Monetary Policy Review

December, 2020

Bangladesh Bank

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Chief Economist's Unit
Bangladesh Bank
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The views expressed in this Review are based on professional analysis carried out by the staff of Bangladesh Bank and do not necessarily reflect the official policy view of Bangladesh Bank.

Message

The Chief Economist's Unit (CEU) of Bangladesh Bank (BB) is mandated to spearhead research on macroeconomic and financial sector issues including monetary, fiscal and financial sector policies. The CEU publishes two flagship periodicals; the yearly Monetary Policy Review (MPR), and the Bangladesh Bank Quarterly (BBQ) in addition to policy notes, policy papers, and working papers on topical economic policy issues. The objective of CEU research is to provide sound analytical input to BB senior management about policy options on various monetary, financial and macroeconomic issues.

The MPR, December 2020, reviews BB's monetary policy stance announced for FY21 and provides a macroeconomic and monetary policy outlook for the near and medium term. This volume also includes four research papers: (1) Inflation trend and persistence in Bangladesh: an empirical analysis, (2) Foreign exchange market structure and exchange rate volatility in Bangladesh, (3) Estimating the neutral interest rate for Bangladesh, and (4) Movements of residential prices in Bangladesh: an empirical analysis. All the research papers are pertinent to understanding monetary transmission mechanism in Bangladesh.

The current volume is published during a period of unprecedented economic slowdown across the globe caused by the COVID-19 pandemic and hence, in an effort to support informed decisions by economic agents and policymakers, it aptly attempts to portray the macroeconomic risks and challenges posed by the pandemic. I hope, the monetary policy review and the accompanied analyses provided in the articles will be useful to researchers as well as policymakers.

Fazle Kabir
Governor

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List of Abbreviations

ADB	Asian Development Bank
ADP	Annual Development Program
ADR	Advance Deposit Ratio
BB	Bangladesh Bank
BDT	Bangladeshi Taka
BOP	Balance of Payment
BSEC	Bangladesh Securities and Exchange Commission
CAB	Current Account Balance
CI	Confidence Interval
CMSME	Cottage, Micro, Small and Medium Enterprise
COVID	Corona Virus Disease
CPI	Consumer Price Index
CRR	Cash Reserve Ratio
CRR	Cash Reserve Requirement
DMBs	Deposit Money Banks
DSE	Dhaka Stock Exchange
DSEX	DSE Broad Index
EDF	Export Development Fund
FA	Financial Account
FDI	Foreign Direct Investment
FIs	Financial Institutions
FX	Foreign Exchange
FY	Fiscal Year
GDP	Gross Domestic Products
ICB	Investment Corporation of Bangladesh
IDR	Investment Deposit Ratio
IMF	International Monetary Fund
IPO	Initial Public Offering
MCFIs	Micro Credit Financing Institutions
MFS	Mobile Financial Services
MPS	Monetary Policy Statement
NBDCs	Non-bank Depository Corporations
NBFIs	Non-bank Financial Institutions
NDA	Net Domestic Assets
NEER	Nominal Effective Exchange Rate
NFA	Net Foreign Asset
NSCs	National Savings Certificates
REER	Real Effective Exchange Rate
RM	Reserve Money
SLR	Statutory Liquidity Ratio
TDTL	Total Demand and Time Liabilities
USD	United States Dollar
WEO	World Economic Outlook
y/y	Year on Year

Chapter 1

Macroeconomic Outlook and Monetary Policy Stance FY21

The Bangladesh Bank (BB) announced its expansionary monetary policy stance for the fiscal year 2020-21, accommodating growth supportive needs while attaining the targeted inflation[1]. While the monetary policy stance is essentially aligned with the growth paths of Bangladesh economy, considering the effect of ongoing global COVID-19 pandemic challenges, the following discussion illustrates the macroeconomic and monetary development of Bangladesh from both global and domestic contexts. Besides, this chapter analyzes BB's current monetary policy stance along with a near and medium macroeconomic outlook.

Like elsewhere in the world, the Bangladesh economy was also badly affected by the pandemic but managed to grow by 5.2 percent during the fiscal year 2019-2020 (FY20), reflecting its robustness as compared to some South Asian peer countries such as India, Pakistan, and Sri Lanka. Though facing pandemic induced challenges, Bangladesh will come back to its economic growth path in FY21, expecting continued huge remittance inflows and recovery in private sector credit growth. To achieve the targeted growth path, the BB is expected to continue its policy supports, while the government of Bangladesh has been providing necessary impetuses through stimulus packages for pandemic-hit economic sectors. By the grace of policy relaxation along with the low cost refinance schemes, the BB is expected to reach the annual target of broad money growth by end of June 2021, maintaining consistency with the recovery of economic growth and containment of inflation in the coming months of FY21.

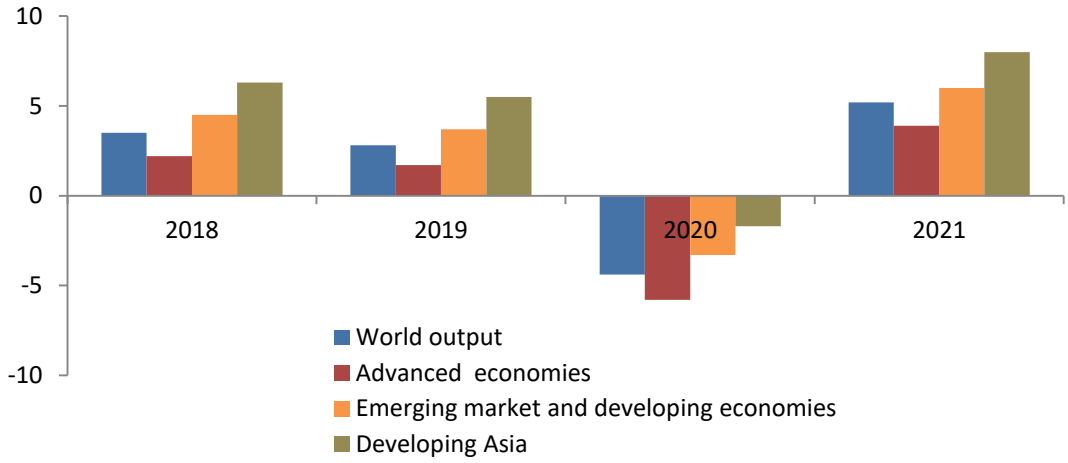
I. Global Economic Outlook

I.1 Economic growth

The IMF in its latest World Economic Outlook published on 15 October 2020 predicted that the global economic growth will experience a 4.4 percent contraction in 2020 with the COVID-19 pandemic continuing to spread. However, the revised growth projection in 2020 is better (+0.8 percentage point) than its June estimates, reflecting better-than-anticipated second-quarter GDP outturns, as many countries, mostly in advanced economies, reopened the activity tentatively sooner than expected after lockdowns were scaled back. Overall, the growth rates in advanced economies, and emerging and developing economies are set to decline by 4.4 and 3.3 percent in 2020, respectively (Chart 1).

[1] Bangladesh Bank (2020*). Monetary policy statement: Fiscal year 2020-2021*. BB: Dhaka.

Chart 1: Output growth of global and selected regional economies (in percent)



Source: World Economic Outlook, October 2020, IMF.

Looking forward, the global growth rate is projected at 5.2 percent in 2021, revised to a little downward (-0.2 percentage point), reflecting a consistency with a more moderate downturn in 2020 and expectations of persistent social distancing (Chart 1). While expecting low-interest rates over a longer period, the projected rebound in growth in 2021 can reduce debt service burdens in many countries. However, both advanced and emerging market and developing economies are likely to face significant losses of output relative to their pre-pandemic projections, reflecting wide negative output gaps and elevated unemployment rates in 2021 across the countries.

Chart 2 shows that growth in the United States is projected to contract at 4.3 percent in 2020, but less severely than forecasted earlier, with government transfers supporting household incomes. A swift recovery in China to positive growth by 1.9 percent in 2020 impacted mainly by boosting their activity through public investment has also surprised on the upward revision of global GDP in the current year. According to the IMF, among the selected South Asian countries as shown in Chart 3, only Bangladesh will maintain a positive growth rate at 3.8 percent in 2020, while the drop of the growth rate was particularly sharp in India (-10.3 percent), given the continued rise of their new infections of virus and extended lockdown.

Chart 2: Economic growth of peer countries: Advanced economies(in percent)

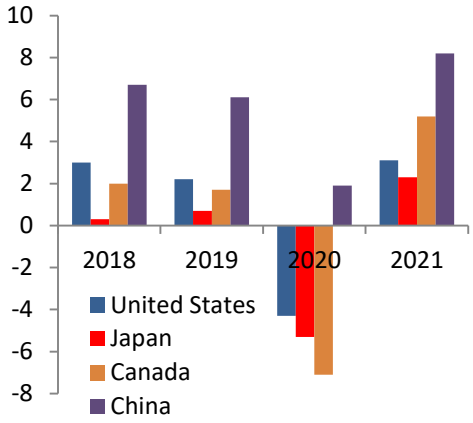
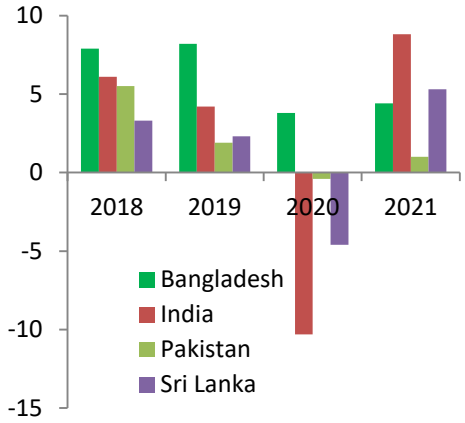


Chart 3: Economic growth of peer countries: South Asia(in percent)

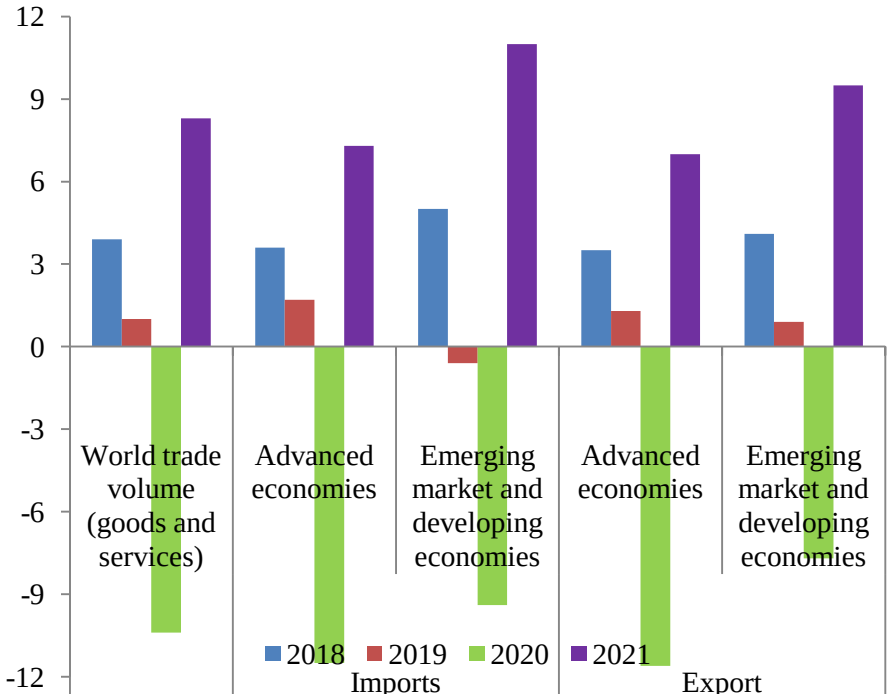


Source: World Economic Outlook, October 2020, IMF.

