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Impact of socioeconomic development on inflation in South Asia: evidence from panel cointegration analysis

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Abstract

Purpose – This study aims to examine the influence of socioeconomic development on inflation in South Asia using the foreign exchange rate and money supply as control variables.

Design/methodology/approach – The study uses annual panel data for five South Asian economies, namely, Bangladesh, India, Nepal, Pakistan and Sri Lanka over the period 1990–2018, applies cointegrating regression techniques, namely, the panel dynamic ordinary least square (OLS) and fully modified OLS estimators to examine the long-run relations and conducts the Toda-Yamamoto Granger causality test to detect the direction of causality among variables.

Findings – The cointegrating regression estimations have documented that the socioeconomic development proxied by the human development index (HDI) has no significant impact on inflation. Although economic development represented by gross domestic product (GDP) growth causes inflation, socioeconomic development represented by HDI has no impact on inflation and has demonstrated as a better macroeconomic indicator, and thus creates no inflationary pressure in the economy. The foreign exchange rate has a positive impact on inflation. The broad money supply has the usual positive effect on domestic inflation that endorses the monetarist view about prices. The Toda-Yamamoto Granger causality test has confirmed several unidirectional causalities: inflation causes HDI, money supply causes both inflation and HDI and the foreign exchange rate causes HDI.

Practical implications – The study has practical implications for policymakers in South Asia, to improve HDI, particularly GDP per capita, education and health-care facilities to realize continuous socioeconomic development, which will take care of inflation. Moreover, these counties may follow a conservative monetary policy to control inflationary pressure in their economies.

Originality/value – The study is original and claims to be the first to examine the impact of socioeconomic development on inflation. The findings have socioeconomic values regarding controlling inflation in South Asia.

Keywords Inflation, South Asia, HDI, Money supply, Foreign exchange rate

Paper type Research paper

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1. Introduction

Economic development refers to the growth in national income accompanied by desired changes in social dimensions. Traditionally, economic indicators such as real gross national product and gross domestic product (GDP) are used to quantify economic development that has several limitations. Those limitations have led to social measures of economic development that indicate countries' preferences toward their resource allocation among alternate uses. One such measure is the "human development index" (HDI), which is a blend of economic and social indicators and comprises GDP per capita, literacy and health. Thus, HDI is a combination of economic and social indicators and it is treated as an indicator of socioeconomic development. Hence, this study considers HDI as a proxy for socioeconomic development that incorporates social indicators with an economic indicator as pointed out.

Plenty of research studies are available on whether inflation causes economic growth, but whether economic growth causes inflation; such research studies are still very few. The growth of GDP generally causes the general price level to rise and results in inflation. This phenomenon is evidenced by several studies such as Paul *et al.* (1997), Pollin and Zhu (2006) and Bandara (2011). These studies have evidenced how economic development demonstrated by growth in GDP causes prices and leads to inflationary pressure in the economy. However, socio-economic development is a better and wider concept than economic development, does it cause inflation? Responding to this question seems to have merit, and therefore, this study specifically aims to study the impact of socioeconomic development on inflation particularly in South Asia.

Inflation is a state of continuous and persistent increase in the general price level of an economy that leads to a decline in the purchasing power of money. There is a consensus among economists that inflation is caused by either an increase in the supply of money or a decrease in the supply of goods and services available in a country. Maintaining economic growth with price stability is one of the vital macroeconomic challenges for many developing areas including South Asia, which comprises several developing countries. South Asia is organized under the umbrella of "South Asian Association for Regional Cooperation" (SAARC) [1], which was formed in 1985 as a transnational and geopolitical group of eight countries in South Asia to promote quality of life and economic development in the region and to strengthen mutual self-reliance (Islam, 2020a).

Inflation is a common problem across countries and is generally calculated in terms of the consumer price index (CPI), which is a numerical indicator of the average price of a bundle of goods and services in an economy during a year. It is linked with the purchasing power of a currency, when inflation occurs it eradicates the purchasing power of money, and hence, consumers always dislike inflation. Therefore, keeping the price level stable is one of the important macroeconomic goals of any economy.

