 1980-2005 only. Thus, this paper attempts to investigate the dynamics of inflation in Sri Lanka for the period of 2000Q1 to 2013Q4. They reported that Sri Lanka's inflation is influenced by both demand and supply-side factors in the short-run as well as in the long run. According to Ratnasiri (2009), money supply growth and the increase in the price of rice are the most important determinants. However, in the short run, exchange rate depreciation can also influence inflation whereas GDP growth does not exert any influence on inflation either in the short run or in the long run. The study of Xiao, (2009) examine the relationship between inflation-economic growth in China using the annual time series data from 1978 to 2007. This study uses co-integration and error correction models along with a correlation matrix and the Granger Causality. The results showed that there is a positive long-run relationship between inflation and economic growth in bidirectional. Further, it was discovered that a high-speed increase in investment would cause inflation in the short run in China. Cheng and Tan (2002) stated that the inflation rate in Malaysia was overcome well in the right way during the financial crisis that faced by the country compared to other countries that faced high inflation during that time. Further, they identified that economically inflation affects many factors and lead to economic problems which can drop the economic growth of a particular country.

Yolanda (2017) analyzed factors affecting Inflation and its impact on Human Development Index and Poverty in Indonesia. The study revealed that the Indonesian Bank rate, money supply, oil price and gold prices partial affect the level of inflation positively and significantly, while the exchange rate variable does not affect the rate of inflation. In 2019 Laurence L et al. discovered the association of the inflation rate of a country to the population's life expectancy within 120 selected countries. To further establish, describe, and explain the relationship between life expectancy and inflation rate, binary logistic regression was utilized. The analysis also reveals an inverse relationship, with life expectancy being lowered by approximately 20% for each unit of increase in the inflation rate. Data for around 100 countries from 1960 to 1990 are used to assess the effects of inflation on economic performance by Robert J. Barro in 2013. Febrianti (2020)



examined the effect of Inflation, Poverty, and Investment has on Sustainable Development in West Kalimantan Province of Indonesia. The analysis procedure employed in this study is Multiple Linear Regression using annual time series data from 2007-2016. The results showed that Inflation and Investment did not affect Sustainable Development in West Kalimantan Province, while Poverty influenced Sustainable Development in West Kalimantan Province.

Most of the studies have been carried out considering only one country. Especially there is no research in the recent past to identify any relationship between the Inflation rate and Human development factors in Asian countries. This study tries to fill this research gap by investigating any relationship between the Inflation rate and Human development factors in South Asian countries by employing correlation techniques, the Cointegration test and Granger causality tests. Considering all the factors the objective of the study is as follows.

Investigate any relationship between the Inflation rate and Human Development Indicators in South Asian countries.

Methodology

This study has been conducted through a Panel data analysis using RStudio software to achieve the research objectives. Annual data for the four variables; Inflation Rate, Life Expectancy Index, Education Index and GDP per capita for the period of 2000 to 2019 are collected from the World Bank Open Data Base. Considering the data availability, the population includes eight South Asian countries namely Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. RStudio statistical software package is used for arranging the data and conducting the empirical analyses.

Annual Inflation rate as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Life expectancy index is calculated as the life expectancy at birth expressed as an index using a minimum value of 20 years and a maximum value of 85 years. GDP per capita is calculated as an aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to international dollars using PPP rates, divided by midyear population. Education index is an average of mean years of schooling (of adults) and expected years of schooling (of children), both expressed as an index obtained by scaling with the corresponding maxima.

The basic model for the study is as follows.



$$\text{Inflation rate}_t = \beta_0 + \beta_1 \text{Life Expectancy}_t + \beta_2 \text{Education Index}_t + \beta_3 \text{GDP per Capita}_t + \xi_t \quad (1)$$

The Basic Model is modified by taking a natural logarithm of both sides and considered as the primary model of this study. In time series and panel data analysis this transformation is often regarded as stabilizing the variance of the time series.

$$\ln(\text{Inflation rate})_t = \beta_0 + \beta_1 \ln(\text{Life Expectancy})_t + \beta_2 \ln(\text{Education Index})_t + \beta_3 \ln(\text{GDP per Capita})_t + \xi_t \quad (2)$$

Where ξ_t is the error term of the model and is assumed Normally Distributed with zero mean and constant variance.