I.2 Global trade

World trade has seen a larger contraction and is projected to decline by 10.4 percent in 2020, reflecting a particularly sharp fall in activities of contact-intensive sectors with much smaller trade intensity than manufacturing. Global trade began recovering in June and is projected to pick up at 8.3 percent in 2021, consistent with the projected recovery in global activity (Chart 4).

Chart 4: Global trade and imports and exports (in percent)



Source: World Economic Outlook, October 2020, IMF.

I.3 Commodity price

Oil price is projected to decline by 32.1 percent in 2020 reflecting the pandemic led collapse in global oil demand and concerns about storage capacity (Chart 5). The IMF in its WEO assumes that the price of oil would be slightly increased from USD 41.69 a barrel in 2020 to USD 46.70 a barrel (+12.0 percent) in 2021. Nonfuel commodity prices are expected to rise faster than previous projections.

Chart 5: Global commodity prices, in percent (year on year)

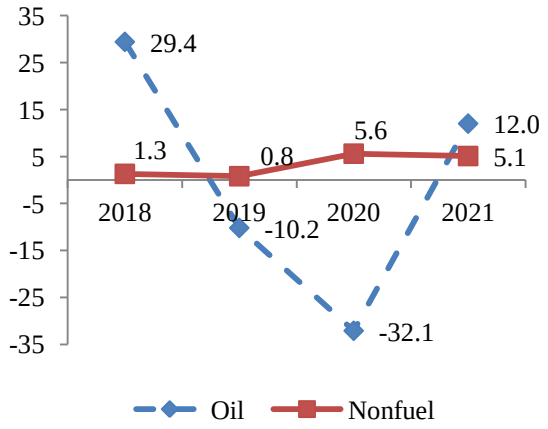
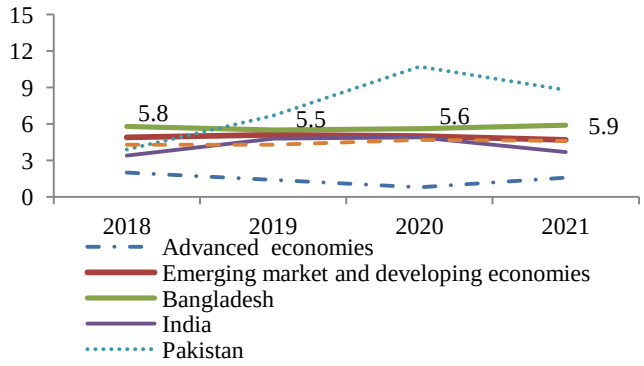


Chart 6: Consumer prices: global and emerging markets and selected peer countries of South Asia (in percent)



Source: World Economic Outlook, October 2020, IMF.

I.4 Inflation

Inflation is expected to remain low in 2020 and 2021 for both advanced and emerging market economies compared with historical averages (Chart 6). Central banks' proactive actions for more credible monetary policy frameworks and communications with market participants intended to support market functioning, consistent with price stability mandates are possible reasons for subdued inflation. Among the selected South Asian countries as shown in Chart 6, the IMF estimates that Bangladesh, India and Sri Lanka will maintain inflation rates below 6.0 percent during 2020 and 2021. So far, declining in aggregate demand, together with the effects of lower fuel price, seems to offset the cost-push pressure from supply disruptions.

I.5 Policy rate

Federal Reserve of US and Bank of England cut their policy interest rates in March 2020, while Euro and Japan continued to maintain near or at zero interest rates over the years, reflecting considerably lower policy rates in more than 10 years after the global financial crisis (Chart 7). Given that policy rates are already very low in many advanced economies, policymakers needed to rely on unconventional monetary policy tools to stimulate the economy, countering the future downturn. Enhancing macroprudential policies with effective implementation could

help deal with ongoing financial sector vulnerabilities because of pandemic related adversities. Ten-year government bond yields of selected advanced economies have a declining trend since December 2018, reflecting a combination of lower return on safe assets and compression of risk premium (Chart 8).

Chart 7. Central bank's policy rate of selected advanced economies

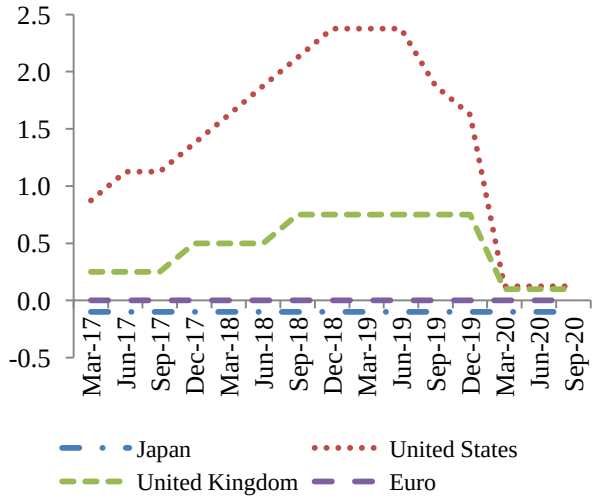
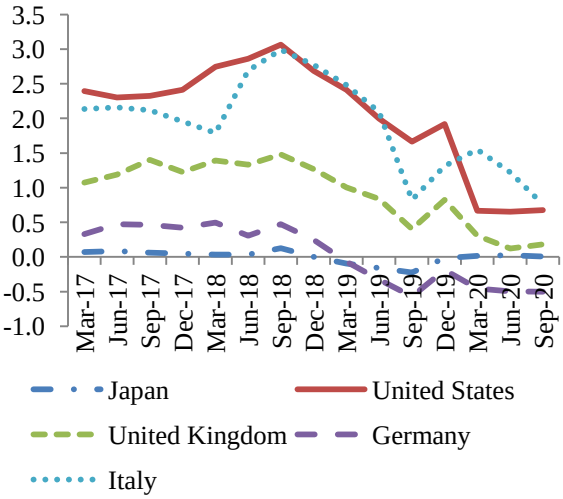


Chart 8. 10-year government bond yields of selected advanced economies



Source: World Economic Outlook, October 2020, IMF.

I.6 Risk and outlook

IMF forecasts remain highly uncertain, with significant downside risks which will continue to come from COVID-19, trade policy and geopolitical uncertainty, among others. Economic recovery might be uneven, as the second wave of the virus began in many countries including euro areas, with renewed social distancing and tighter lockdowns.

Rising public and private debt provide a sizable fiscal risk. IMF's Fiscal Monitor published in October 2020 estimates that global general government debt will jump up to almost 100 percent of GDP in 2020[2]. According to the IMF's Global Financial Stability Report[3] of October 2020, vulnerabilities are rising both in the nonfinancial corporate sector and sovereign sector. In the non-financial corporate sector, firms have taken on more debt to cope with cash shortages, while, in the sovereign sector, fiscal deficits have widened to support the economy. However, the Fiscal Monitor report recommends that the government's financial support should persist, at least into 2021, to sustain the recovery and to limit long-term scarring. Fiscally constrained economies need to assess the benefits, costs, and risks of support measures, prioritizing the protection of the most vulnerable and eliminating wasteful spending.

[2] International Monetary Fund (2020). Fiscal Monitor: Policies for the Recover, Washington: IMF, p. ix.
[3] International Monetary Fund (2020). Global Financial Stability Report: Bridge to Recovery, Washington: IMF, p. xi.

II. Domestic Economic Outlook

II.1 Economic activity and growth outlook

Bangladesh economy faced COVID-19 pandemic-induced challenges in all economic sectors, but managed a 5.24 percent real GDP growth rate in FY20, though significantly lower than a record high of 8.15 percent growth rate in FY19. The economy of Bangladesh witnessed an impressive GDP growth trend in last decade, maintaining more than 7.0 percent yearly growth during FY16-FY19, breaking the phase of yearly 7.0 percent growth mark in FY16.

The contraction in GDP for FY20 stemmed mostly from the supply-side shocks, suffered mainly by pandemic-induced disturbances in the industry sector, particularly by substantial production loss in large and medium scale manufacturing output. While the industry sector had been contributing to GDP with double-digit growth rates since FY16, the growth rate in this sector sharply came down to 6.48 percent in FY20. The industry sector decelerated to low but positive growth rates during the first three quarters of FY20, while the growth of the industry sector fell to a negative territory reflected in the growth of Quantum Index of Industrial Production (-14.98 percent) during Q4FY20.

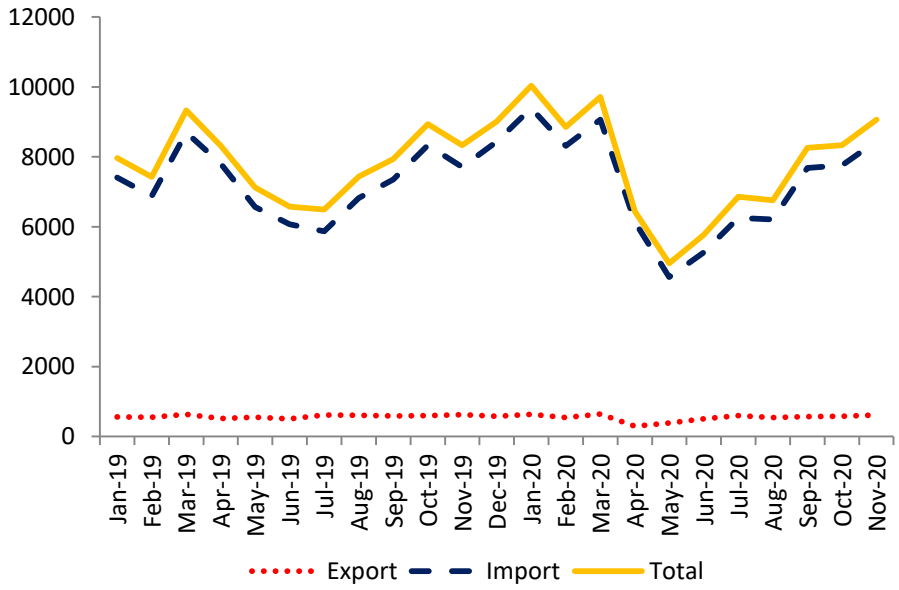
The service sector, which also impacted by the pandemic but less severe than the industry sector, grew by 5.32 percent in FY20 against 6.78 percent in FY19 as most of the leading sub-sector activities such as wholesale and retail trade activities, transport, storage and communication, financial intermediations, education, real estate, renting and business activities waned due to lockdown measures. On the other hand, the agriculture sector maintained solid growth even amid the COVID period on the back of the healthy production of most of the cereal and non-cereal crops aided by the timely availability of inputs, favorable weather conditions at the time of cultivation and harvesting.

In the backdrop of the COVID-19 pandemic, the government of Bangladesh and BB took a series of timely and appropriate initiatives such as stimulus packages of more than BDT 1.21 trillion, policy relaxations, low cost refinance schemes, etc., among others, to support weaker segments of the economy and to ensure sufficient liquidity in the banking system. Aided by those prompt policy initiatives, the economic recovery of Bangladesh remained at the forefront among the neighboring South Asian economies and attained a 5.2 percent growth rate in FY20 while growth rates of India, Pakistan, and Sri-Lanka are expected to be negative in 2020.