The foreign exchange rate (FEXR) has a major influence on inflation through trade and remittance channels. South Asia hosts one-fourth of the world population, but remains a place of a low level of living along with low income (Islam, 2020b); therefore, labor exporting to major countries to earn alternate livelihoods is a common practice. Although there is a paucity of data on exactly how many people from South Asia work abroad, they earn and remit a significant volume of inward personal remittances each year to their home countries. For example, during the 2010–2018 period Bangladesh, Nepal, India, Pakistan and Sri Lanka received inward remittances, which accounted for 8.04%, 27.30%, 3.24%, 6.48% and 8.34% of their GDPs, respectively (World Bank, 2019). The member countries of South Asia mainly face continuous depreciation in their official exchange rates quoted in terms of the US$. Historically, a depreciation in local currency has a long-run affirmative impact on the domestic inflation rate (Thuy and Thuy, 2019).

A depreciation in domestic currency value generally leads to increased demand for exports, which eases the production process and accounts for falling average cost of production particularly in industries facing increasing scale and decreasing cost of production. This helps developing countries to grow and to keep prices low. By contrast, developing countries, which rely on imports of raw materials and capital goods lead to inflation through the import channel (Ahmad and Ali, 1999). This is because any depreciation of local currency makes imports costly, which raises the cost of production causing cost-push inflation, as South Asia is a place of developing countries need many imported raw materials, capital goods, etc. for production purposes. Besides, exchange rate depreciation attracts remittances, most of which reach the end-users directly and causes demand-pull inflation in the economy through the aggregate demand channel (Roy and Rahman, 2014; Narayan *et al.*, 2011). Therefore, the inclusion of the FEXR in the determination of inflation is important as a control variable.

Money supply has a substantial role in the determination of inflation in any country. Usually, inflation is considered a monetary phenomenon by many economists, who consider that the quantity of money directly causes the price level. This concept was rooted in the thoughts of the monetarist economist, Marshall (1890). Afterward, Fisher (1911) pioneered this concept and many [Pigou, 1917; Lavington, 1921, 1922; Robertson, 1922; Marshall, 1923; Friedman, 1956] followed, even built and developed the monetarist thought. When monetary authority injects more money into an economy, the interest rate goes down that leads to increased demand for funds to purchase goods and services, consumer durables and to finance residential constructions. This eventually leads to inflation. Several studies such as Liu and Adedeji (2000), Magda and Hanan (2009), Abidemi and Malik (2010), Adu and Marbuah (2011) and Bandara (2011) support this argument.

An overview of the above variables in South Asia is documented in Table 1. Data presented in Table 1 demonstrates that CPIs across the selected countries have steadily increased over the years and there have been moderate inflations in South Asia during the study period. It shows that the cost of living is the highest in Nepal, followed by Bangladesh, India, Pakistan and finally Sri Lanka.

Sri Lanka has the highest HDI score in South Asia, followed by India, Bangladesh, Pakistan and Nepal. Thus, Nepal has the lowest score among the countries reported; all of these countries are grouped in the medium human development group of the United Nations Development Program (UNDP) (UNDP, 2019).

Among the currencies of South Asian economies reported in this study, the Pakistani Rupee is the most depreciated in recent years, followed by Sri Lankan and Nepalese Rupee, while Indian Rupee and Bangladeshi Taka remained relatively stable.

The broad money supply as a percentage of GDP has been the highest in Nepal; it is second in India, third in Pakistan, fourth in Bangladesh and the lowest in Sri Lanka. However, the money supply in Nepal is even more than its GDP, which is alarming for its economy.

South Asia is a home of 1.87 billion population, which accounts for 25% of the world populace and a place of a low level of living coupled with little per capita income [2]. However, with some remarkable social development especially in terms of social indicators, South Asian countries have made their places in the group of medium human development. Therefore, it seems to be a meaningful exercise to investigate the impact of HDI as a proxy for socioeconomic development. Thus, this study examines the impact of HDI, money supply and FEXR on CPI in South Asia. Out of eight countries in SAARC, only five countries are selected leaving three due to lack of availability of necessary data to conduct the study. The selected countries include Bangladesh, India, Nepal, Pakistan and Sri Lanka.