The preliminary analysis is conducted by examining any outliers in the data set and obtaining the descriptive statistics for each variable. Shapiro Wilk test which checks the null hypothesis the data series is normal used to investigate the normality of the variables.

After determining the normality of the variables, the correlation between the Inflation rate and the other three variables are tested accordingly. That is if all the variables are normal Pearson's correlation is used otherwise Spearman's correlation is used.

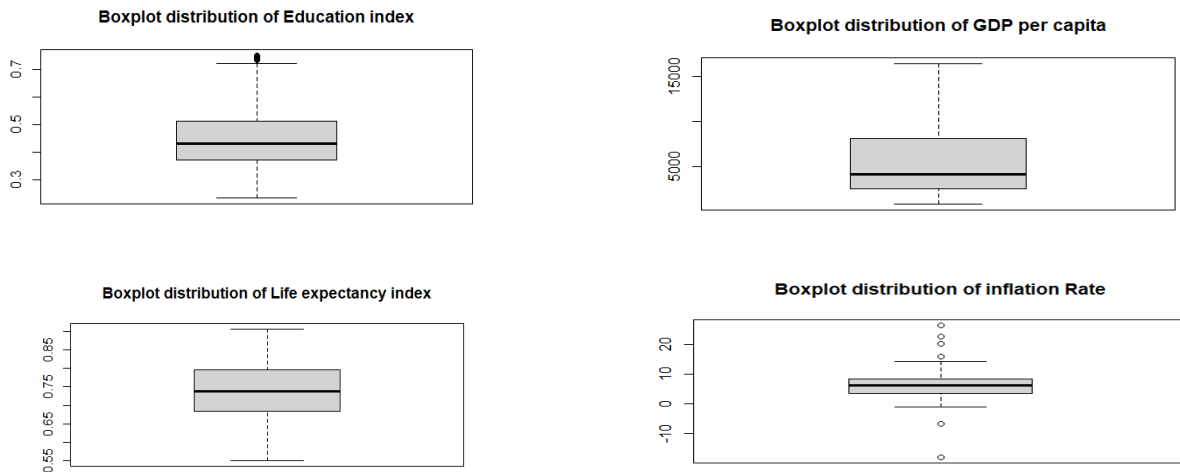
Levin, Lin and Chu (2002) and Hadri (2000) panel data unit root tests are used to check the stationarity of the variables. Levin, Lin and Chu test check the null hypothesis the data series is nonstationary while Hadri tests the null hypothesis data series is stationary. Past research has identified the importance of new techniques for the analysis of panel data set due to the difference in nature. Traditional methods like Augmented Dickey Fuller (ADF) test may not give accurate results for the panel data set (Barbieri, 2009). It has been found that comparatively Levin, Lin and Chu (2002) and Hadri (2000) gives more precise results than that of other panel data unit root tests (Hlouskova, 2006).

LM test in RStudio used to investigate the Granger causality where the null hypothesis for the test is that lagged x-values do not explain the variation in y. In other words, it assumes that x(t) does not Granger-cause y(t) (Panchenko, 2006).

Johansen Cointegration test (Boswijk, 2015) adopted to check cointegration between the Inflation rate and Human development indicators variables. Cointegration investigates whether two or more time series can move together very closely over the long run. In other words, it explores any long-run relationship between any two data series.

Results

Figure 1: Boxplot distributions of the variables



As per the Figure 1, presence of outliers can be seen in the variables Education index and Inflation Rate. Winzorization is used to eliminate the effect of the outliers (Chambers, 2000).

