

An Analysis Of Selected Macroeconomic Variables In Bangladesh: A Monthly Time-Series Analysis (2015–2023)

Md. Alamin,

Deputy Director (Research), Research Department, Bangladesh Bank, Bangladesh.

Prianka Mandal,

Assistant Director (Research), Research Department, Bangladesh Bank, Bangladesh.

Abstract

The paper examines dynamic interrelationships between five important macroeconomic variables in Bangladesh monthly remittance inflows, the Industrial Production Index (IPI), foreign exchange reserves, consumer price inflation (both point-to-point and 12-month average) and the BDT/USD exchange rate using monthly data between January 2015 and July 2023 (103 observations). The dataset, obtained in the form of the Bangladesh Bank and the Ministry of Economic Transition (MET), captures two structurally distinct episodes: the pre-COVID-19 stability period (2015-2019) and the highly turbulent post-COVID era characterized by a surge in remittances in 2020-2021, a sharp diminishing of reserves in 2022-2023, and a depreciating currency that drove the exchange rate to the level of BDT 77.80 to BDT 109.50 per USD. The paper documents descriptive trends, computes correlation structures, and presents annual aggregates, showing that: (i) remittance inflows are the most stable macroeconomic buffer in Bangladesh, reaching USD 2,598 million in July 2020; (ii) the IPI has grown steadily between 216 and 549 with only the April 2020 pandemic shock interrupting this trend; and (iii) foreign reserves have been rising steadily between 216 and 549 with only the April 2020 pandemic shock breaking this trend. The implications of these findings on policy in Bangladesh Bank in managing its reserves are important, monetary policy calibration, and the government's overseas employment strategy.

Keywords: *Remittances, Industrial Production Index, Foreign Exchange Reserves, Inflation, Exchange Rate, Migrant Workers, Bangladesh, Monetary Policy, Time-Series Analysis*

Date of Submission: 27-07-2026

Date of Acceptance: 07-08-2026

I. Introduction

Bangladesh is at a significant turning point in macroeconomic growth. With a history of an average of 6-8% real GDP growth rate over 20 years, the country has developed a reputation as one of the most resilient emerging economies in Asia. This resilience has been anchored on two structural pillars; a thriving garment export sector and a massive and ever-growing inflow of worker remittances by the Bangladeshi diaspora. Collectively, these two external sources of revenue have paid import bills, kept comfortable foreign exchange reserves and provided a cushion against external shocks.

The 2020-2023 period has however revealed how this macroeconomic balance is fragile. The 2020 COVID-19 pandemic first reduced the number of migrant workers leaving the country to near zero, threatening the remittance pipeline. Ironically, there was a surge in remittance inflows during the period at record levels as the overseas Bangladeshis transferred savings home through formal banking channels rather than informal hawala networks - partly due to the 2% cash incentive scheme introduced by Bangladesh Bank to encourage remittances through formal banking channels instead of informal hawala networks. In mid-2021, the foreign exchange reserves reached an all-time high of USD 48 billion.

The resulting normalisation was much disruptive. With the rebound of the import demand in 2022, the global commodity prices soared in the aftermath of the Russia-Ukraine war, and the US Federal Reserve embarked on its fastest tightening path in forty years, Bangladesh found itself in a similar predicament: a widening current account deficit, a depreciating taka, rapidly draining foreign reserves, and a spiking imported inflation. As of mid-2023 foreign reserves had dropped to USD 23 billion, the exchange rate had fallen to USD 109 per BDT 84, and inflation of the consumer price had soared to 9.94% - not seen in recent Bangladeshi economic history.

To capture these dynamics and analyse them using five key macroeconomic indicators, including remittance inflows, the Industrial Production Index (IPI), foreign exchange reserves, consumer price inflation, and the BDT/USD exchange rate, the current paper uses monthly data between January 2015 and July 2023. Using descriptive trend analysis, correlation statistics and annual aggregates, the paper offers a detailed

empirical record of this turbulent period and makes policy-relevant conclusions to the Bangladesh Bank and the Ministry of Finance.

The rest of the paper has been organized in the following way. Section 2 is a review of the literature in this area. Section 3 explains the definition of data and variables. Section 4 is a descriptive analysis and correlation analysis. The trend analysis with charts is provided in Section 5. In section 6, key findings and policy implications are discussed. Section 7 concludes.

II. Literature Review

Remittances and Macroeconomic Stability

The macroeconomic impacts of remittances inflows have received a lot of scholarly interest, especially to the economies where remittances form a large proportion of the GDP. In a panel study of 109 developing countries, Aggarwal, Demircuc-Kunt and Martinez Peria (2011) find that remittances have positive and significant impact on financial development through both deposit and credit channels. In the case of Bangladesh, in the long-run, Kumar and Stauvermann (2014) confirm a significant positive effect of remittances on output per worker in an augmented Solow framework finding a Granger-causal bilateral relationship between remittances and economic output.

Remittances and their stabilising effect in times of crisis has been a especially significant branch of the literature. In contrast to foreign direct investment and portfolio flows, remittance inflows are countercyclical, i.e. when host-country conditions are unfavourable and recipient-country needs are acute (Chami, Fullenkamp, and Jahjah, 2005). The dramatic illustration of this countercyclical feature was observed during the COVID-19 crisis, when the formal-channel remittances to Bangladesh skyrocketed, even as the departure of migrant workers collapsed.