Year	1990	1995	2000	2005	2010	2015	2016	2017	2018
Consumer price index (CPI), 2010 = 100									
Bangladesh	32.25	42.53	53.91	69.15	100	144.56	152.53	161.23	170.16
India	22.95	37.75	54.34	66.04	100	148.6	155.95	159.83	167.60
Nepal	23.61	40.07	55.75	68.51	100	152.39	165.78	171.8	178.77
Pakistan	17.85	30.33	43.05	55.32	100	145.28	150.75	156.91	164.88
Sri Lanka	14.49	23.62	36.48	58.25	100	131.37	136.57	147.09	150.23
Human development index (HDI) score									
Bangladesh	0.388	0.427	0.47	0.506	0.549	0.588	0.599	0.609	0.614
India	0.431	0.463	0.497	0.539	0.581	0.627	0.637	0.643	0.647
Nepal	0.38	0.411	0.446	0.474	0.527	0.568	0.572	0.574	0.579
Pakistan	0.404	0.428	0.449	0.499	0.524	0.55	0.556	0.558	0.56
Sri Lanka	0.625	0.65	0.687	0.721	0.75	0.772	0.774	0.776	0.78
Foreign exchange rate (FEXR), local currency per US$, (annual average)									
Bangladesh	34.57	40.28	52.14	64.33	69.65	77.95	78.47	80.44	83.47
India	17.5	32.43	44.94	44.1	45.73	64.15	67.2	65.12	68.39
Nepal	29.37	51.89	71.09	71.37	73.26	102.41	107.38	104.51	108.93
Pakistan	21.71	31.64	53.65	59.51	85.19	102.77	104.77	105.46	121.82
Sri Lanka	40.06	51.25	77.01	100.5	113.06	135.86	145.58	152.45	162.46
Broad money supply (MS) as a percentage of GDP									
Bangladesh	22.45	28.83	30.55	47.42	58.75	64.51	65.85	65.69	64.3
India	42.18	43.55	54.65	65.55	77.68	78.01	74.69	74.12	73.67
Nepal	32.01	38.03	51.34	54.2	73.24	98.28	109.05	102.87	108.7
Pakistan	39.14	43.57	38.59	49.86	52.51	53.32	57.18	57.25	57.99
Sri Lanka	28.26	38.85	38.44	41.68	32.61	52.48	55.66	47.81	48.44

Sources: World Bank (2019); UNDP (2019)

Table 1.
An overview of CPI, HDI, FEXR and MS in South Asia

The remaining parts of the paper are structured as follows. Section 2 discusses the literature review, Section 3 defines the data and methodology, Section 4 analyzes the results and findings and finally, Section 5 concludes the study.

2. Literature review

A significant volume of studies is available in the economic literature about the determinants of inflation including inflation and economic growth relation, but there is hardly any study, which relates to the impact of socioeconomic development on inflation. This study tries to review the available literature in materializing the objective of the study.

Bruno and Easterly (1996) examined the inflation and growth relationship and found no indication of any association between inflation and growth at less than 40% annual inflation rate, which they termed as high inflation. They found a short to medium-run negative association between high inflation and growth, found no long-term damage to growth from different high inflation crises, as countries were inclined to recover back to their pre-crisis growth rate. Paul *et al.* (1997) using annual data for the period 1960–1989 for 70 countries applied Granger methodology to study the pattern and direction of causality between inflation and growth and found non-uniform relation between inflation and economic growth across countries. Among the countries, 40% showed no causality, 33% revealed unidirectional causality, 20% exhibited bidirectional causality.

Liu and Adedeji (2000) examined the factors causing inflation in the Islamic Republic of Iran using the vector error correction model (VECM) approach for the period 1989–1999 and found that the lag value of the supply of money, monetary growth and four years preceding rate of inflation had a positive effect on inflation, while two years preceding value of exchange rate harmed inflation. Pollin and Zhu (2006) studied the relationship between economic growth and inflation for 80 middle-income and low-income countries for the period 1961–2000, using nonlinear regression techniques. The study found higher inflation to be associated with moderate gains in economic growth over the total period, while grouping by decades, inflation and growth was highly correlated to the degree of aggregate demand management policies as stimuli to growth.

Magda and Hanan (2009) investigated the contributing factors of inflation in the Gulf economies using empirical data for the 1970–2007 period and reported that the credit expansion and aggregate spending powered by oil revenue, in addition to foreign factor (average of price in major trading partners) reinforced the inflationary pressure in the region. An increase in government spending, however, was expected to moderate the inflation rate by reducing supply-side bottlenecks. Abidemi and Malik (2010) using the error correction model analyzed the dynamic association between inflation and its determining factors in Nigeria for the period 1970–2007 and found that growth of GDP, money supply, imports and interest rate directly affected the inflation rate, while the exchange rate and fiscal deficit were indirectly related to inflation.