Table 1: Normality of the variables

| Variable | Shapiro – wilk test |
|-----------------------|---------------------|
| Inflation rate | 0.456 |
| Education Index | 0.0568 |
| Life expectancy index | 0.0798 |
| GDP per capita | 0.0698 |

According to Table 1 p-values of the four variables are less than 0.05 which implies that the null hypothesis is accepted at 5% level of significance. Therefore, all the variables are normal at 5% level of significance.

Hence the study used Pearson’s correlation to estimate the correlation values and the magnitude between Inflation rate and the other three variables of the study.



Table 2: Correlation Matrix

| Variable | Pearson’s correlation | P-value |
|-----------------------|-----------------------|---------|
| Education Index | 0.061691 | 0.0438 |
| Life expectancy index | -0.01419998 | 0.8586 |
| GDP per capita | -0.1725643 | 0.0291 |

Table 2 summarizes the results of the correlation between the Inflation rate and Education index, Life expectancy index and GDP per capita. According to the results, there is a weakly positive correlation between the Inflation rate and the Education index and the correlation is significant at a 5% level of significance. The correlation between the Inflation rate and Life expectancy index is weakly negative and it is not significant at a 5% level of significance. The inflation rate and GDP per capita have a strong negative correlation which is significant at a 5% level of significance.

Figure 2: ACF plots of the variables

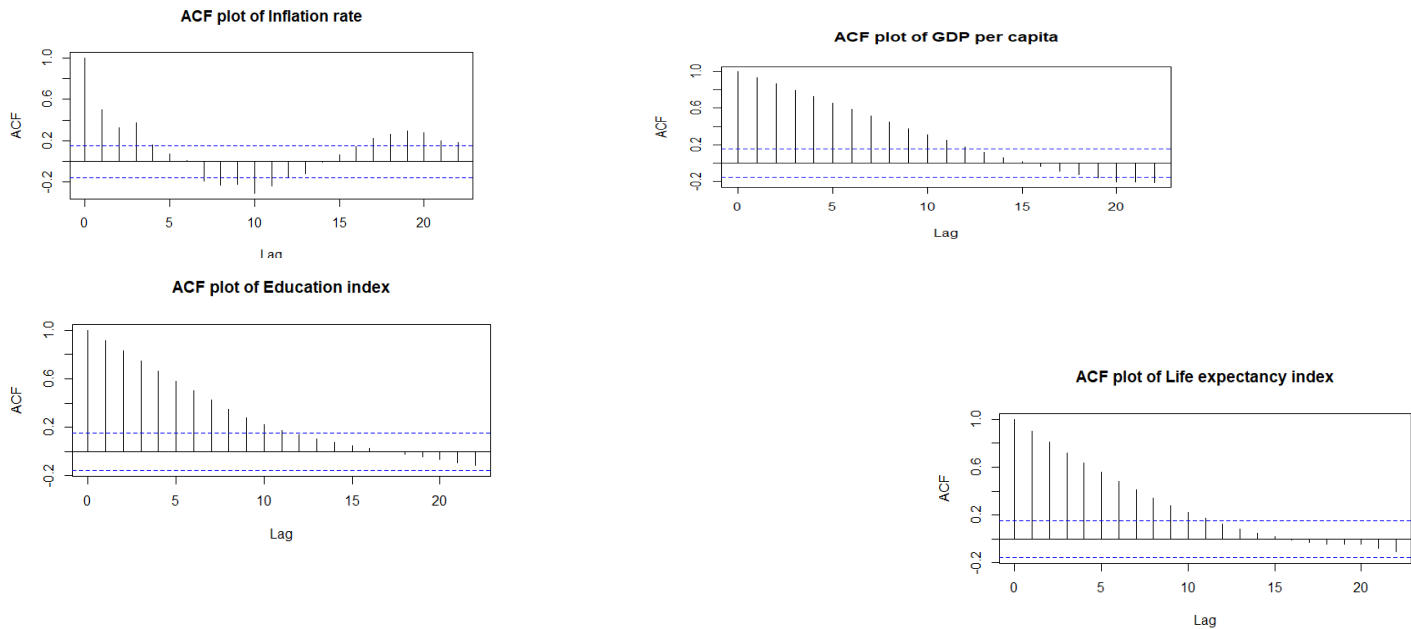


Figure 2 illustrates the Auto Correlation Function (ACF) Plots of the four variables of the study. According to Figure 2, all four variables are significant at lag 1.