Industry and service sector activities are recovering aided by government and BB's continued supportive policy measures to boost the sectoral performances. The industry sector has staged a magnificent turnaround from the pandemic deadlock with faster-than-expected growth of Quantum Index of Industrial Production (QIIP) at 7.94 percent in Q1FY21. Mostly manufacturing sector led by wearing apparel, textile, pharmaceuticals, non-metallic mineral product, leather and related products and chemical production spurred the QIIP. Besides, service sector related activities also climbed out from their pandemic depths. Cargo handled through Chattogram port started increasing sharply after May 2020 and came back to the pre-pandemic level in November 2020 (Chart 9). Private

sector credit growth in trade and commerce and consumer finance increased significantly during the first quarter of FY21.

Chart 9: Cargo handled by Chattogram port (in thousand metric tons)



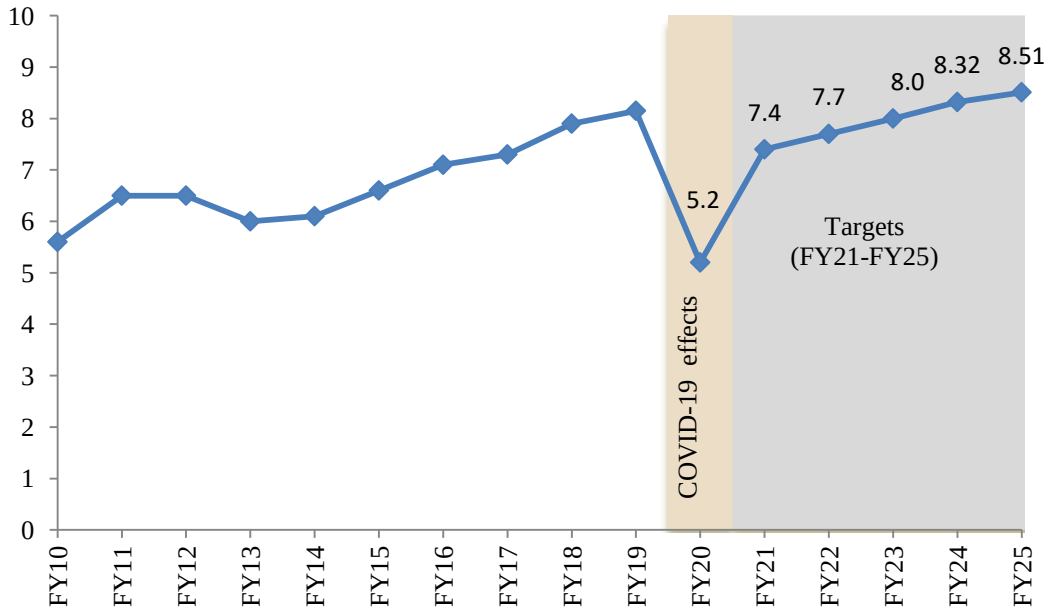
Source: Chattogram Port Authority.

The expected progress in the implementation of all supportive policy initiatives helped domestic demand to maintain at 5.05 percent growth in FY20 of which four-fifth of the demand was contributed by private investment and consumption. Domestic demand revived further as supported by more than 37.6 percent growth in inflows of workers' remittances during July – December 2020. Though the growth rate of import demand remained in negative territory (-8.84 percent during July – November 2020 and -5.24 percent during July – November 2019), external demand gained momentum with acceleration in export growth nearing 1.0 percent during July – November 2020 compared to a negative 8.22 percent growth at the same period of last year.

Looking forward, the government has set a 7.4 percent real GDP growth target for FY21 weighing on the rebound in the economic situation aided by continued policy initiatives such as stimulus packages, low cost refinance schemes, and policy relaxations, among others. Bangladesh economy has recovered faster reflected in sector-wise performance for the first quarter of FY21 amid a dreadful situation as the pandemic continues. The growth targets[4] indicate that growth will recover at a faster pace in FY21 and will increase gradually (Chart 10). The economy is likely to maintain the targeted growth path with an expectation that a second wave of the pandemic would not harm the economy seriously. Besides, an advanced stage of vaccine development would have a positive impact on the global as well as domestic economy.

[4] Eighth Five-Year Plan, Ministry of Planning, Bangladesh.

Chart 10: Real GDP growth rates and targets (in percent)



Source: Bangladesh Bureau of Statistics; Eighth Five-Year Plan, Ministry of Planning.

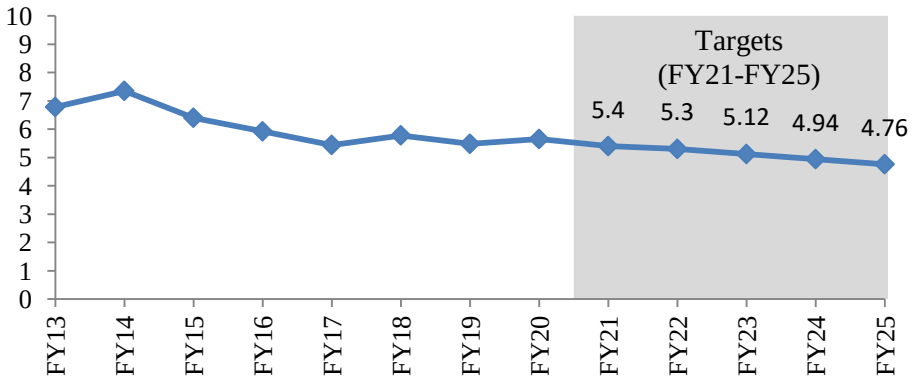
II.2 Inflation trend and outlook

Headline CPI inflation (point to point) remained broadly stable over the last three years hovering around 5.60 percent on average till March 2020, while it crossed the 6.0 percent level in November 2019 when the outbreak of coronavirus came to light. Later on CPI inflation became some sort of unstable after the detection of the first COVID patient in Bangladesh in March 2020 and gradually increased to 6.44 percent in October 2020, but then started to decrease to 5.52 percent in November 2020 which came down further to 5.29 percent in December 2020. The recent increase in inflation until October 2020 was mainly driven by an increase in food inflation. Despite the bumper crop production in the last two quarters of FY20, both cereal and non-cereal food items especially rice and pulses prices remained elevated in recent months because of some non-cereal crop loss and supply chain disruptions due to recent monsoon floods and COVID-19 related lockdowns. On the other hand, non-food inflation remained low during the coronavirus pandemic due mainly to subdued domestic demand. Twelve-month average CPI inflation continued its upward trajectory during July - October 2020 and later decreased in November and December 2020, reflecting a noticeable fall in food inflation. Average food inflation, which remained on the rising trend during May - October 2020, declined in November and December 2020.

According to the MPS for FY21, a moderate and tolerable single-digit average CPI inflation was projected. The slow recovery in the international commodity and energy prices signaled the enervated inflationary pressure from external sources. Besides, food inflation is expected to decline in the coming months with increased domestic production of crop and non-crop agriculture, which was reflected already in softened headline inflation in

November and December 2020 driven by decreased food inflation. However, the recent increasing trend in food inflation related to supply-side disruption may cause some upside risks to the headline inflation. Besides, BB's policy relaxations and low-cost refinancing lines of credit along with the government's stimulus packages injected huge liquidity in the economy might also add some risks to increase the headline inflation in near future. The BB will remain watchful at any such developments and will act accordingly to take the required policy action. Prudent macroeconomic and monetary management would need to be continued to ensure that the headline inflation rate is contained in line with the targeted path (Chart 11).

Chart 11: Headline CPI inflation (12-month average) and targets



Source: Bangladesh Bureau of Statistics; 8th Five Year Plan (Revised second draft part 1, October 30, 2020), Bangladesh Planning Commission, Ministry of Planning.

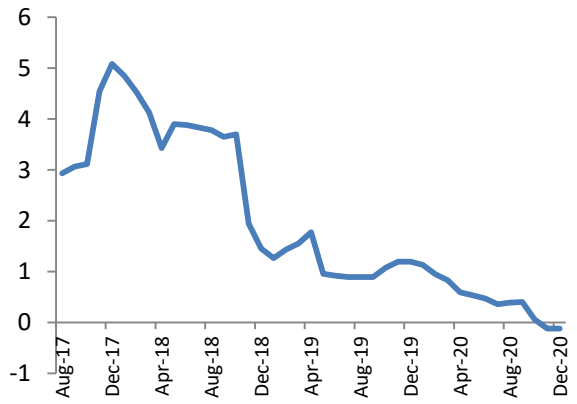
II.3 External Sector Development and Outlook of Exchange Rate

II.3.1 Exchange rate

The nominal exchange rate of BDT/USD remained mostly stable with a moderate depreciating trend (Chart 12). Year on year, the exchange rate depreciated moderately from 0.47 percent in June 2020 compared to 0.92 percent in June 2019. The depreciation rate, which showed a declining trend since October 2017, decreased gradually to 0.06 percent at the end of October 2020, but then experienced a little bit of appreciation (0.12 percent) both in November and December 2020. However, the nominal exchange rates of some peer countries such as India, Pakistan, Indonesia, and Sri Lanka except the Philippines experienced more depreciation than that of Bangladesh, indicating that the nominal exchange rate of BDT/USD remained broadly stable during FY20 and until November 2020[5] (Chart 13).

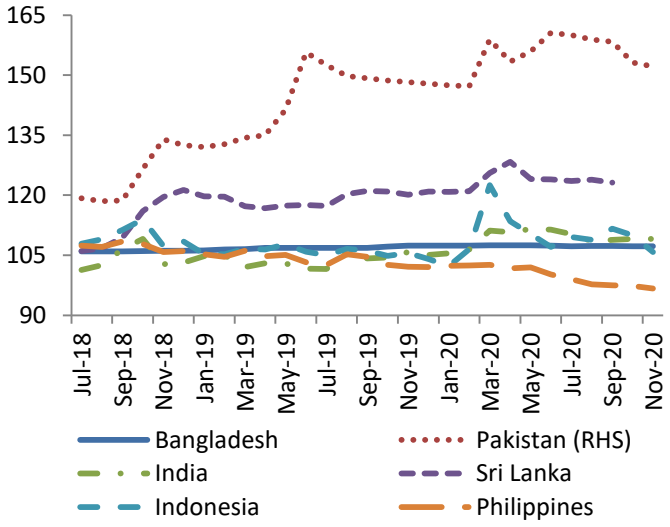
[5] In the case of Sri Lanka, exchange rate data for October and November 2020 are not available.

Chart 12: Trend in depreciation/ appreciation of the BDT/USD exchange rates (in percent)



Source: Bangladesh Bank.

Chart 13: Cross-country nominal exchange rate indices (base: January 2017=100)



Source: International Financial Statistics, IMF.

The recent updates on the NEER and REER until October 2020 indices reflected some degrees of appreciation due mainly to higher price differentials with the major trading partner countries. However, both the NEER and REER indices witnessed depreciation in November 2020. BB continuously intervened in the foreign exchange market by purchasing and selling USD to stabilize and to keep the exchange rate competitive. In FY20, BB intervened in the market by net buying of 42 million USD, while, in FY19, BB was a net seller of 2339 million USD. On the other hand, BB bought USD 5291 million (net) during the first half of FY21, injecting an equivalent amount of BDT 448677 in the system (Table 3).