The correlation between remittances and inflation is more complicated. According to Barajas, Chami, Fullenkamp, Gopen, and Montiel (2009), remittances have an inflationary effect when they are mainly directed into the consumption of non-tradeable goods and services, such as housing, food, and education. Elahi and Rahman (2021) above use an ARDL model to find that remittances have a significant positive effect on inflation in short-run but not in long-run. The remittanceinflation relationship can be long run neutral, which is reflected by productive investment that is channeled by formal banking intermediaries.

Industrial Production and Economic Transformation

The Indian Production Index of Industrial production is mainly led by the ready-made garment (RMG) sector which contributes to about 80 percent of the export earnings and employs more than four million workers. The IPI has increased sharply within the sample period, which indicates not only the growth in the garment production capacity but also the growth of the pharmaceutical, cement, and consumer goods industries. The structural change in the manufacturing sector of Bangladesh to take less productive industries to more productive industries, which is closely correlated with the investment in the machinery and human capital is documented by Ahmed, Saifullah, and Hossain (2021).

The COVID-19 crisis caused an acute, yet short-lived, break in industrial production in Bangladesh. The IPI reached its minimum point in the sample period in April 2020, followed by a rapid recovery as evidenced by an increase in export orders and domestic demand returning to normal. Subsidiary data reveal that the IPI has continued to go up during the 9-year sample period to 202223 with a sample maximum of 548.9 (Index, base year 200506) which represents a large growth in the structure of the industrial base over the 9-year sample period.

Foreign Exchange Reserves and Exchange Rate Management

The sufficiency of foreign exchange reserves is a decisive factor on the external vulnerability of a country. IMF reserve adequacy measures are usually used to measure reserves in terms of three to four months of imports. The reserves of Bangladesh passed this mark comfortably throughout the majority of the sample period, reaching a high of around nine months of imports in 2021. The resulting drainage - fueled by import boom, debt service payments, and intervention on behalf of the taki by the Bangladesh Bank - is recorded in detail in the current dataset.

Hossain (2014) examines the exchange rate policy of Bangladesh, and notes that Bangladesh bank has traditionally maintained the taka within a managed float regime, where the Bangladesh bank would intervene to prevent excessive volatility. The episode in 202223 was a major change, and a 28 percent depreciation of the taki against the dollar in a few months was quite an addition to this stability. This depreciation also contributed to the deterioration of the import bill, the increasing inflationary pressures, and even partially counteracted the US-dollar value of the remittance inflows when converted to taka, which created complex feedback loops among the variables under analysis in this paper.

Inflation Dynamics in Bangladesh

Most of the 2010s saw consumer price inflation in Bangladesh relatively contained between 5% and 7% due to the stabilising effects of administered fuel prices, rice price controls, and the appreciated exchange rate. The recent inflation surge of 9.94% point-to-point by May 2023, is a structural break, unlike this pattern. Islam, Ahmed, and Salim (2023) explain the surge by this factor as largely due to foreign inflation imported through the exchange rate channel and global shock in the prices of commodities, rather than domestic demand-pull factors. Such a pattern is also correlated with the correlation patterns recorded in the current dataset, which depict that there exists strong positive correlation between the exchange rate (BDT/USD) and consumer price inflation.

III. Data Description

Data Sources and Period

The dataset contains eight series of eight macroeconomic variables, with the largest number of monthly observations in a series being 103. The sources of the data used are the Monthly Economic Trends published by the Bangladesh Bank and the Ministry of Economic Transition (MET). The base year of 2005 is used as the base year in the Industrial Production Index: 2005 = 100. All the monetary values are reported in nominal terms, i.e., remittances and foreign exchange reserves in USD millions, and the exchange rate in BDT per USD.

The period of sample was chosen to cover two structurally different macroeconomic regimes: the relative stability of 2015-2019, with low inflation (56.5%), controlled exchange rate (BDT 7785 per USD), gradual accumulation of reserves (USD 2233 billion), and a moderate increase in remittances; and the very turbulent 2020-2023 period, characterized by the disruption of the COVID-19 pandemic followed by a sudden increase in remittances, reserve accumulation and then rapid depletion, currency depreciation, and a large episode of inflation.

Variable Definitions

The summary of all the variables, their definitions, units, and sources are provided in Table 1.

Table 1: Variable Definitions and Data Sources

Variable	Definition	Unit	Source
Remittance	Personal remittances received from abroad through formal banking channels	USD Million	Bangladesh Bank / MET
IPI	Industrial Production Index (base year 2005-06 = 100), measuring monthly output across manufacturing sub-sectors	Index (2005-06=100)	Bangladesh Bank
FX Reserve	Gross official foreign exchange reserves held by Bangladesh Bank	USD Million	Bangladesh Bank
Inflation (PtP)	Point-to-point consumer price inflation: percentage change vs. same month of prior year	Percent (%)	Bangladesh Bureau of Statistics
Inflation (12M Avg)	12-month moving average of consumer price inflation	Percent (%)	Bangladesh Bureau of Statistics
Exchange Rate (EOP)	BDT/USD exchange rate at end of reporting period	BDT per USD	Bangladesh Bank
Exchange Rate (Avg)	BDT/USD exchange rate period average	BDT per USD	Bangladesh Bank
Migrant Workers	Number of Bangladeshi workers departing abroad for overseas employment	Number of Workers	Bureau of Manpower, Employment and Training (BMET)

Source: Bangladesh Bank Monthly Economic Trends; Ministry of Economic Transition (MET); Bureau of Manpower, Employment and Training (BMET). Base year for IPI: 2005-06.

IV. Descriptive Statistics And Correlation Analysis

Summary Statistics

Table 2 presents descriptive statistics for all eight variables over the full sample period. The statistics reveal substantial variation across variables, reflecting the structural shifts documented in the trend analysis.