Adu and Marbuah (2011) using the autoregressive distributed lag (ARDL) bounds testing method examined the determinants of inflation in Ghana and found that the real output, broad money supply, nominal exchange rate, interest rate and fiscal deficit played a significant role in inflation determination. They concluded that inflation in Ghana was explained by a combination of monetary and structural factors consistent with prior studies. Bandara (2011) investigated the determinants of inflation in Sri Lanka using the vector autoregressive (VAR) model for the period 1993–2008, when its economy was facing upward and downward trends and found that foreign exchange rate, the supply of money and GDP explained the inflation behavior in Sri Lanka.

Narayan *et al.* (2011) surveyed the determinants of inflation using panel data for 54 developing countries for the period 1995–2004 applying the generalized method of moment's estimator and found that remittances generated inflation in developing countries, where the impact of remittances on inflation was large in the long-run than the short-run. Coutinho (2012) examined the determinants of economic growth and inflation in EU neighboring southern Mediterranean 11 countries, analyzed the differences in growth scenarios and macroeconomic stability across those countries and found the main challenge for the region to implement structural reforms, which could help them use an immense pool of unemployed resources without creating increasing risks to inflation.

Roy and Rahman (2014) investigated the influence of remittances on inflation in Bangladesh using monthly data for the period July 2003 – July 2013 and reported that remittance inflows caused inflationary pressure, while the response of food inflation was almost two and half times greater than general inflation. Kiganda (2014) applied the VECM technique and Granger causality to investigate inflation and money supply relation in Kenya using data for 1984–2012 and found a significant long-run positive link between inflation and money supply and unidirectional causation from money supply to inflation that validated the monetarist view.

Monfared and Fetullah (2017) analyzed the relation between exchange rate and inflation in Iran using time series quarterly data for the period 1976(3)–2012(4) and applied a vector autoregression model estimation. The study found both the money supply and exchange

rate influenced inflation in a positive direction in which the impact of the money supply was greater than that of the exchange rate on inflation. André *et al.* (2018) studied the relationship between inflation and economic growth using 2001–2011 data for 65 countries, applied a GLS estimator and presented a theoretical and empirical model linking inflation to economic development. They listed several variables commonly used in explaining the variances in the stage of economic growth across economies and reported that inflation was negatively correlated with the technological content of an economy, human capital formation and cyclical unemployment; while it was directly related to terms of trade growth. They concluded an inverse and low link between inflation and economic growth.

Thuy and Thuy (2019) examined the influence of exchange rate changes on exports in Vietnam, using time series quarterly data for 2000(1)–2014(4) and the ARDL bounds testing technique. They found that a depreciation in the country's domestic currency causes exports adversely in the short run, while positively in the long run. Sean *et al.* (2019) examined the relations among inflation, the supply of money and the exchange rate in Cambodia applying the Bayesian vector autoregressive method for monthly data October 2009 – April 2018. They used the money-in-utility function and purchasing power parity and found that money supply induced depreciation in the exchange rate and led to inflation.

The above-cited studies dealt with several phenomena that included the association between inflation and economic growth, the impact of the exchange rate on inflation, the influence of remittance on inflation, the effect of money supply on inflation. None of them inquired into the impact of socioeconomic development on inflation. In fact, to the best of the author's understanding, the study on the impact of socioeconomic development on inflation is yet to be done. This study claims to be the first one, and hence, the author gets motivated to conduct it to uncover the influence of socioeconomic development on inflation particularly in South Asia that will generate new economic literature. Therefore, this study aims to examine the impact of HDI, a proxy for socioeconomic development on inflation incorporating two more control variables, e.g. FEXR and money supply, as they are believed to have a significant impact on inflation.

3. Data and methodology

Inflation is measured in terms of the consumer price index (CPI). The model has formulated CPI as a function of HDI- a proxy for socioeconomic development, money supply and foreign exchange rate. The annual panel data for five selected South Asian economies are used for the 1990–2018 period. The data on CPI, FEXR and money supply is obtained from the world development indicators published by the World Bank (2019), while data on HDI is obtained from the UNDP (2019). The model is outlined in equation (1) and the variables encompassed in the model are specified in Table 2.

$$LnCPI = f(HDI, LnMS, \ FEXR) \tag{1}$$

In the first-generation panel unit root test, it is assumed that the cross-sections are uncorrelated. However, in practice, in most cases, the cross-sections are dependent on each other, and thus, the use of the first-generation panel unit root test may result in a misleading outcome. Therefore, the cross-section dependence (CD) test developed by Pesaran (2004) is applied to determine the correlation among the cross-sections. In the presence of cross-sectional dependence, the second-generation panel unit root tests, namely, cross-section augmented Dickey-Fuller (CADF) unit root test developed by Pesaran (2007) and cross-section augmented Im, Pesaran and Shin (CIPS) unit root test developed by Pesaran *et al.* (2009) are used to test the stationarity of the cross-sections. Moreover, the weak cross-sectional