Table 3: Foreign exchange market intervention by BB

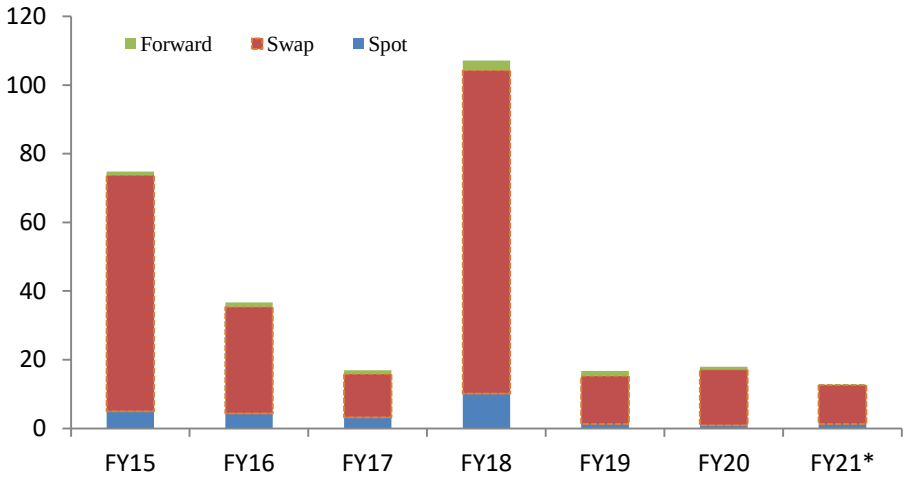
Year	Buy (million USD)	Sale (million USD)	Net Buy (million USD)	Net Buy@ (in million BDT)
FY 11	316.5	1279	-963	-71369
FY 12	157	776	-619	-50647
FY 13	4539	0	4539	+352998
FY 14	5150	0	5150	+399795
FY 15	3758.5	357	3402	+264667
FY 16	4131	0	4131	+323870
FY 17	1931	175	1756	+141534
FY 18	0	2311	-2311	-193500
FY19	0	2339	-2339	-197646
FY20	877	835	42	+3566
H1FY21	5791	200	5289	+448677

Source: Bangladesh Bank.
Note:
@ (-) refers to the shrinking of liquidity and (+) indicates increased liquidity.

II.3.2 Foreign exchange market

The foreign exchange market of Bangladesh remained dominated by SWAP transactions which contributed almost 90 percent of total turnover, while spot and forward transactions remained insignificant. Since swap transaction involves a simultaneous purchase and sale of one currency for another currency with two different value dates, it is widely used by market participants in Bangladesh to reduce exchange rate risk. Total turnover increased by 7.44 percent in FY20 (Chart 13).

Chart 13: Total turnover by instruments (in billion USD)



*= Up to September 2020.
Source: Bangladesh Bank.

II.3.3 Balance of payments (BOP)

The current account balance recorded deficit persisted for the last 4 years because of the higher import payments compared to exports receipts. However, CAB witnessed a significant surplus of USD 4.1 billion during July - November 2020. The positive export growth along with negative import growth contributed mostly to the surplus of CAB. During the first five months of FY21 (July - November), the total export earnings of Bangladesh (USD 15.5 billion) posted a positive growth (y/y) of around 0.86 percent compared to a negative 8.84 percent growth in the same period of FY20. During this period, however, Bangladesh's leading export item, readymade garments, registered a 1.5 percent decline on account of slow export demand due to the global second wave of COVID-19 pandemic. Besides, strong growth in remittances inflows (37.6 percent during July - December 2020) played a

positive role in the surpluses in CAB. During FY20, the CA deficit had decreased by almost 5 percent compared to that of FY19 due to a significant fall in import payments and an increase in remittance inflows amidst the outbreak of COVID-19. The financial account (FA) witnessed a surplus of USD 949 million during July - November 2020. The last two consecutive years had also experienced a notable surplus of FA: USD 5907 million in FY19 and USD 7658 million in FY20. The surplus of financial account resulted from a significant amount of FDI (gross inflows and other investments (net). However, the surpluses in CAB and FA resulted in an overall BOP surplus of USD 5.0 billion during July - November 2020. In fact, except for FY18, BOP was in surplus for the last several years due mainly to high financial inflows including strong inflows of FDI.

II.3.4 Remittance

In the first half of FY21, the inward remittances witnessed a phenomenal growth of 37.6 percent as compared to the same period of FY20, mainly driven by recent policy initiatives of 2 percent cash incentives on inward remittance and relaxation of conditions for incentives including an extension of document submission time to 2 months instead of 15 days. The inflow of remittance in FY20 had also increased by 10.87 percent over the FY19. Strong growth in remittance inflows and positive export growth together with large financial assistance from multinational international institutions and development partners helped to reach a record foreign exchange reserve of USD 41.08 billion at the end of November 2020 which can approximately meet more than 8 months of import coverage.

II.3.5 Outlook of the external sector

As global economies are opening up, export in ready-made garments and remittance inflows are likely to bounce back in the near term as expatriate workers are started to join their works, reflecting employment generation in the economy. Moreover, FDI inflows are expected to grow by resuming the different development projects including continued collaboration with partner countries for investing in Bangladesh's transportation, energy and electricity, telecommunications, and other fields. The government's stimulus packages along with the restoration of business confidence may boost up public and private investment. Following the strong growth in export and remittances, foreign exchange reserves are expected to continue its uptrend.

II.4 Monetary Aggregates and Monetary Policy Stance

The real GDP growth which kept momentum during the first 9 months of FY20, but disrupted thereafter because of the COVID-19 pandemic, necessitated the adjustment in the monetary program announced for FY21. This section reviews the development of key monetary aggregates against the programs as shown in Table 4 under the

circumstances where the government and BB continued their efforts with appropriate policy directions to combat the COVID-19 related economic challenges.

Table 4: Monetary program and progress (year on year growth in percent)

	Actual				Program	
	Jun-19	Dec-19	Jun-20	Nov-20	Dec-20	Jun-21
Net foreign assets	2.92	3.56	9.15	27.75	12.48	5.80
Net domestic assets	12.06	14.56	13.64	10.29	14.41	18.34
Domestic credit	12.26	14.83	14.20	10.56	15.02	19.31
Credit to the public sector	19.75	54.28	53.97	24.06	35.74	44.40
Credit to the private sector	11.32	9.83	8.61	8.21	11.50	14.80
Broad money	9.88	12.04	12.64	13.99	14.00	15.60
Reserve money	5.33	6.93	15.56	20.68	15.50	13.50

Sources: Monetary Policy Statement (Fiscal Year 2020-21); Statistics Department, Bangladesh Bank.

II.4.1 Development of broad money (M2)

The recent data show that the growth rate of broad money (M2) was in line with the December 2020 projection. M2 grew by 13.99 percent (y/y) at the end of November 2020 against the target of 14.00 percent till December 2020, mainly impacted by net foreign assets (NFA) with 27.75 percent growth in November 2020 which was much higher than the target of 12.48 percent for December 2020. The rise of NFA reflected a strong surge of inflows of remittance by 41.19 percent and foreign loans by 28.24 percent during the first five months of FY21. NFA's growth was projected low at 5.80 percent for June 2021. However, the NFA's growth might exceed the target by end of FY21, as exports of the ready-made garments and inflows of workers' remittances are likely to bounce back in the near term provided that adverse effects of the second wave of COVID-19 on western economies would not be serious. Overall, the growth rate of M2 is still below the annual target of 15.60 percent but is expected to reach the target by end of June 2021, with the policy measures taken by the BB and government for increasing domestic credit in the economy (Table 4 and Chart 14).

Chart 14: Trend in broad money (M2) growth (in percent) - program vs. actual

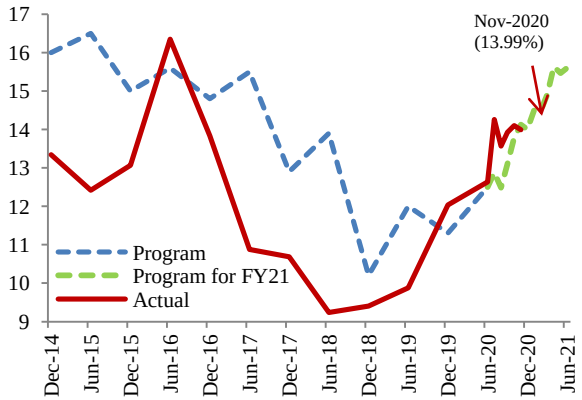
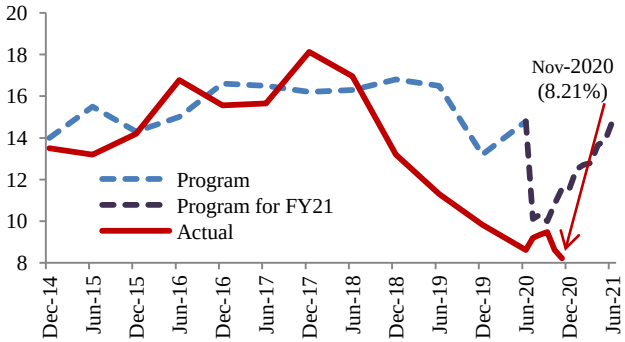


Chart 15: Trend in the growth of credit to the private sector (in percent) - program vs. actual



Sources: Monetary Policy Statement (Fiscal Year 2020-21); Statistics Department, Bangladesh Bank.

The growth rate of net domestic assets (NDA) was 10.29 percent in November 2020, against the targets of 14.41 percent in December 2020 and 18.34 percent in June 2021, reflecting lower than expected credit growth to the private sector during the first five months of FY21. Credit to the public sector including government borrowing from the banking system increased by 24.06 percent in November 2020 which was lower than the growth rates of December 2019 and June 2020 as well as the programmed growth rates of December 2020 and June 2021. Since there were large inflows of foreign loans and aids and a significant rise in net sales of national saving certificates during the first five months of FY21, demand for credit to the public sector was lower during that period. On the other hand, credit to the private sector had started picking up, registering 9.48 percent growth in September 2020, favored by the implementation of the government's stimulus packages as well as BB's reduction of policy rates aiming at faster recovery towards pre-COVID economic growth rate. However, the growth rate of credit to the private sector decreased to 8.21 in November 2020 which is still lower than the projections for December 2020 and June 2021 (Table 4 and Chart 15).

II.4.2 Development of reserve money

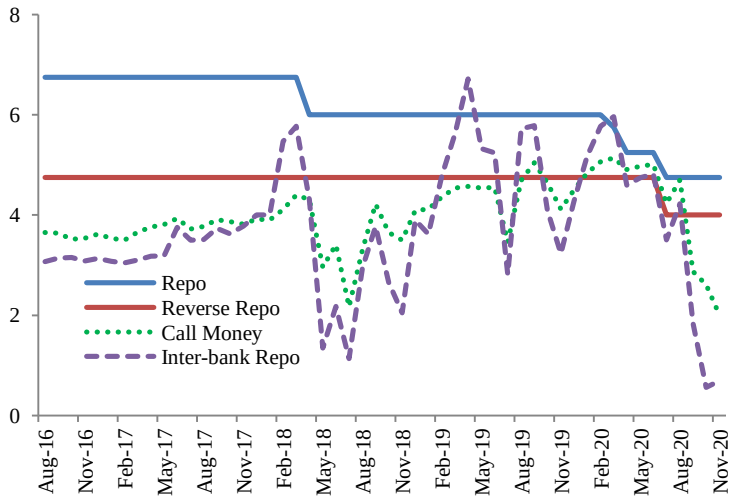
The growth rate of reserve money (RM) was 20.68 percent in November 2020, significantly higher than the target of 15.50 percent growth projected for December 2020 as well as 13.50 percent for June 2021. The growth rate of reserve money was higher mainly due to the robust growth in net foreign assets of BB resulted from huge purchases of foreign exchanges and net claims of BB on deposit money banks (DMBs) relating to the implementation of government stimulus packages.