Table 2: Descriptive Statistics of Key Macroeconomic Variables (Jan 2015 – Jul 2023)

Variable	N	Mean	Std. Dev.	Min	25th Pct.	Median	75th Pct.	Max
Remittance (USD mn)	103	1,500.3	356.1	856.9	1,210.7	1,444.8	1,737.4	2,598.2
IPI (Index)	100	371.2	89.8	216.3	295.2	372.1	450.6	548.9
FX Reserve (USD mn)	103	34,016.7	6,299.1	22,043.1	31,312.2	32,598.6	36,882.4	48,060.0
Inflation PtP (%)	103	6.16	1.20	5.02	5.49	5.68	6.17	9.94
Inflation 12M Avg (%)	103	6.02	0.84	5.38	5.55	5.69	6.17	9.20
Exch. Rate EOP (BDT/USD)	104	85.02	7.24	77.80	79.59	84.48	84.95	109.50
Exch. Rate Avg (BDT/USD)	104	84.92	7.17	77.80	79.46	84.41	84.95	109.46
Migrant Workers (no.)	102	63,468	29,062	0	49,564	62,288	80,784	131,316

Source: Authors' calculations from Bangladesh Bank and MET data. N = number of valid monthly observations.

There are a number of observations. To start with, inflows of remittances are highly volatile (coefficient of variation 23.7%), with the minimum of USD 856.9 million (September 2017) and the maximum of USD 2,598.2 million (July 2020) as the COVID-19 remittance surge. Second, the IPI increased more than doubled during the sample period, a minimum of 216.3 to maximum of 548.9, which is indicative of sustained industrialisation of the Bangladeshi economy. Third, the standard deviation of the foreign exchange reserves is 6.3 billion USD, but with a mean of USD 34.0 billion, presenting a sharp accumulation (2019-2021) and depletion (2022-2023) cycle. Fourth, the mean of inflation of 6.16% conceals a significant structural change, with the distribution skewed to the high values in the 2022-2023 tail. Fifth, the exchange rate depicts a mean of BDT 85.02/USD with a maximum of BDT 109.50/USD, which displays the extent of the depreciation in 2022-2023.

Annual Aggregates of Remittance Inflows

Table 3 shows annual totals of remittance inflows, which is directly useful in the analysis of national accounts and balance of payments.

Table 3: Annual Remittance Inflows — Bangladesh (USD Million, 2015–2023)

Year	Annual Total (USD mn)	Year-on-Year Change (USD mn)	YoY Growth (%)	Notes
2015	15,317	—	—	Stable baseline year
2016	13,611	−1,706	−11.1%	Global oil price fall reduces GCC wages
2017	13,535	−76	−0.6%	Continued GCC slowdown
2018	15,545	+2,010	+14.8%	Recovery; incentive schemes introduced
2019	18,332	+2,787	+17.9%	Strong pre-COVID growth
2020	21,742	+3,410	+18.6%	COVID surge; 2% cash incentive; formal channel shift
2021	22,072	+330	+1.5%	Record high; sustained post-COVID flow
2022	21,285	−787	−3.6%	Partial normalisation; hundi recovery
2023	13,091*	n/a	n/a	Partial year (Jan–Jul only)

Source: Bangladesh Bank Monthly Economic Trends. * 2023 figure covers January–July only (7 months). YoY comparisons exclude 2023.

Table 3 shows annual data on remittance, and it is possible to see a dramatic structure. Remittances bounced back sharply after a decline of 11.1% in 2016 - mainly due to the fall in global oil prices that reduced the disposable incomes of Bangladeshi workers in the Gulf Cooperation Council (GCC) countries - estimate. Since 2016, remittances have recovered strongly, inspired by the government's cash incentive of 2 percent on formal-channel remittances and an increase in the number of migrant workers in the stock. COVID-19 period

saw a paradoxical increase: although the numbers of migrant departures have collapsed to near zero in April 2020 through June 2020, the annual remittances in 2020 have increased by 18.6% and reached its record in 2021 of USD 22.1 billion.

Correlation Analysis

Table 4 is the Pearson correlation matrix of the six core quantitative variables throughout the entire sample period. Correlations give a first-order characterisation of the linear relationships between variables.

Table 4: Pearson Correlation Matrix of Key Macroeconomic Variables

Variable	Remittance	IPI	FX Reserve	Inflation PtP	Inflation 12M	Exch. Rate
Remittance	1.000	0.662	0.512	0.310	0.348	0.502
IPI	0.662	1.000	0.648	0.451	0.481	0.714
FX Reserve	0.512	0.648	1.000	-0.156	-0.035	0.118
Inflation PtP	0.310	0.451	-0.156	1.000	0.963	0.791
Inflation 12M	0.348	0.481	-0.035	0.963	1.000	0.844
Exch. Rate (EOP)	0.502	0.714	0.118	0.791	0.844	1.000

Source: Authors' calculations. All correlations computed using pairwise available monthly observations. Bold indicates $|r| > 0.7$.

The correlation table indicates that there are some economically significant relationships. As expected, the two measures of inflation are co-moved by construction, as reflected by the strongest positive correlation of the two measures of inflation ($r = 0.963$). The exchange rate is highly correlated with both 12-month average inflation ($r = 0.844$), and the point to point inflation ($r = 0.791$), all of which are consistent with a significant pass-through channel of exchange rates in Bangladesh open economy, i.e. imported goods, especially energy and food are responsive to taka depreciation. The IPI has a very high level of correlation with the exchange rate ($r = 0.714$), reflecting the fact that both variables are positively correlated over the sample period, as a result of industrialisation and nominal depreciation of the taka respectively. There is a moderate positive correlation between remittances and the IPI ($r = 0.662$), and it is possible that they share an upward time pattern. Inflation has a negative correlation with foreign reserves ($r = -0.156$ in the case of PtP), which is also true of the 2022/2023 episode where the decrease in reserves and the increase in inflation rates were observed simultaneously.