Variable	Description	Source
LnCPI	LnCPI stands for the natural logarithm of CPI and is measured in terms of change in CPI (2010 = 100) expressed in respective local currencies	World Bank
HDI	HDI stands for the "human development index," a measure of socioeconomic development, expressed as an index of GDP per capita, literacy and health	UNDP
LnMS	LnMS is the logarithm of broad money supply in the local currency, the "sum of currency outside banks; demand deposits; the time, savings and foreign currency deposits; bank and traveler's checks; certificates of deposit and commercial paper," measured as in local currencies	World Bank
FEXR	FEXR stands for the foreign exchange rate, measured as weighted period average rates, amount of respective local currencies to one US$	World Bank

Table 2. Description of variables

dependence is tested based on Pesaran (2015) assuming the null hypothesis that the errors are weakly cross-sectional dependent.

In the presence of panel stationarity and weak cross-sectional dependency, the second-generation Westerlund's (2007) bootstrap cointegration test is used to determine cointegration among the above variables. Then the panel-cointegrating regression techniques, namely, the fully modified ordinary least square (OLS) (FMOLS) and the panel dynamic OLS (PDOLS) estimators devised by Kao and Chiang (2000) are applied to assess the long-run cointegration vector. These estimators are free from serial correlation and endogeneity problems that exist in any standard OLS long-run relationship. A fixed-effect panel regression is considered as given in equation (2).

$$y_{it} = \alpha_i + x_{it}^{'}\beta + u_{it}, i = 1, \ldots\ldots, N; t = 1, \ldots..T; \tag{2}$$

where y_{it} is the dependent variable of (1,1) matrix, α_i is the individual fixed effect, $x_{it}^{'}$ is the vector of independent variables of (k,1) integrated of order 1 for all i that $x_{it} = x_{it-1} + \varphi_{it}$; β is the vector of coefficients (k,1) dimensions and u_{it} is the stationary disturbance term.

In equation (3), the y_{it} and $x_{it}^{'}$ are cointegrated. The FMOLS estimator is estimated using the following specification given in equation (3).

$$\hat{\beta}_{FMOLS} = \left[\sum_{i=n}^{N}\sum_{t=n}^{T}(x_{it} - \overline{x}_i)'\right]^{-1}\left[\sum_{i=n}^{N}\left\{\sum_{t=1}^{T}((x_{it} - \overline{x}_i))\right\}\hat{y}_{it}^{+} + T\hat{\omega}_{\varphi u}^{+}\right] \tag{3}$$

where the term $\hat{\omega}_{\varphi u}^{+}$ fixes the serial correlation, $\hat{y}_{it}^{+}$ is the converted variable of y_{it} to fix the endogeneity problem. The serial correlation problem and the endogeneity issue can also be resolved by applying the PDOLS estimator, which is an extension of Stock and Watson (1993). In the PDOLS estimation, the long-run regression is enriched by lead and lagged differences in the explanatory variables to check endogenous feedback (Saikkonen, 1991). The PDOLS estimator is obtained from equation (4).

$$y_{it} = \alpha_i + x_{it}^{'}\beta + \sum_{j=-q}^{q} \gamma_{ij}\Delta X_{i,t+j} + u_{it} \tag{4}$$

where β is the estimated long-run coefficient, q is the number of leads and lags in the first differenced variables and γ_{ij} is the associated parameters and ΔX is the explanatory variables in differenced forms. The estimated parameter assumes cross-sectional independence and remains asymptotically normally distributed. The estimated coefficient of the PDOLS is obtained by the following equation (5).

$$\hat{\beta}_{DOLS} = \sum_{i=n}^{N} \left\{ \sum_{t-1}^{T} z_{it} z_{it}^{'} \right\}^{-1} \left\{ \sum_{t=1}^{T} z_{it} \hat{y}_{it}^{+} \right\} \tag{5}$$

Where $z_{it} = \left\{ x_{it} - \overline{x}_i, \Delta X_{i,t-q}, \Delta X_{i,t+q} \right\}$ is $2(q+1) \times 1$ vector of regressors.