Table 3: Lag selection of the variables

| Variable | AIC | Lag |
|-----------------------|---------------|-----|
| Inflation rate | 2.601239 | 1 |
| Education Index | -6.297227013 | 1 |
| Life expectancy index | -6.9784376488 | 1 |
| GDP per capita | 1.471003e+01 | 1 |

Table 3 summarizes the statistical test result of finding the optimum lag order for the three variables and the test uses AIC criteria to achieve the objective. This test also confirms the results from the visual representation which is that all the variables are significant at lag 1.

Table 4: Unit Root Test Results

| Variable | Levin, Lin and Chu Test | Hadri Test |
|-----------------------|-------------------------|------------|
| Inflation Rate | 0.0001464 | 0.8221 |
| Education index | 0.01888 | 0.22 |
| Life expectancy index | 2.2e-16 | 0.5569 |
| GDP per capita | 0.002369 | 0.0798 |

According to Table 4 p-values of the Levin, Lin and Chu Test are less than 0.05 for all the four variables while the p-values of the Hadri test are more than 0.05. Hence it can be concluded that both the tests confirm all the four variables are stationary at a 5% level of significance. Since the variables are stationary study proceeds the further analysis accordingly.

Table 5: Granger Causality Test

| Variable | Granger Causality Test | AIC |
|-----------------------|------------------------|-----------|
| Education index | 0.4638608 | -4.761278 |
| Life expectancy index | 0.4958251 | -4.761278 |
| GDP per capita | 0.1033402 | 16.84081 |

As per the results of the Granger Causality test, p-values of the Education index, Life expectancy index and GDP per capita are greater than 0.05. Hence null hypothesis is accepted at a 5% level of significance. Therefore, the Education index, Life expectancy index and GDP per capita do



not Granger-cause Inflation rate at 5% level of significance. In other words, it can be stated that Inflation can not be forecasted using the Human development indicators that used in the study. AIC values in Table 5 gives the goodness of fit of the test used in the study.

Table 6: Johansen Cointegration Test Results

| Johansen Cointegration Test (Trace Statistic value) | Critical Value (5%) |
|--|---------------------|
| 71.92 | 53.12 |

The results of Table 6 shows the Johansen cointegration test. It includes the Trace test statistic and the critical value at a 5% level of significance. The rejection criteria of the null hypothesis are that if the test statistic is greater than that of the critical value. According to the results, the test statistic is 75.12 which is greater than the critical value, 53.12. Hence null hypothesis is rejected at a 5% level of significance. That is cointegration is presence among the four variables in the study at a 5% level of significance.

Conclusion

The study reveals that the Inflation rate has a significant positive relationship with the Education index and insignificant positive relation with the Life expectancy index while GDP per capita has a negative relationship. Therefore, it can be concluded that there is a relationship between the Inflation rate and the Human development factors in South Asian countries. Through the findings, it can be concluded that the Inflation rate cannot be forecasted using the Human development factors in South Asian countries. Although there is a relationship between the Inflation rate and Human development factors, values of the inflation rates cannot be forecasted accurately by taking Human development factors into account. Further, the study reveals that there is a long-run relationship between the Inflation rate and Human development factors in South Asian countries.

These results are consistent with the findings of Yolanda, (2017); Mansi, (2020) and Ahmed, (2008) where the studies are extended to Asian countries as well as European countries.