II.4.3 Development of policy rates and interest rates

While sufficient liquidity in the banking system to be aligned with the government's effort of implementing stimulus packages to revive the economy from the COVID-19 fallout is critical, the BB cut its cash reserve ratio (CRR) by 150 basis points from 5.50 to 4.00 percent in two steps during March – April 2020. Moreover, BB reduced the bank rate from 5.00 to 4.00 percent in July 2020, which had been remained unchanged at 5.00 percent since 2003, rationalizing it with the current interest rate regime.

The BB also slashed its repo from 6.00 to 4.75 percent in three steps during March - July 2020, aiming at easy access for the banks to lend more credit to the priority sectors during the pandemic period (Chart 16). Consequently, the interest rate in the call money market and interbank repo rate continued to decline from 5.14 and 5.96 percent in March 2020 to 2.00 and 0.70 percent in November 2020, respectively, reflecting an expansionary monetary policy stance.

Chart 16: Movements in policy and money market rates (in percent)



Sources: Monetary Policy Department and Debt Management Department, Bangladesh Bank.

Weighted average interest rates in the retail market also witnessed a significant decline both in lending and deposit, following the ceiling of 9.0 percent lending rate cap effective from 1 April 2020. Weighted average lending and deposit rates decreased from 5.51 and 9.58 percent in March 2020 to 4.64 and 7.62 percent in November 2020, respectively. The rise in the liquidity in the banking system amid COVID-19 driven weak credit demand led to a sharper fall in the interest rates on lending, which, in turn, induced to lower the cost of funds by the way of lowering the interest rate on deposit.

Chart 17: Weighted average nominal interest rates on lending and deposit (in percent)

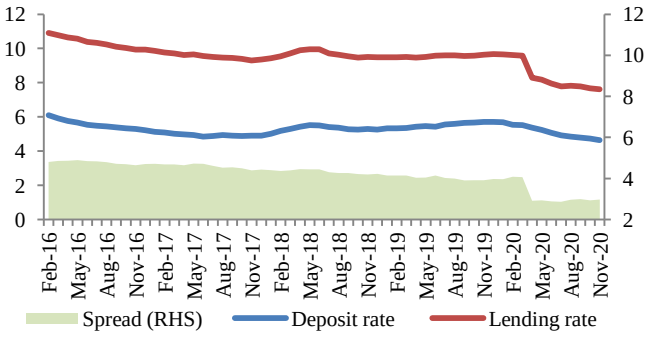
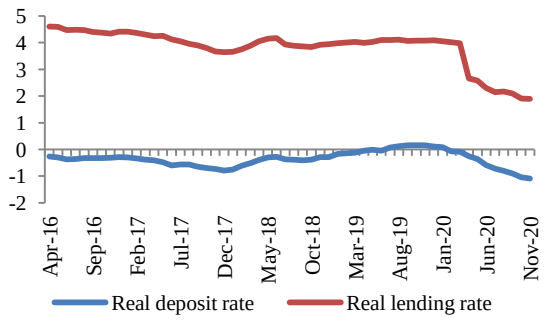


Chart 18: Weighted average real interest rates on lending and deposit (in percent)

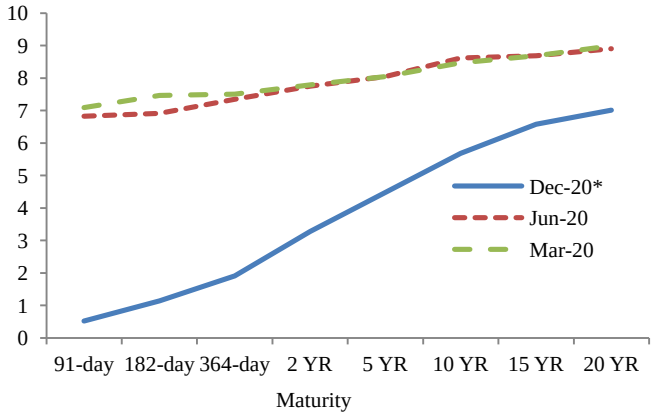


Source: Statistics Department, Bangladesh Bank.

The recent reduction of the intermediation spread with the objective to increased efficiency of banks will be difficult to sustain if the bank deposit rate is close to or below the prevailing inflation rate. Chart 18 reveals that real deposit rates were negative since April 2020 and onwards. The gap between lending and deposit interest rates both in nominal and real terms has started to narrow down since April 2020 but widened slightly in November 2020 as the banks have gradually declined their interest rates on deposit products as compared to that for financing or investment products. In this regard, Chapter 4 discusses in detail the estimation of a neutral interest rate for Bangladesh.

T-bills and bond markets experienced a precipitous fall of yields on all types of government securities, as banks preferred to invest their excess funds in the risk-free government securities. The less flattened line based on December 2020 indicates that the fall was more pronounced in the case of shorter-term securities (Chart 19).

Chart 19: Yield of government securities (in percent)

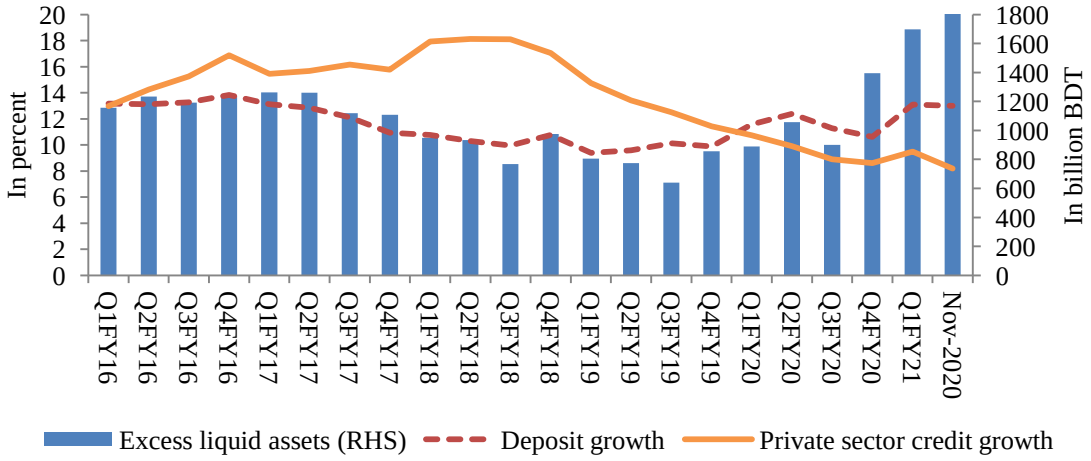


* Up to 24 December 2020.
Source: Debt Management Department, Bangladesh Bank.

II.4.4 Liquidity and outlook

The liquidity condition of the banking system broadly remained stable and sufficiently adequate, while following a wavy trend of excess liquid assets over the last couple of years as shown in Chart 20. The amount of total excess liquid assets[6] which was BDT 1,157 billion at the end of Q1FY16 had been plummeting gradually and dropped to BDT 639 billion at the end of Q3FY19. Excess liquidity started to pick up since Q4FY19 and continued until Q2FY20, attributed to the rising growth rate of bank deposits. In Q3FY20, the deposit growth rate turned to decline which impacted to lower the excess liquid assets, but at a higher rate, during the same period. In the wake of the COVID-19 pandemic since March 2020, BB's easing monetary policy stance (reduction of CRR and repo rate) and enhancing the refinance schemes against the government's stimulus packages helped further improve the excess liquidity in the banking system in Q4FY20. Total excess liquid assets stood at BDT 1951.7 billion at the end of November 2020. The deposit growth rate continued to decline until Q4FY20 but increased thereafter until November 2020 (13.0 percent).

Chart 20: Excess liquidity, deposit growth and private credit growth

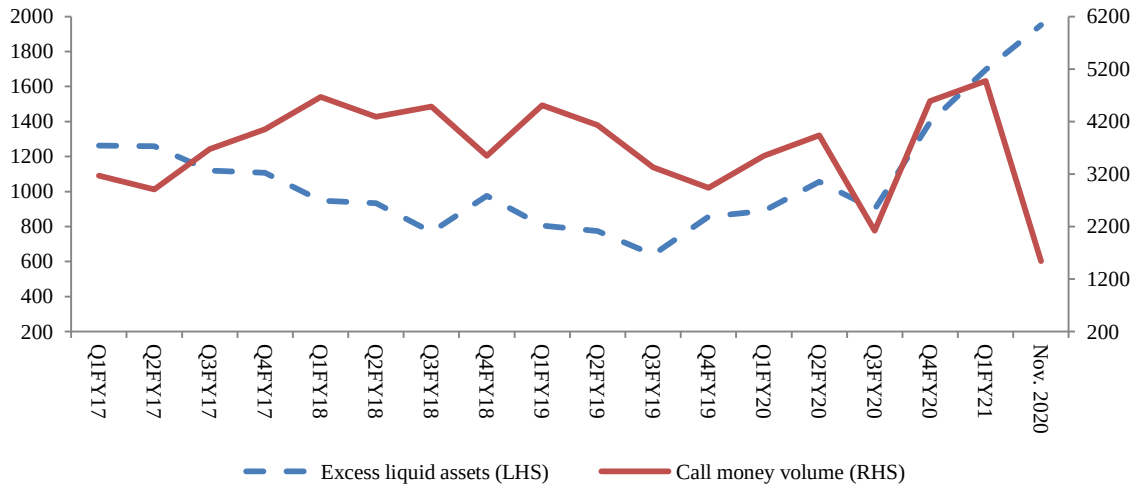


Source: Department of Off-site Supervision and Statistics Department, Bangladesh Bank.

Chart 20 also indicates that liquidity in the banking sector was adequate to feed private sector credit growth over the years. Moreover, a gradual declining trend in the private sector credit growth that started in the middle of FY18 further helped to pile up the excess liquidity. Favored by the government's stimulus packages and BB's reduction of policy rates, private sector credit growth is likely to be improved in the coming months, if the second wave of COVID-19 infections would not be disastrous. Liquidity short-fall in the banking system is closely linked with the call money market. Chart 21 exhibited that the volume of call money has an opposite relationship with excess liquidity over the periods, which is expected.

[6] Excess liquid assets refer to the liquid assets of the banks after maintaining their CRR and statutory liquidity ratio (SLR), while the total liquid assets of the banks include balances with BB in local and foreign currency, balance with Sonali Bank as an agent of BB, and unencumbered approved securities.