A residual diagnostic test, namely, the normality test is conducted to validate the estimated cointegrating regression estimators. Finally, the Toda and Yamamoto (1995) Granger causality test is carried out to explore the causal relationship between inflation, HDI, money supply and foreign exchange rate. Although cointegration shows the existence or nonexistence of Granger causality, it cannot indicate the direction of causality among variables. The following VAR model is used to test the Toda and Yamamoto Granger causality.

$$LnCPI_t = \alpha_{10} + + \sum_{i=1}^{l+d_{max}} \alpha_{1i} LnCPI_{t-i} + \sum_{i=1}^{m+d_{max}} \beta_{1i} HDI_{t-i} + \sum_{i=1}^{n+d_{max}} \gamma_{1i} LnMS_{t-i} + \sum_{i=1}^{p+d_{max}} \delta_{1i} FEXR_{t-i} + u_{1t} \tag{6}$$

$$HDI_t = \alpha_{20} + + \sum_{i=1}^{l+d_{max}} \alpha_{2i} LnCPI_{t-i} + \sum_{i=1}^{m+d_{max}} \beta_{2i} HDI_{t-i} + \sum_{i=1}^{n+d_{max}} \gamma_{2i} LnMS_{t-i} + \sum_{i=1}^{p+d_{max}} \delta_{2i} FEXR_{t-i} + u_{2t} \tag{7}$$

$$LnMS_t = \alpha_{30} + + \sum_{i=1}^{l+d_{max}} \alpha_{3i} LnCPI_{t-i} + \sum_{i=1}^{m+d_{max}} \beta_{3i} HDI_{t-i} + \sum_{i=1}^{n+d_{max}} \gamma_{3i} LnMS_{t-i} + \sum_{i=1}^{p+d_{max}} \delta_{3i} FEXR_{t-i} + u_{3t} \tag{8}$$

$$FEXR_t = \alpha_{40} + + \sum_{i=1}^{l+d_{max}} \alpha_{4i} LnCPI_{t-i} + \sum_{i=1}^{m+d_{max}} \beta_{4i} HDI_{t-i} + \sum_{i=1}^{n+d_{max}} \gamma_{4i} LnMS_{t-i} + \sum_{i=1}^{p+d_{max}} \delta_{4i} FEXR_{t-i} + u_{4t} \tag{9}$$

The Toda-Yamamoto method is applicable for any order of integration specifically I(0), I(1) and I(2), which makes it useful. In the above system equation, d_{max} is the maximum order of integration among the variables, while l, m, n and p are the optimal lag length of the respective variables; u_{1t}, u_{2t}, u_{3t}, u_{4t} are the error terms having zero mean, constant variance and no autocorrelation.

4. Results and findings

4.1 Panel unit root test results

The result of the CD test developed by Pesaran (2004) is summarized in Table 3, show that all the cross-sections are correlated across panel groups at the 1% significance level.

Moreover, the weak cross-sectional dependence test result [CD = −0.356 and p-value = 0.722] based on Pesaran (2015) reveals that the cross-sections are weakly correlated. Despite a weak cross-sectional dependency, the CADF and CIPS unit test results based on Pesaran (2007) are reported in Table 4.

The results exhibited in Table 4 show that all variables have unit roots at their levels. However, at the first difference, they are stationary at 1% and 5% levels of significance. Thus, all variables are of the same order and they are I(1).

4.2 Cointegration test results

4.2.1 Westerlund bootstrap cointegration test results. The second-generation bootstrap cointegration test is used assuming a null hypothesis that there is no cointegration among the variables against the alternate hypothesis that the variables are cointegrated. The cointegration test's results are outlined below (Table 5).

As the values of Ga, Pt and Pa statistics and their corresponding robust p-values are significant at the 1% level of significance, the null hypothesis of no cointegration is rejected and it is concluded that the variables are cointegrated. Thus, the second-generation cointegration test establishes a cointegrating relationship among the variables.

Table 3. Cross sectional dependence (CD) test result

Variable	CD-test	p-value	Corr.	Abs(corr.)
LnCPI	16.90	0.000***	0.992	0.992
HDI	16.89	0.000***	0.992	0.992
FEXR	16.17	0.000***	0.950	0.950
LnMS	16.96	0.000***	0.996	0.996

Notes: CD ~ N(0,1); *** denotes significance at the 1% level

Table 4. Panel unit root test results

	CADF		CIPS	
Variable	Level	1st difference	Level	1st difference
LnCPI	−1.524	−3.961***	−1.602	−4.213***
HDI	−1.287	−2.472**	−0.994	−4.067***
FEXR	−2.116	−2.850***	−1.902	−3.920***
LnMS	−2.282	−2.961***	−1.304	−3.787***

Note: *** and ** show significance at the 1% and 5% levels, respectively

4.3 Fully modified OLS and the panel dynamic OLS estimators: long-run relationship

Based on the unit root tests and the cointegration test results, the panel-cointegrating regressions, e.g. the PFMOLS and the PDOLS estimators are suitable to determine the long-run cointegration. The other options, namely, the ARDL model and the VECM are not appropriate in this context. The results of the panel-cointegrating regressions are summarized in Table 6.