Studies also show that the causality relation can be different in the short run and the long run. Hence the results can be improved by further analyzing the causality in both the short run and long run separately. VAR models, VECM and ARDL models and Error correction Terms can be used for this purpose. Specially VECM can be used to identify the linkage between the short-run and long-run equilibrium. Further, the study can be improved by using different Human development indicators like Health facilities, Education facilities etc.



References

- 1) Ahmed, S. (2008). Global food price inflation: implications for South Asia, policy reactions, and future challenges. The World Bank.
- 2) Barbieri, L. (2009). Panel unit root tests under cross-sectional dependence: An overview. *Journal of Statistics: Advances in Theory and Applications*, 1(2), 117-158.
- 3) Boswijk, H. P., Jansson, M., & Nielsen, M. Ø. (2015). Improved likelihood ratio tests for cointegration rank in the VAR model. *Journal of Econometrics*, 184(1), 97-110.
- 4) Chambers, R. L., Kokic, P., Smith, P., & Cruddas, M. (2000, June). Winsorization for identifying and treating outliers in business surveys. In *Proceedings of the Second International Conference on Establishment Surveys* (pp. 717-726). American Statistical Association Alexandria, Virginia.
- 5) Cheng, M. Y., & Tan, H. B. (2002). Inflation in Malaysia. *International Journal of Social Economics*.
- 6) Diks, C., & Panchenko, V. (2006). A new statistic and practical guidelines for nonparametric Granger causality testing. *Journal of Economic Dynamics and Control*, 30(9-10), 1647-1669.
- 7) Febrianti, S., & Indriyati, J. (2020). THE EFFECT OF INFLATION, POVERTY, AND INVESTMENT ON SUSTAINABLE DEVELOPMENT IN WEST KALIMANTAN PROVINCE. *Jurnal Ekonomi dan Manajemen*, 14(1), 208-218.
- 8) Garcia, L. L., Rabago, S. B., & Ocat, J. R. M. (2019). Predictive capacity of country inflation rate to life expectancy at birth. *International Journal of Advanced and Applied Sciences*, 6(12), 67-70.
- 9) Hlouskova, J., & Wagner, M. (2006). The performance of panel unit root and stationarity tests: results from a large scale simulation study. *Econometric Reviews*, 25(1), 85-116.
- 10) Howitt, P. (1990). Zero inflation as a long-term target for monetary policy. *Zero Inflation: The Goal of Price Stability*, 67-108.
- 11) Mallik, G., & Chowdhury, A. (2001). Inflation and economic growth: evidence from four south Asian countries. *Asia-Pacific Development Journal*, 8(1), 123-135.
- 12) Mansi, E., Hysa, E., Panait, M., & Voica, M. C. (2020). Poverty—A Challenge for Economic Development? Evidences from Western Balkan Countries and the European Union. *Sustainability*, 12(18), 7754.
- 13) McGillivray, M., & White, H. (1993). Measuring development? The UNDP's human development index. *Journal of international development*, 5(2), 183-192.
- 14) Ratnasiri, N. G. S. C. (2009). Economic growth, inequality and technology adoption in transitional economies (Doctoral dissertation, Queensland University of Technology).
- 15) Roncaglia de Carvalho, A., Ribeiro, R. S., & Marques, A. M. (2018). Economic development and inflation: a theoretical and empirical analysis. *International Review of Applied Economics*, 32(4), 546-565.



-
- 16) Roser, M. (2014). Human development index (HDI). Our World in Data.
 - 17) Sattarov, K. (2011). Inflation and Economic Growth. Analyzing the Threshold Level of Inflation.: Case Study of Finland, 1980-2010.
 - 18) Yolanda, Y. (2017). Analysis of factors affecting inflation and its impact on human development index and poverty in Indonesia.
 - 19) Xiao, J. (2009). The relationship between inflation and economic growth of China: empirical study from 1978 to 2007.