V. Trend Analysis

Remittance Inflows

Figure 1: Monthly Remittance Inflows — Bangladesh (2015-2023)



Figure 1: Monthly Remittance Inflows — Bangladesh (Jan 2015 – Jul 2023, USD Million)

Figure 1 shows the series of monthly remittances throughout the entire sample. A number of structural features are apparent. To begin with, remittances are highly seasonal with an average higher increase in inflows in the Islamic holy months of Ramadan and Eid and low increases in the first quarter. Second, the general trend is generally upwards, increasing between USD 1,200 million per month in 2015 to over USD 2,000 million in 2021. Third, the surge of COVID-19 in mid-2020 is drastically visible: the inflow of the remittances in the form of formal banking channels incentivised by the 2% cash bonus scheme of the Bangladesh Bank soared: monthly

inflows increased to USD 2,598 million in July of 2020, the single highest monthly figure in the entire dataset. Fourth, following the record peak in July 2020, remittances moderated somewhat in 2021/22 as informal channels (hundi) somewhat reclaimed their market share, before showing renewed strength in mid-2023.

Industrial Production Index

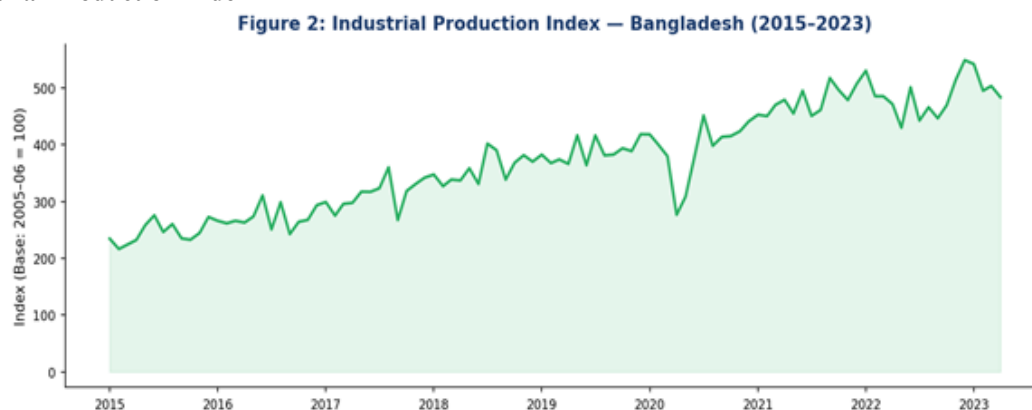


Figure 2: Industrial Production Index — Bangladesh (Jan 2015 – Jul 2023, Base: 2005-06 = 100)

The monthly series of indexes of Industrial production are represented in Figure 2. The chart shows a strong positive structural tendency: between an index level of about 216 at the beginning of the 2015 year and almost 549 at the end of the sample period the positive structural tendency of industrial output is approximately 154% over a period of eight and a half years, or an average annual growth trend of approximately 11.5%. This pattern indicates that Bangladesh is still undergoing structural change, growing its ready-made garment industry, and expanding its manufacturing capacity in various industries. The most notable anomaly in the IPI series is the sharp V-shaped recession in April 2020 (IPI = 276.6), when nationwide lockdowns caused factory closures in the manufacturing sector of Bangladesh. The following recovery was quick, with the IPI surpassing its pre-pandemic course by the end of 2020, due to the restoration of garment export orders and the recovery of domestic demand. In the current dataset, no IPI data are available since May 2023 in the present dataset.

Foreign Exchange Reserves

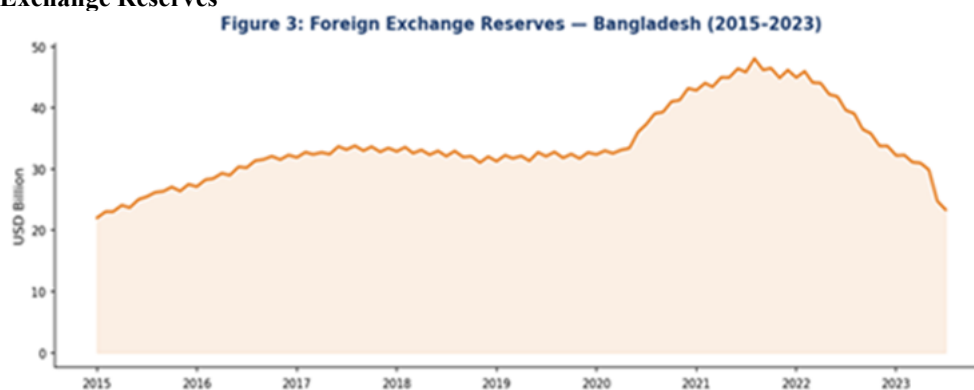


Figure 3: Foreign Exchange Reserves — Bangladesh (Jan 2015 – Jul 2023, USD Billion)

The monthly series of indexes of Industrial production are represented in Figure 2. The chart shows a strong positive structural tendency: between an index level of about 216 at the beginning of the 2015 year and almost 549 at the end of the sample period the positive structural tendency of industrial output is approximately 154% over a period of eight and a half years, or an average annual growth trend of approximately 11.5%. This trend suggests that Bangladesh is yet to fully go through a structural change, develop its ready-made garment industry, and increase its manufacturing capacity in other sectors. The best anomaly in the IPI series is the sharp V-shaped recession in April 2020 (IPI = 276.6), when nationwide lockdowns led to factory closures in the manufacturing sector of Bangladesh. The next recovery was rapid, when IPI exceeded its course prior to the pandemic, since the garment export orders were restored and the domestic demand was recovered. In the current dataset, there are no IPI data since May 2023 in the present dataset.