Chart 21: Call Money Volume and Excess Liquidity (in billion BDT)

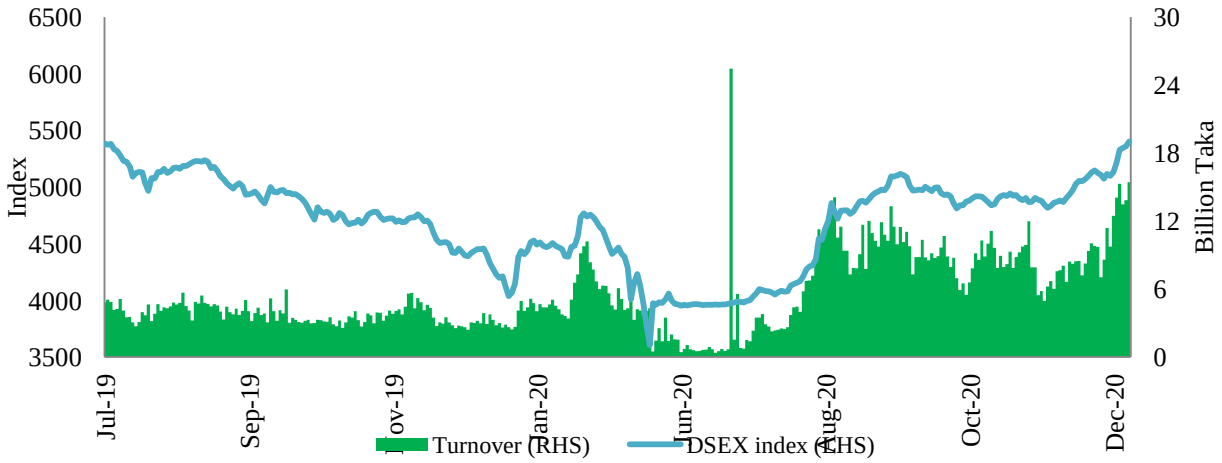


Source: Department of Off-site Supervision and Debt Management Department, Bangladesh Bank.

II.5 Capital Market Developments and outlook

The downward movements of share prices and trade volume with some degrees of volatility continued in the capital market during FY20 compared to FY19 due to investors' disquiet stemmed mainly from the Covid-19 pandemic. However, the country's capital market experienced some improvements during the first half of FY21 by the favorable policy supports of BB and related regulatory bodies as reflected in increased price indices, turnover, and market capitalization.

Chart 22: Trend in DSE Broad Index (DSEX) and turnover

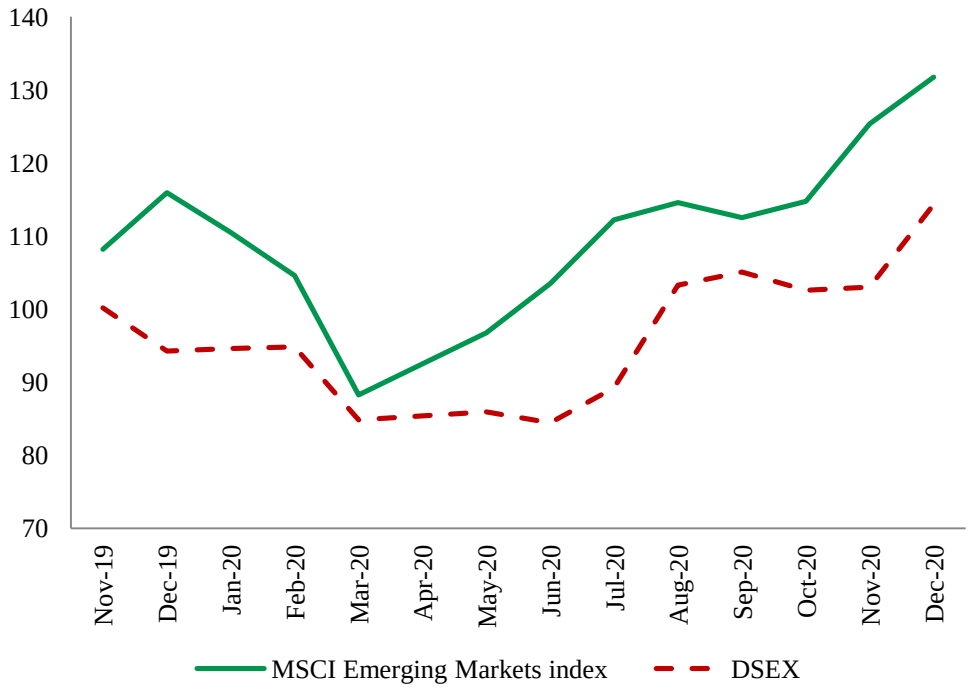


Source: Dhaka Stock Exchange

The key indicators of the capital market, the DSEX dropped by 26.9 percent (y/y) in June 2020 as the investors feared during the last quarter of FY20 that the economy may worsen further by the COVID-19 pandemic. Thereafter, the DSE broad index (DSEX) grew by 21.31 percent (y/y) in December 2020, where the daily average turnover picked up significantly to BDT 8.2 billion at the end of December 2020 from BDT 3.8 billion at the end of June 2020 (Chart 22).

The DSE market capitalization increased to 14.1 percent of GDP in December 2020 from 11.2 percent in June 2020 but is still low as compared to peer countries such as India, the Philippines, and Sri Lanka. The Bangladesh Securities Exchange Commission (BSEC), merchant banks, and stock exchanges may consider appropriate initiatives to increase the number of good fundamental companies, especially profitable state-owned and multinational companies, to enhance the market capitalization. The new commission of BSEC has already taken special attention for faster approval of initial public offerings (IPO) in the capital market. Meantime, the BSEC has approved some companies with large paid-up capital which is expected to increase the market capitalization.

Chart 23: Synchronization of DSEX with Global Markets (base: January 2015 = 100)



Source: Dhaka Stock Exchange and www.msci.com

The synchronized movements between the global equity market and DSE were observed for the last several years due to the increase in trade and financial integration and global portfolio participation in DSE. In response to the COVID-19 pandemic outbreak, many central banks adopted unprecedented easy monetary and prudential financial policies, and the global capital market started to recover. Likewise, the Bangladesh capital market started to recover since June 2020.

To improve the liquidity condition in the capital market, the BB and related regulatory bodies took several initiatives such as: (i) the BB has asked all scheduled banks to create a special investment fund of BDT 2.0 billion for investment in the stock market in addition to banks' stock market exposure limit; (ii) banks can avail financial support from BB through long term repo (iii) the BSEC approved Investment Corporation of Bangladesh's (ICB) BDT 20.0 billion funds for capital market investment and (iv) budget FY21 announced that the Government allowed the investment of undisclosed money in the capital market without any question from any agencies after paying 10 percent tax.

In response to the COVID-19 crisis, BB took an unprecedented easy monetary and prudential financial policy which will help indirectly to increase liquidity in the capital market and impact the market positively.

III. Looking forward

Timely and effective responses to the COVID-19 pandemic were essential to improve Bangladesh economy's resilience. BB's expansionary monetary policy stance along with the government's fiscal stimulus measures are exactly what the economy needed. Relying on these policy initiatives, two crucial components of aggregate demand - consumption, and investment - are showing signs of improvement in recent months, aided by hefty remittance inflows and increased money supply. However, the second wave of COVID-19 resurgence can elevate downside risk and the economic recovery could be uneven.

According to a recent report published by FDI Intelligence[7], Bangladesh is among the top five economies that are recovering faster. Recent impressive progress with more than 90 percent successful results for vaccine development against COVID-19 is indeed a good news for humanity which will impact positively global as well as domestic economy.

Overall developments in the money and credit markets indicate that a strong pick up of net foreign assets was the main contributing factor to the broad money growth. Net domestic assets, however, decreased in November 2020, but will have space to increase as the credit to the public sector including government borrowing from the banking system is still below the projection levels. At the same time, private sector credit growth rebounded but increased slowly because of banks' cautiousness towards quality lending as well as investors' stickiness to survival strategies during the COVID-19 period instead of expanding their businesses. It is expected that the recovery of private sector credit growth along with using the space of expanding credit to the public sector mainly for implementing annual development program (ADP) and supporting stimulus packages for the pandemic hit economy would help align the monetary aggregates with the projections for FY21.

[7] O'Farrell. S. (2020). *Five economies dodging the Covid bullet*. FDI Intelligence: https://www.fdiintelligence.com/article/79063

Inflation Trend and Persistence in Bangladesh: An Empirical Analysis

Nasrin Akther Lubna, Mahmud Salahuddin Naser, Md. Yousuf, Md. Ezazul Islam[8]

Abstract

This paper tries to estimate the trend inflation and examines the degree of persistence in three inflation series (i.e. food, non-food, and headline) for Bangladesh. Our sample period starts in the first month of 2003 and ends in the last month of 2019. The paper uses a Multivariate Unobserved Component Model based on a state-space representation and estimates the model using maximum likelihood via Kalman filter. It identifies a high degree of persistence in all the three inflation series, which means that the effect of shocks on inflation is long-lasting. Consequently, it would take a longer time to bring inflation back to its long-run average path after a shock than if persistence were low. This high persistence of inflation may be attributed to the evidenced fact that inflationary memory remains alive amongst the economic agents. Therefore, it requires relatively rigorous policy action to bring inflation back to its target level.

Keywords: Inflation; Inflation persistence; Monetary policy.

JEL Classification: E30, E31, E52

1. Introduction

Maintaining a reasonable degree of price stability while ensuring an adequate expansion of credit to assist economic growth have been the primary goals of monetary policy in Bangladesh. To achieve the goal variables monetary policy uses a quantity theory equation to back out an intermediate target for the growth of broad money based on projections for real GDP growth, numerical inflation goal, and expected velocity trends. Monetary targeting, far from being a rigid policy rule, is quite flexible in practice as there are no explicit numerical objectives for output and inflation. Bangladesh Bank (BB) demonstrated its flexibility by allowing its inflation goal to vary over time and to achieve other objectives, including output and exchange rates. For the last few years BB is increasingly emphasizing targeting an annual average CPI. By this shift of emphasis, BB has in effect adopting inflation targeting as a strategy for conducting monetary policy, albeit implicitly. In adopting such a framework, it is necessary to know the most useful information about inflation persistence to decide on the timing and magnitude of policy actions which are geared toward achieving price stability.

[8] The authors are from Chief Economist's Unit of Bangladesh Bank. The authors are grateful to Dr. Md. Habibur Rahman, Executive Director, Bangladesh Bank for suggesting new explorations that led to a better understanding of the findings of the study. The views and opinions expressed in the paper are those of the authors and do not reflect the position of the institution where they are working in. The authors welcome comments and suggestions for improvement of the content and those may be forwarded to salahuddin.naser@bb.org.bd

Understanding the inflation process is crucial for economic agents because they base many of their economic decisions on inflation pattern. It is also important for policymakers conducting monetary policy; for investors hedging the risk of nominal assets; for firms making investment decisions and setting prices, and for labor and management negotiating wage contracts. One of the most important characteristics of inflation is its degree of persistence, that is, how slowly it returns to its long-run path after a disturbance of some kind.

Nelson and Batini (2002), Marques (2004), and Dias & Marques (2010) interpret persistence with the idea of speed, i. e. the speed with which inflation converges to its equilibrium after a shock. Inflation is said to be more (less) persistent the slower (faster) it converges or returns to its equilibrium after the occurrence of a shock. An important implication of the inflation persistence is the fact that any estimate of inflation persistence is conditional on the assumed long-run inflation path. Putting it slightly differently, to be able to tell whether inflation is moving slowly or quickly in response to a shock, we need information on the likely path inflation would have followed had the shock not occurred as well as on the level inflation is expected to be once the effect of the shock has died off.