The FMOLS and PDOLS estimators are obtained based on the pooled panel method, with constant trend specification. The long-run co-variances are calculated using the automatic bandwidth estimation of Andrews (1991). Based on both the FMOLS and PDOLS estimations, the coefficients of HDI are statistically insignificant, which implies an increase in the HDI score does not cause inflation. Thus, as an indicator of socioeconomic development, HDI does not influence inflation in the long run. It implies though economic growth causes inflation as suggested by literature Pollin and Zhu (2006), Paul *et al.* (1997) and Bandara (2011); socioeconomic development does not affect inflation. Thus, HDI seems to be a better economic indicator, which does not cause inflation in the economy that is a good sign of it. Generally, an increase in income (growth in GDP) affects inflation through the aggregate demand channel. However, when we consider growth in income along with improvements in education and longevity of life (improvement in HDI), it is inflation neutral because in that case, incremental income (GDP) leads to an equivalent increase in aggregate supply in the economy by creating an infrastructure for education and health services. The managerial implication of this result for the policymakers is to give proper attention to improve the quality and quantity of noneconomic factors of the HDI [education and health] along with economic growth.

The coefficients of LnMS are positive and statistically significant in both estimations, implying that an increase in the supply of money invariably causes the price level to rise to lead

Statistic	Value	Z-value	*p*-value	Robust *p*-value
Gt	−1.532	1.662	0.952	0.683
Ga	−15.002	1.283	0.100	0.002***
Pt	−3.988	1.290	0.614	0.000***
Pa	−17.050	3.270	0.001	0.000***

Note: *** denotes significance at the 1% level

Table 5. Bootstrap cointegration test results

Variable	Coefficient	Std. error	*t*-statistic	Prob.
FMOLS estimators				
HDI	2.051755	1.446554	1.418374	0.1584
LnMS	0.008755	0.001408	6.217853	0.0000***
FEXR	0.221922	0.084093	2.638998	0.0093***
PDOLS estimators				
HDI	−0.515285	2.290422	−0.224974	0.8226
LnMS	0.009069	0.001642	5.523034	0.0000***
FEXR	0.335334	0.127309	2.634021	0.0102**

Note: *** and ** indicate significance at the 1% and 5% levels, respectively

Table 6. Panel cointegrating regression results

to inflationary pressure in the economy. Thus, the finding endorses the monetarist view about prices and validates the findings of Abidemi and Malik (2010), Adu and Marbuah (2011), Bandara (2011) and Kiganda (2014). The policy implication of this outcome for the monetary authorities in South Asia is to be prudential regarding the supply of money to keep inflation in control. They should follow a noninflationary conservative monetary policy.

The coefficients of FEXR in both methods are statistically significant meaning that the FEXR has a positive impact on domestic inflation in the long run. Any increase in the domestic currency exchange rate invariably influences inflation in the long run. When the exchange rate of domestic currency with the US$ increases, it alters domestic money supply through foreign remittance inflow, as when the FEXR depreciates, remittance inflow goes up that directly adds to the quantity of money in the circulation. The finding is in line with most of the literature including Abidemi and Malik (2010), Adu and Marbuah (2011), Bandara (2011), Monfared and Fetullah (2017) and Sean *et al.* (2019), who stated a positive impact of FEXR on inflation in the long-run.

The values of Jarque-Bera (JB) and corresponding probabilities for normality tests under the FMOLS estimator are JB: 1.51, probability 46.98%, while under the PDOLS estimator JB: 0.95, probability 62.15%. Thus, normality test statistics validate the cointegrating regression estimators.

4.4 Toda-Yamamoto Granger causality test results

In the determination of higher order of integration d_{max}, we have to be careful to select the lag length because a lower lag length less than d_{max} can cause bias and a higher lag than true lag may result in inefficient estimation. The optimum lag length d_{max} selection (=1) is based on the final prediction error, Akaike information, Hannan-Quinn and Schwarz-Bayes information criteria.