Consumer Price Inflation

Figure 4: Consumer Price Inflation — Bangladesh (2015-2023)



Figure 4: Consumer Price Inflation — Point-to-Point and 12-Month Average (Jan 2015 – Jul 2023, %)

Both the point to point and the 12 months average consumer price inflation series are presented in Figure 4. Throughout the period of the sample and up to 2021, inflation was relatively contained within a range of 5.06.5% as the net effect of administered fuel prices, subsidised food distribution, and the relative stability of the exchange rate. The two series naturally follow each other in time with the 12-month average naturally lagging and smoothing the point-to-point series. The most dramatic aspect of Figure 4 is the inflation boom of 2022-2023. In May 2022 (7.42%), in September 2022 (9.10%), and in May 2023 (9.94%), which is the highest level in the dataset, point-to-point inflation has crossed the 7% threshold, then the 9.10% threshold, and finally the 9.94% threshold. Three factors were primarily involved in this surge: the sharp depreciation of the taki (which increased the domestic cost of imported fuel, fertiliser, and food); the world commodity price shock as Russia-Ukraine conflict led to the reduction of domestic fuel subsidies); and the partial passthrough of the world energy prices as the domestic fuel subsidies were cut. That the high inflation was not a one-time spike but a prolonged outbreak necessitating a response by monetary policy is confirmed by the 12-month average series of inflation that reached 9.20% by July 2023.

Exchange Rate

Figure 5: BDT/USD Exchange Rate — Bangladesh (2015-2023)

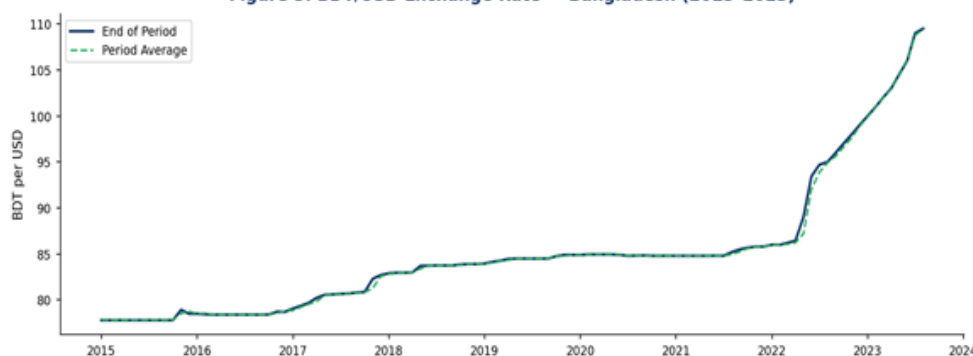


Figure 5: BDT/USD Exchange Rate — End of Period and Period Average (Jan 2015 – Jul 2023)

Figure 5 demonstrates the dynamics of exchange rate BDT/USD. We can differentiate three different regimes. Under the first regime (2015-2020), the taki was held within a very narrow range of about BDT 77.8085.00 per USD and indicates that Bangladesh Bank actively managed the nominal exchange rate. This regime, which was essentially a fixed rate over long periods of time, inhibited the exchange rate volatility mechanism but also inhibited the balance of payments adjustment mechanism. The exchange rate also decreased slowly in the second regime (2021-mid 2022), with the current account pressures starting to accumulate, between BDT 84 and BDT 89. The third and most dramatic regime (mid-2022 to 2023) exhibits a steep and accelerating depreciation, with the taki falling in the period between May 2022 and July 2023 between BDT 89 and BDT 109.50 a cumulative depreciation of about 23 percent in just 15 months. The fact that the end-of-period and period-average exchange rates converged before 2022 and then spread wide in 2022, is an indication of an increase in intra-month volatility during the depreciation episode. This sharp depreciation

both enhanced the taki-equivalent value of remittances (partially offsetting the effect on recipients), and increased the cost of imports, and contributed to the inflationary pressures that have been reported in Section 5.4.

Migrant Worker Departures

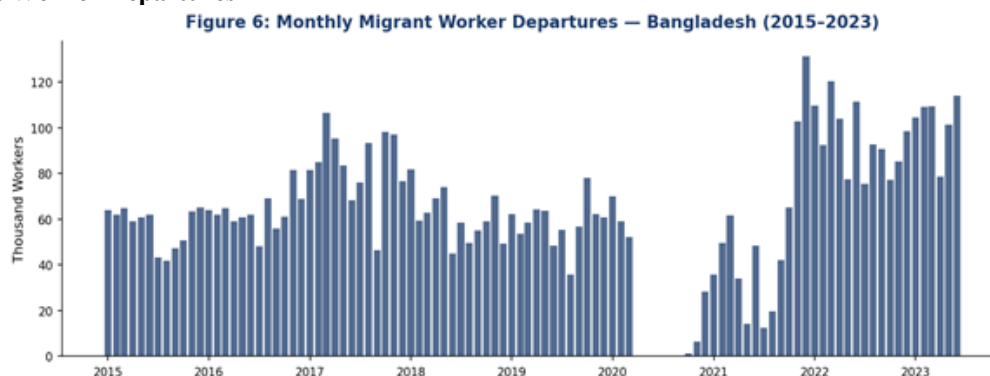


Figure 6: Monthly Migrant Worker Departures — Bangladesh (Jan 2015 – Jul 2023, Thousands)