In particular, the appropriate response to a random shock depends on the degree to which its effects on inflation will persist. If inflation is highly persistent, then bringing inflation back to its target level after a shock would require a more vigorous policy action than if persistence were low. Hence, in the case of low inflation persistence, a country can keep its output growth at a relatively high standard with the rate of inflation being at a low level. Therefore, the reduced inflation persistence in a country effectively helps maintain inflation at a relatively low level during the period of high economic growth. Policymakers need to know how rapidly their policy actions take effect: with less persistence, inflation can be established in a shorter time following a shock (Dossech and Evereart, 2005).

Persistent deviations of inflation from policymakers' inflation target can also affect the possible trade-off between stabilizing inflation and economic output: if inflation is more persistent, policymakers may be keener to avoid inflation that is too high or too low, which may require larger deviations of output from its normal level.

A more compelling argument for a continual focus on the characteristics of inflation is that it contains information that is important for changing the stance of monetary policy. There is a complex chain of events that links a change in the monetary policy actions with subsequent changes in inflation. Development anywhere along this chain can alter how much a policy action will affect inflation and when. So, it can take time for a monetary policy action to affect inflation. With the lags associated with the monetary policy actions, BB needs to know in advance when inflation is likely to rise so that it can react in time and neutralize inflationary pressure that could appear in the future.

With this view in mind, the objective of our study is:

i) to measure the degree of persistence in the headline, food, and non-food inflation to identify long-run inflation expectation for Bangladesh; and
ii) to identify the implications of inflation persistence for decision making for both the public and private sectors.

In this study, we want to answer the following questions:

i) Is inflation persistence is high for Bangladesh?
ii) How inflation persistence has been deviating from their historical norms in recent years?

The remainder of the paper is structured as follows. Taking after the introduction, section 2 reviews some related studies regarding inflation persistence. Section 3 describes the data and methodology. Section 4 lays out the estimated results. The conclusion of the paper is specified in section 5.

2. Literature Review

Various factors can explain persistence. Persistence may be inherited from persistent fluctuations in the determinants of inflation, like marginal cost or output gap, called extrinsic persistence. The dependence of inflation on its past is called intrinsic persistence. Moreover, due to asymmetric information, sticky information or imperfect credibility, private agents' perceptions about the central bank's inflation target can differ from the true in the inflation target. The persistence of such deviations can be called expectations-based persistence (Angeloni et al., 2004).

Furthermore, Batini and Nelson (2002) and Batini (2002) distinguish three different types of persistence: (1) positive serial correlation in inflation (2) lags between systematic monetary policy actions and their (peak) effect on inflation and (3) lagged responses of inflation to non-systematic policy actions (i.e. policy shocks).

Given the important implication of inflation persistence on monetary policy analysis, a small but growing literature has flourished examining the nature of inflation persistence with the specific focus on industrial economies, notably Taylor (2000), Cogley and Sargent (2001), Cecchetti and Debelle (2006), Pivetta and Reis (2007), and Zhang, Osborn, and Kim (2008) studying the issue for the U.S., O'Reilly and Whelan (2005) for Europe, and Levin and Piger (2004) for twelve industrial countries. Surprisingly little research, however, has been conducted on the study of inflation persistence in Bangladesh.

Two kinds of theoretical discussion have been found on inflation persistence in the literature. First, the accelerationist hypothesis and the Fisher hypothesis suggest that inflation is a non-stationary process. The accelerationist view implies that inflation will remain on an ever-increasing level to maintain lower the natural rate of unemployment. Consequently, inflation would be characterized as a unit root where the unemployment rate is kept lower than the natural rate (Romero-Avila and Usabiaga, 2009). Moreover, the Fisher hypothesis claims that if the nominal interest rate contains a unit root, for the real interest rate to be stationary, it is necessary for the inflation rate to follow a unit root process and to be cointegrated with the nominal interest rate.

Cecchetti and Debelle (2006) in a study on US inflation found that allowing for changes in the mean inflation leads to a considerable decline in the measured inflation persistence. They also found that inflation expectations are directly related to changes in the mean of inflation in many developed countries. O'Reilly and Whelan (2005) use an annualized quarterly log difference of GDP deflator for the EURO area and document a very high degree of persistence.

For emerging markets, Mohanty and Klau (2001) document a high degree of inflation persistence for many countries in Asia as well as Latin America. This finding is consistent with Baum et al. (1999) who reports a high degree of persistence for both developed and developing economies for the period 1971-1995. Both of these studies find a high degree of inflation persistence in India. Mohanty (2011) finds that the persistence in non-food inflation remains high, whereas food inflation has increased in recent years.

As outlined in Russell (2011), inflation could also be a stationary process around shifting means. The rational expectations hypothesis proposes that the stable growth of the money supply implies stationary inflation (Yellen and Akerlof, 2006), Arize et al. (2005), and Arize and Malindretos (2012) also put emphasis on the stationarity of the inflation rate to estimate the money demand relations. Cecchetti and Debelle (2006) stressed that stationary inflation will incur a lower cost for the monetary authorities in conducting monetary policy.

Fang Yao (2011) opined that when a central bank aggressively responds to inflation deviations, inflation persistence shifts from inherited persistence to intrinsic persistence, making inflation more stably anchored on its history, so that it is less affected by the extrinsic driving forces. On the other hand, when the central bank holds an easing policy stance on inflation, they would face a capricious inflation dynamic even in the short- run. Erceg and Levin (2003) show that inflation will appear to be highly persistent if the central bank changes its inflation objective, but the public is uncertain about the change, even in a model where inflation displays very little persistence if the long-run inflation objective is constant.

Understanding persistence in macroeconomic variables is a well-established concern in the macroeconomic literature. Consequently, it is no surprise that considerable academic literature evaluates different inflation persistence measuring models. One common feature of the literature is the use of a scalar measure of persistence which is particularly useful in comparing the degree of persistence across the series. The most popular scalar indicator of persistence, in the inflation persistence literature, in particular, is the sum of autoregressive coefficients. Other commonly used measures of persistence include the largest autoregressive root, the spectrum at zero frequency, or the half-life decay[9].

Our approach differs from the current literature that we measure the degree of persistence using a multivariate unobserved component model to estimate the trend inflation for headline CPI inflation with the objectives of identifying long-run inflation expectations for Bangladesh economy. Our framework utilizes the information contained in the two components of Headline CPI inflation i.e. food inflation and non-food inflation. Using information from food and non-food inflation is valuable in the context of Bangladesh since persistent movements in food and non-food inflation can affect long-term inflation in a developing country like Bangladesh.

The decomposition of inflation into a trend and a cyclical component used in our study is motivated by Stock and Watson (2007). One of the advantages of this approach is that it provides us with a measure of the inflation gap (deviation of inflation from a time-varying trend) that can be used to measure its persistence. However, in their setting inflation innovations are serially uncorrelated, which makes the model unsuitable to investigate persistence of the inflation gap. This problem does not arise in our setup because we allow serial correlation in the inflation gap. The absence of any evidence about measuring the degree of persistence in inflation for Bangladesh is an important void in the literature that we tried to fill with this paper. This contribution enhances the current literature that exists on inflation persistence.

3. Data and Methodology

3.1 Data: Sources and Description

We use monthly data for the year-on-year rate of inflation for Bangladesh from January 2003 through December 2019. Data were obtained from the Bangladesh Bureau of Statistics (hereafter BBS). The monthly rate of inflation

[9] The persistence of an inflation response can be captured in a single number called the half-life, which states how long after a shock it takes for inflation to fall to half its initial value.

is measured using the overall Consumer Price Index (CPI) (headline inflation), two specific CPI indexes (food and non-food inflation). All variables are measured in percentages.

3.2 Unit Root Analysis

Almost all macroeconomic time series one typically uses have a unit root (Nelson and Plosser, 1982). The presence or absence of unit roots helps to identify some features of the underlying data generating process of a series. In the absence of unit root (stationary), the series fluctuates around a constant long-run mean and implies that the series has a finite variance which does not depend on time. On the other hand, in the presence of a unit root (non-stationary), the variance of the series is time-dependent. Non-stationary series suffer permanent effects from random shocks and thus the series follows a random walk.

The debate on unit root hypothesis underwent renewed interest following the important findings of Nelson and Plosser (1982). The traditional view of the unit root hypothesis was that the current shocks only have a temporary effect and the long-run movement in the series is unaltered by such shocks. The most important implication under the unit root hypothesis sparked by Nelson and Plosser (1982) is that the random shocks have permanent effects on the long-run level of macroeconomics; that is the fluctuations are not transitory.

These findings were challenged by Perron (1989), who argues that most macroeconomic series are not characterized by a unit root, but rather that persistence arises only from large and infrequent shocks and that the economy returns to deterministic trend after small and frequent shocks. We test the unit root hypothesis for the three inflation series (headline, food and non-food inflation) using the Augmented Dickey-Fuller (ADF) test.

3.3 Random Walk Process of Persistence

We model the long-run inflation trend as a slow-moving random walk process to capture the degree of persistency of inflation in Bangladesh. Slow-moving random walk process can overcome the problem of varying local mean that has been much discussed in the literature on inflation dynamics (Cecchetti and Debelle 2006; Cogley et al. 2010). We outline our model using the three-variable unobserved component model where the three variables are Headline, Food and Non-food.

3.4 A Multivariate Unobserved Component Model of Trend Inflation

We used the information from the CPI headline, food and non-food inflation in our model. We argue that using information from food inflation is valuable in the context of Bangladesh since persistent movements in food inflation can affect long-term inflation in a developing country like Bangladesh.

Formally, at a given time t, we assume that inflation for each component of CPI headline inflation can be decomposed into a stochastic trend and an idiosyncratic transitory component. We also assume that these variables share a common trend because of having a significant association.

$$\pi^{CPIHead} = \phi_t + C_t^{CPIHead} \quad \text{..... (1)}$$

$$\pi^{Food} = \gamma_1 + \lambda_1 \phi_t + C_t^{Food} \quad \text{..... (2)}$$

$$\pi^{NonFood} = \gamma_2 + \lambda_2 \phi_t + C_t^{NonFood} \quad \text{..... (3)}$$

Trend Dynamics (τ_t):

Trend inflation has been modeled as a slow-moving random walk process

$$\phi_t = \phi_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim \text{iidN}(0,\ \sigma_\varepsilon^2) \ldots\ldots\ldots\ldots(4)$$

Cycle Dynamics (c_t):

Each inflation series is allowed to have an idiosyncratic cycle. The idiosyncratic cycles c_t are assumed to follow an AR (1) process.

$$C_{it} = \theta_i C_{t-1} + \upsilon_{it} \qquad \upsilon_{it} \sim \text{iidN}\left(0,\ \sigma_{\upsilon i}^2\right) \ldots\ldots\ldots\ldots(5)$$

Trend inflation has been estimated using CPI headline inflation by employing univariate decomposition which is a special case of the three-variable model presented above. The multivariate model has the following structure:

$$\pi_t = \phi_t + C_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$
$$\phi_t = \phi_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim \text{iidN}(0,\ \sigma_\varepsilon^2) \ldots\ldots\ldots\ldots(7)$$
$$C_{it} = \theta_i C_{t-1} + \upsilon_{it} \qquad \upsilon_{it} \sim \text{iidN}\left(0, \sigma_{\upsilon i}^2\right) \ldots\ldots\ldots(8)$$

The model is presented with the state-space form and estimated using maximum likelihood via the Kalman filter. Representing a dynamic system in state-space form has two main benefits. First, the state-space form allows unobserved variables to be incorporated into and estimated along with the observable model. Second, state-space models can be analyzed using the powerful recursive Kalman filter. The state-space representation of the three-variable unobserved component model is presented below.
The measurement or signal equation can be written as:

$$Z_t = \alpha + L_t \psi_t$$

The unobserved state variables ψ_t are generated by a first-order Markov process defined by the transition or state equation:

$$\psi_t = F\psi_{t-1} + u_t \qquad u_t \sim \text{N}(0, Q)$$

Where Z_t is an (n*1) vector of observable variables, L_t is an (n*m) matrix, βt is an (m × 1) vector of (possibly) unobservable state variables.