The direction of causality among the variables based on the Toda-Yamamoto Granger causality test is determined using $d_{max} = 1$ and $k = 1$ and reported in Table 7. It is demonstrated that there is no causality from HDI to LCPI and socio-economic development does not cause inflation in South Asia. Thus, the Toda-Yamamoto Granger causality test result authenticates the results of both the PDOLS and FMOLS, which reveal that HDI does not influence inflation in the long run. Hence, the robustness of cointegrating regression estimators is validated. However, a unidirectional causality exists from LnCPI to HDI, indicates that a rise in the consumer price index pushes the HDI to alter in either direction.

A unidirectional causality is running from LnMS to LnCPI; meaning that any increase in broad money supply will invariably raise the price level pushing inflationary pressure in the economy. This finding also reinforces the findings of cointegration regression estimators. The unidirectional causality runs from LnMS to HDI, shows a change in the money supply has a deal with a change in HDI through the price channel.

Another unidirectional causality is running from FEXR to HDI; an increase in the domestic exchange rate (devaluation in the foreign exchange rate) is likely to cause causes human development index. When the FEXR depreciates, more domestic currency is traded for one unit of the US$ that attracts foreign remittances. South Asia largely depends on remittance income, which directly goes to households. When households receive foreign income through remittance, their income is straightforward augmented and they become able to spend on health and better education for school-going family members. Thus, an increase in foreign exchange rates plays a positive role in human development.

5. Conclusion

The study has attempted to examine the influence of HDI, the FEXR and the money supply on inflation in South Asia. The Westerlund bootstrap cointegration test has provided evidence that there exists a long-run association between inflation, HDI, the FEXR and money supply.

Null hypothesis	Chi-sq	df	Prob.	Direction of causality
HDI does not Granger cause *LnCPI*	1.789873	2	0.4086	LnCPI→ HDI unidirectional
LnCPI does not Granger cause HDI	7.739296	2	0.0209**	
LnMS does not Granger cause *LnCPI*	8.162395	2	0.0169**	LnMS→ LnCPI unidirectional
LnCPI does not Granger cause LnMS	1.644792	2	0.4394	
FEXR does not Granger cause *LnCPI*	0.509311	2	0.7752	No causal relation
LnCPI does not Granger cause FEXR	2.985378	2	0.2248	
LnMS does not Granger cause *HDI*	4.923042	2	0.0853*	LnMS→ HDI unidirectional
HDI does not Granger cause LnMS	4.454727	2	0.1078	
FEXR does not Granger cause *HDI*	10.55028	2	0.0051***	FEXR→ HDI unidirectional
HDI does not Granger cause FEXR	2.918919	2	0.2324	
FEXR does not Granger cause LnMS	4.421318	2	0.1096	No causal relation
LnMS does not Granger cause FEXR	1.617152	2	0.4455	

Note: ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Table 7. Toda-Yamamoto Granger causality test result

The cointegrating regressions of both the PDOLS and the FMOLS results have documented that socioeconomic development presented by HDI has no influence on inflation in the long run. Although economic development represented by GDP growth causes inflation as captured by economic literature, socioeconomic development denoted by HDI has no impact on inflation, an increase in HDI is inflation neutral. Thus, HDI stands for a better macroeconomic indicator, which does not create any inflationary pressure on the economies of South Asia.

The money supply has a positive and significant influence on inflation, any increase in the money supply will raise the inflationary pressure on the economy that endorses the monetarist view about prices. The FEXR has a positive significant impact on domestic inflation, in the long run; any depreciation in the exchange rate is likely to cause an inflationary trend in the economy.

The Toda-Yamamoto Granger causality test has confirmed four unidirectional causalities. Money supply causes inflation, the consumer price index; an increase in the supply of money raises the price level and the consumer price index, both the supply of money and consumer price index cause HDI and the FEXR leads to an increase in HDI. Therefore, South Asia should focus on the improvement of the HDI score, through increasing per capita income, enhancing the level and quality of education and health-care services to achieve socio-economic development, which will take care of inflation. Moreover, it should follow a conservative monetary policy to control inflationary pressure and its negative consequences in these economies.

The study has investigated the impact of socioeconomic development on inflation with reference to South Asia. Similar study/studies may be carried out concerning other countries/regions of the world to gather further insights.

Notes

1. The eight countries of SAARC are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.
2. In the year 2017, for example, the regional average GDP per capita of South Asia was US $1,842.25 only, compared to US$10,368.48 for the East Asia and Pacific and US$23,422.19 for the Europe and Central Asia (Islam, 2020a).

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