Figure 6 shows the number of Bangladeshi workers leaving their country to go abroad to work in different countries. The upstream determinant of the remittance inflows, this series is also a significant source of background information about the dynamics of remittances. The chart shows various characteristics that are of interest. To begin with, the number of migrants leaving their countries is highly seasonable and unstable, ranging between about 35,000 up to 131,000 workers per month in normal times. Second, the COVID-19 shock created a total breakdown in the number of departures: since March 2020, the number of departures has been reduced to almost zero (reported as 0, 0, 0 in April, May, and June 2020 in the dataset) this is due to the closure of international airports and the suspension of overseas recruitment processes. This breakdown explains why the 2020 remittance boom was propelled entirely by transfers of the already existing stock of overseas workers rather than by new departures. Third, the recovery in migrant departures in the post-pandemic period was strong with monthly departures of up to 131,316 in December 2021 - the highest in the data - as pent-up demand in overseas labour was released simultaneously across GCC and other destination markets. Fourth, the recent 2023 data indicate a very high continuation of strong departures, enabling the assumption that remittance inflows will be very high in the medium term.

Remittance vs. Industrial Production Scatter

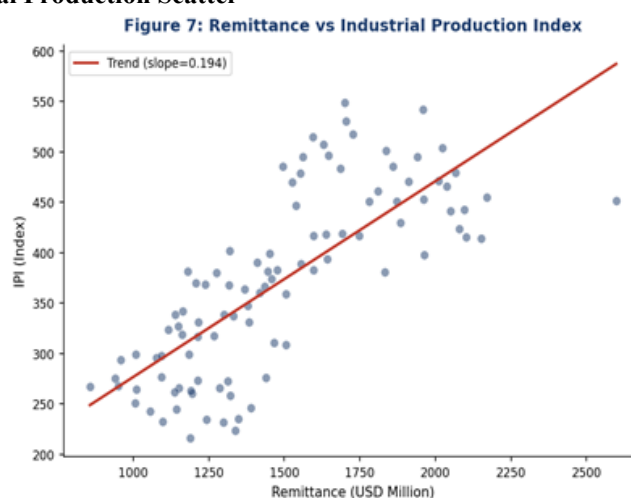


Figure 7: Scatter Plot — Monthly Remittance Inflows vs. Industrial Production Index

Figure 7 is a scatter plot of monthly remittances versus the IPI, with a linear trend line overlaid. The positive slope ($r = 0.662$), is also consistent with both series having a common upward time trend brought about by the structural economic expansion of Bangladesh over the sample period. The increased inflows of remittance will supply foreign exchange liquidity, domestic consumption, and indirectly, investment in industrial capacity via the banking system. On the other hand, an increased industrial activity will result in

higher incomes and employment, which will reduce the domestic pressure to emigrate, and will at the same time increase the capacity of the government to fund overseas employment programmes. The scatter plot also indicates that some of the highest-remittance, high-IPI observations (upper-right cluster) are dated 2021/2022, and lower-remittance, lower-IPI observations (lower-left cluster) are dated 2015/2016.

Annual Average Indicator Comparisons

Figure 8: Annual Average Macroeconomic Indicators — Bangladesh

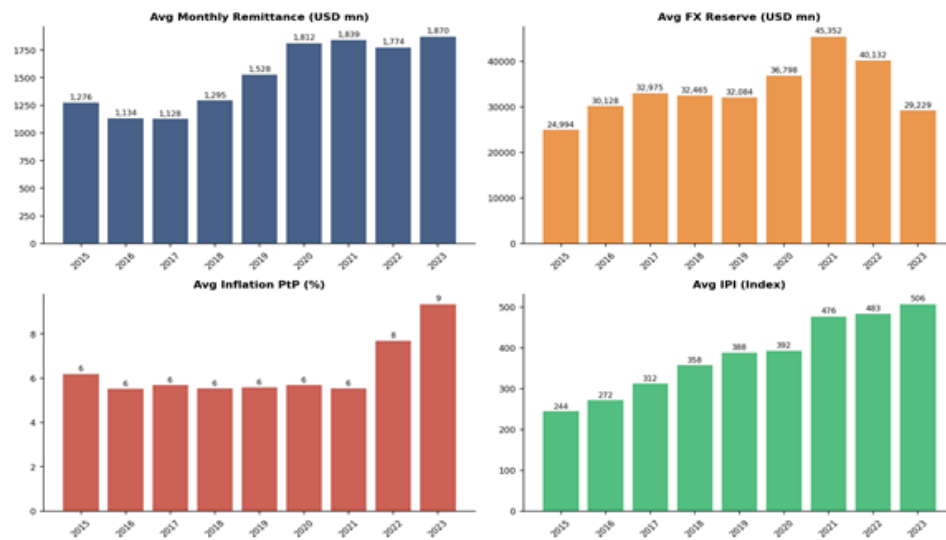


Figure 8: Annual Average Macroeconomic Indicators — Bangladesh (2015–2022)

The four-panel bar chart in figure 8 compares the average values of four key quantitative indicators per annum. The time-series analysis is confirmed and supplemented by the panels. The remittance panel reflects the sheer increase in annual average monthly remittances between about USD 1,135 million (2016) to USD 1,839 million (2021) with a partial normalisation in 2022. It is clearer in the FX reserve panel and shows the accumulation-depletion cycle which peaks at USD 44,000 million average in 2021 and then declines in 2022. The sharp upward step in 2022 is shown by the inflation panel, which retains a low scale through 2021 but with the sharp upward step in 2022, the annual average point-to-point rate rose sharply to 8% as compared to prior levels below 6.3. The IPI panel indicates the only upward trend of any of the indicators with no annual year-on-year drop across the entire sample period.

Correlation Heatmap

Figure 9: Correlation Matrix of Key Macroeconomic Variables

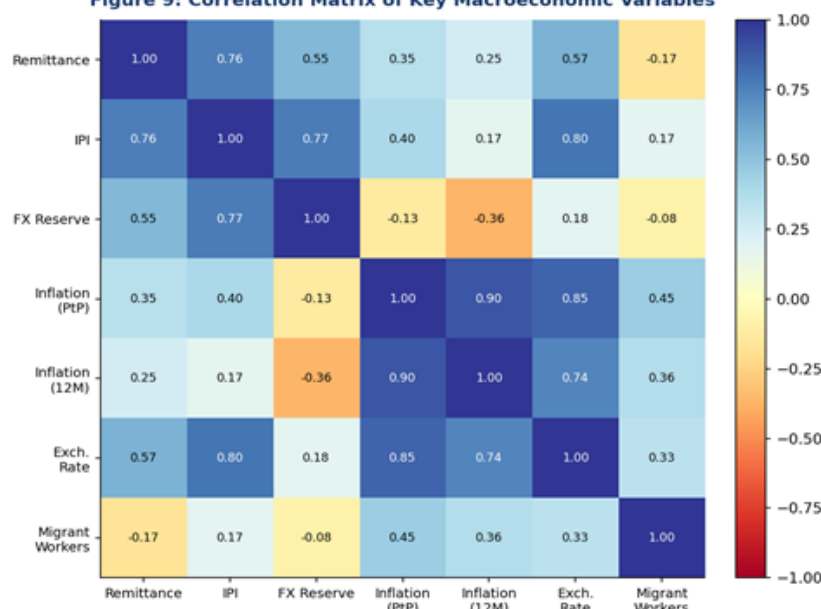


Figure 9: Correlation Heatmap — Key Macroeconomic Variables (Monthly, 2015–2023)

The correlation heatmap presented in figure 9 is shown in its visual form of the correlation heatmap, where warmer (red) colours indicate strong positive correlations and cooler (blue) colours indicate negative correlations. The heatmap renders the arrangement of the correlation matrix intuitively clear. The strong co-movement of the two inflation series (deep red, upper-right quadrant) is the dominant visual feature. The positive strong correlations between the exchange rate, IPI and both measures of inflation (the orange-red corridor in the lower-right of the matrix) attest to the interdependence of the dynamics within the external sector in Bangladesh. The weak negative correlation between FX reserves and inflation (blue cell on the reserves-inflation cross-section) is especially noteworthy: it confirms that the decrease in reserves and inflation are negatively correlated in the cross-section of months, which is consistent with the 20222023 episode being the period of the lowest reserves and the highest inflation at the same time.

VI. Discussion And Policy Implications

Remittances as a Macroeconomic Stabiliser

The data confirm that remittance inflows act as the most significant macroeconomic stabiliser in Bangladesh - one that even demonstrated its ability to remain resilient even during the COVID-19 pandemic. This finding has a number of policy implications. The 2 percent cash incentive on formal-channel remittances offered by Bangladesh Bank has been successful in directing such flows towards the banking system, boosting recorded inflows and strengthening the reserve position. It must continue to be upheld and possibly expanded to include digital transfer platforms, which are quickly gaining a market presence among younger overseas workers. Second, the government ought to invest in lowering the cost of transfer of overseas Bangladeshis which stands at higher than the Sustainable Development Goal target of 3% of the transferred amount. Reduction in transaction costs directly enhances net remittance receipts to households and to the economy. Third, the BMET must proceed to extend overseas employment programme to diversify destination markets beyond the GCC, which is highly susceptible to oil price fluctuations and geopolitically instigated migration policy shifts.

Reserve management and External vulnerability.

The most worrisome macroeconomic development developed in the dataset is the reserve depletion episode of 20222023. The loss of about USD 25 billion of reserves in less than two years - out of a peak of USD 48.1 billion to USD 23.4 billion - has caused the import coverage in Bangladesh to be reduced to around three months of reserve out of approximately nine months of reserve in the peak. The Bangladesh Bank must prioritize the reserve rebuilding by a combination of measures; (i) reducing the foreign exchange market intervention and allow greater earnings by the exchange rate to discourage speculative demand of dollars; (ii) accessing multilateral concessional financing by the IMF, World Bank and Asian Development Bank to supplement the reserves; (iii) implementing demand-management policies to compress the import bill especially the luxury and non-essential items; and (iv) diversifying export earnings beyond the garment sector to pharmaceuticals, information communication technology services, and processed foods.

Inflation Management

The 20222023 inflationary spike presents a serious challenge to the monetary policy framework of Bangladesh Bank that has historically operated off an implicit 6% inflation target. The correlation analysis confirms that exchange rate depreciation is the dominant channel of transmission of inflation in Bangladesh with correlation coefficient of 0.791 (PtP) and 0.844 (12M average) between the exchange rate and consumer prices. This means that the most direct lever that can be used to contain inflation is through exchange rate stabilisation. Simultaneously, the efficacy of the transmission of interest rates is restricted by the impossibility of dealing with the problem of supply-side cost-push inflation only with the help of monetary tightening. An integrated strategy, including moderate monetary tightening and exchange rate stabilisation, rationalisation of target subsidies, and supply-side interventions to enhance domestic food and energy availability, is probably the most effective.

Industrial Production and Structural Change

The IPI data can confirm that the industrial base of Bangladesh has been significantly and steadily expanding over the sample period, and has shown remarkable resilience to external shocks such as the COVID-19 pandemic. To continue this trend will require further investment in energy infrastructure (to mitigate the power shortage that constrains the utilisation of industrial capacity), upgrading of skills and vocational training programmes (to help reduce the cost and time of trade), and improvement of logistics and port infrastructure (to help reduce the cost and time of trade). The positive relationship of the IPI with remittances ($r = 0.662$) is indicative of a potentially virtuous cycle: stronger industrial production generates higher incomes, helps government finances overseas employment programmes, and ultimately strengthens the remittance pipeline - all of which can be reinforcing should it be managed proactively.

VII. Conclusion

This paper has given a detailed empirical study of five main macroeconomic variables in Bangladesh - remittance inflows, industrial production, foreign exchange reserves, consumer price inflation, and the BDT/USD exchange rate using monthly data between January 2015 and July 2023. In the analysis, two macroeconomic regimes of structural distinctiveness have been documented: the relative stability of 2015-2019 and the turbulent period of 2020-2023 characterised by the COVID-19 shock, a historic remittance surge, reserve accumulation and a rapid depletion, currency depreciation and a large episode of inflation.

The most important empirical results can be summarised as follows. In July 2020, inflows of remittances through the formal-channel reached an all-time high of USD 2,598 million monthly and a record annual high of USD 22.1 billion in 2020 and 2021 respectively, exhibiting the countercyclical and incentive-responsive nature of formal-channel remittances during the pandemic. Although faced with external shocks, the IPI more than doubled over the sample period, growing at an average annual rate of about 11.5, which attests to the structural industrialisation of Bangladesh despite external shocks. The foreign exchange reserves followed a dramatic pattern- it had reached USD 48.1 billion in mid-2021 and then dropped to USD 23.4 billion in July 2023, reflecting the combined effect of import surge, debt service and foreign exchange intervention. Inflation was kept within a 5-6.5 percent range until 2021, when it soared to a peak of 9.94 percent due to the exchange rate being depreciated and global commodity price shock transmitted through an open economy with high dependence on imports. The policy-relevant relationship that emerged as the strongest in the correlation analysis is the exchange rate correlation with the inflation.

The policy implications are obvious: Bangladesh must rebuild its foreign exchange reserves, allow a greater degree of exchange rate flexibility in order to support external adjustment, maintain its formal remittance incentive framework, and pursue a coordinated fiscal-monetary policy to bring inflation back within the 5-6% comfort zone. The high industrial production curve would offer a good background of increasing the medium-term growth, though it would need continuous investment in the energy, logistics, and human capital.

The next study should use formal time-series econometric techniques - such as ARDL bounds testing, VAR impulse response analysis, and structural break detection - to determine the causal relationships among these variables and quantify the magnitudes of key transmission channels. The current data presents a perfect base on which such analysis can be done.

References

- [1]. Aggarwal, R., Demirgüç-Kunt, A., & Martinez Peria, M. S. (2011). Do Remittances Promote Financial Development? *Journal Of Development Economics*, 96(2), 255–264. <https://doi.org/10.1016/j.jdevco.2010.10.005>
- [2]. Ahmed, F., Saifullah, M., & Hossain, M. (2021). Structural Transformation And Industrial Policy In Bangladesh: Evidence From Manufacturing Census Data. *Bangladesh Development Studies*, 44(1), 1–28.
- [3]. Barajas, A., Chami, R., Fullenkamp, C., Gapen, M., & Montiel, P. (2009). Do Workers' Remittances Promote Economic Growth? (IMF Working Paper WP/09/153). International Monetary Fund.
- [4]. Bangladesh Bank. (Various Years). Monthly Economic Trends. Bangladesh Bank. <https://www.bb.org.bd>
- [5]. Chami, R., Fullenkamp, C., & Jahjah, S. (2005). Are Immigrant Remittance Flows A Source Of Capital For Development? IMF Staff Papers, 52(1), 55–81.
- [6]. Elahi, S. M., & Rahman, M. H. (2021). Remittance And Inflation Nexus In Bangladesh: Application Of Dynamic ARDL Model With Linear Trend. *Indonesian Journal Of Business And Economics*, 4(2), 114–130.
- [7]. Hossain, A. A. (2014). Monetary Policy, Inflation, And Inflation Volatility In Bangladesh. *Journal Of Asian Economics*, 35, 66–87. <https://doi.org/10.1016/j.asieco.2014.09.004>
- [8]. Islam, M. S., Ahmed, M., & Salim, M. (2023). Inflation Dynamics In Bangladesh: Monetary Or Non-Monetary Phenomenon? *Journal Of South Asian Development*, 18(1), 45–72.
- [9]. Kumar, R. R., & Stauvermann, P. J. (2014). Exploring The Nexus Between Remittances And Economic Growth: A Study Of Bangladesh. *International Review Of Economics*, 61, 399–415. <https://doi.org/10.1007/S12232-014-0201-1>
- [10]. Ministry Of Economic Transition. (2023). Monthly Macroeconomic Data Digest. Government Of Bangladesh.
- [11]. Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches To The Analysis Of Level Relationships. *Journal Of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>
- [12]. World Bank. (2023). Bangladesh Economic Update: Navigating An Uncertain Environment. World Bank Group. <https://www.worldbank.org>
- [13]. World Bank. (2024). World Development Indicators. World Bank Group. <https://databank.worldbank.org/source/world-development-indicators>