The prediction equations and updating equations for the Kalman filter model are as follows:

Prediction Equations:

$$\psi_{t/t-1} = F\psi_{t-1/t-1}$$
$$\rho_{t/t-1} = F\rho_{t-1/t-1}F' + Q$$
$$\Omega_{t/t-1} = Z_t - L_t\psi_{t/t-1}$$
$$y_{t/t-1} = L_t\rho_{t/t-1}L_t'$$

Updating Equations:

$$\psi_{t/t} = \psi_{t/t-1} + K_t\Omega_{t/t-1}$$
$$\rho_{t/t} = \rho_{t/t-1} - K_tL_t\rho_{t/t-1}$$
$$K_t = \rho_{t/t-1}L_t'y_{t/t-1}^{-1}$$

4. Empirical Result

Figure 1 plots the monthly rate of inflation for the three inflation series and Table 1 presents some summary statistics, where μ stands for the mean, σ stands for the standard deviation and σ/μ stands for the coefficient of

variation. The coefficient of variation shows the extent of variability to the mean. The variability of food inflation is higher than the non-food inflation. Despite the impact of food inflation on the cost of living, the high variability of food inflation makes it more difficult for BB to address it without the risk of exacerbating output variability. Correlation coefficients of the three inflation series, presented in table 2, depict statistically significant association among the series.

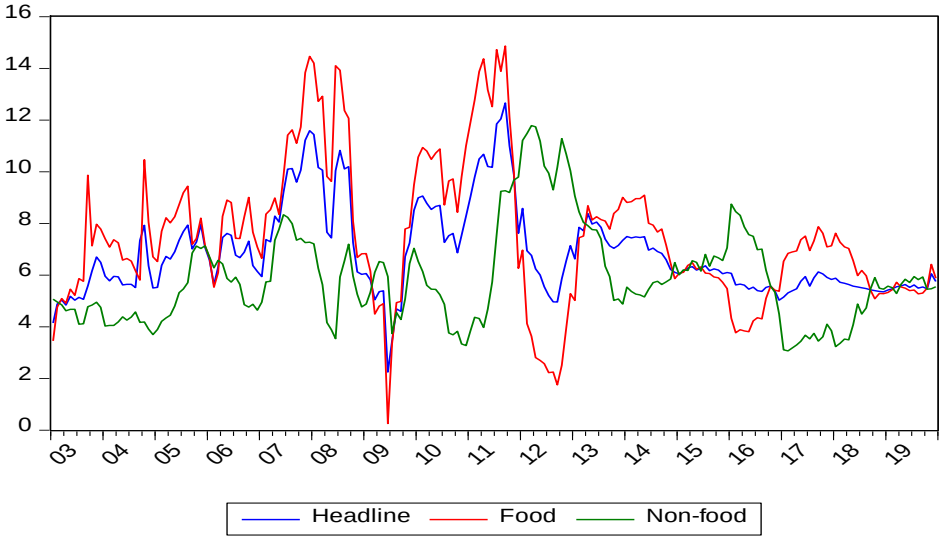


Figure 1: Monthly rate of inflation for the headline, food and non-food.
(2003m01-2019m12)
Source: Bangladesh Bureau of Statistics.

Table 1: Summary Statistics of Inflation
(2003m01-2019m12)

Headline						**Food**						**Non-food**				
μ		σ		μ/σ		μ		σ		μ/σ		μ		σ		μ/σ
6.3		2.3		2.7		6.7		3.3		2.9		5.6		2.0		2.8

Source: Authors' calculation based on the Bangladesh Bureau of Statistics (BBS) data.

Table 2: Correlation Coefficients of Headline, Food and Non-food Inflation
(2003m01-2019m12)

	Headline	Food	Non-food
Headline	1		
Food	0.90	1	
Non-food	0.24	- 0.18	1

Source: Authors' calculation based on the Bangladesh Bureau of Statistics (BBS) data.

We test the unit root hypothesis for the three inflation series using the Augmented Dickey-Fuller *t*-test. The *t*-test for the whole sample series strongly suggests that the null hypothesis of a unit root can be rejected for all variables (Table 3).

Table 3: Unit Root Tests

(2003m01-2019m12)

Variables	DET	ADF *t*-statistics	P-value
Headline Inflation	Intercept	-3.08	0.03**
Food Inflation	Intercept	-3.25	0.02**
Non-food Inflation	Intercept	-2.65	0.08*

Note: DET stands for Deterministic Component, SIC stands for Schwartz Information Criteria. Critical values for unit root test with intercept and trend:1%: (-5.719131);
*5%: (-5.175710); and 10%: (-4.893950). ***p<0.01, **p< 0.05, *p<0.10*
Source: Authors' calculation based on the Bangladesh Bureau of Statistics (BBS) data.

Table 4: Parameter estimates of the model

(2003m01-2019m12)

Parameter	Estimate	Standard Error	P-value
σ_{Trend}	0.698	0.040	0.00
$\sigma_{CPIhead}$	0.006	3.841	0.99
σ_{Food}	0.574	0.080	0.00
$\sigma_{Nonfood}$	0.547	0.023	0.00
$\theta_{CPIhead}$	0.917	0.025	0.00
θ_{Food}	0.874	0.051	0.00
$\theta_{Nonfood}$	0.955	0.026	0.00
γ_{Food}	-2.496	1.965	0.20
$\gamma_{Nonfood}$	4.437	2.545	0.08
λ_{Food}	1.439	0.164	0.00
$\lambda_{Nonfood}$	0.222	0.071	0.00

Source: Authors' calculation based on the Bangladesh Bureau of Statistics (BBS) data.

Table-4 presents the estimated parameters and their respective standard errors. We found that the cyclical components of CPI Headline, food, and non-food inflation are highly persistent with respective persistency value of 0.92, 0.87, and 0.96 which are very close to 1, recommended as fully persistent.

Again, persistency of the cyclical component of food inflation is comparatively lower than that of non-food inflation. This may be because shock in food inflation is somewhat offset by different government initiatives to keep food price lower such as subsidy in the agriculture sector, open market sales etc. Also, seasonal bumper production of main crops might be an important component of lower persistency of food inflation.

We also find that food and non-food inflation have significant loadings on the common trend where food inflation loading is 1.44 and non-food inflation loading is 0.22 implying that trend inflation is affected by the long-run movements of food and non-food inflation. Again, it is apparent that food inflation has a much larger impact on trend inflation. Hence plays a greater role in long-run inflation dynamics of Bangladesh.

We plot the estimated trend inflation from the model in Fig.2 and also cycles for CPI headline, food and non-food inflation in Fig. 3, Fig. 4, and Fig. 5 respectively. It can be pointed out that our estimated trend inflation measure is smoother than the CPI inflation. During our sample period, 2003-2019, the standard deviation of CPI inflation is 1.73 whereas the corresponding value for our estimated trend inflation is 0.17. This is expected as the trend inflation is a long-term forecast of inflation that filters out the short-term noises and cyclical component in the data. Our results also suggest that the trend inflation started declining in the middle of 2012.

Fig. 2: Estimated Trend Inflation

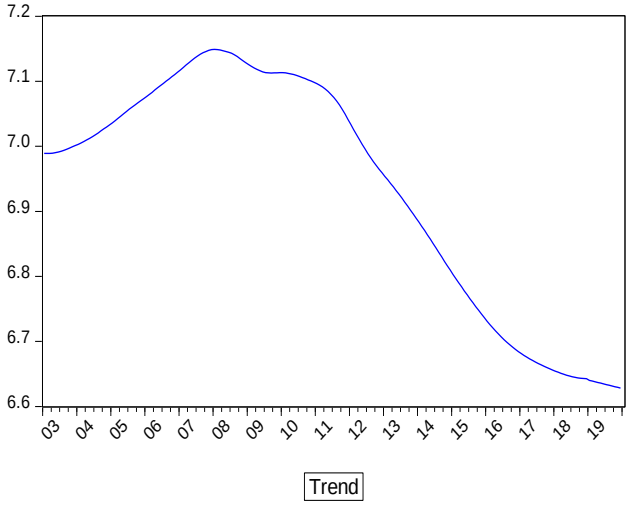


Fig. 3: CPI headline inflation and estimated cycle headline inflation

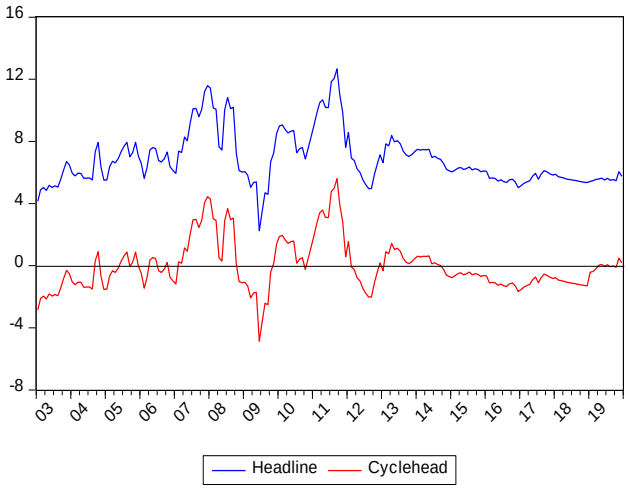


Fig. 4: Food inflation and estimated cycle of food inflation

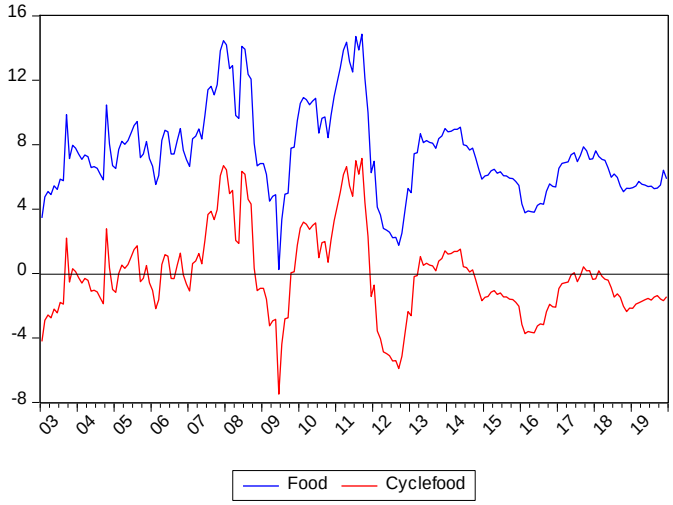
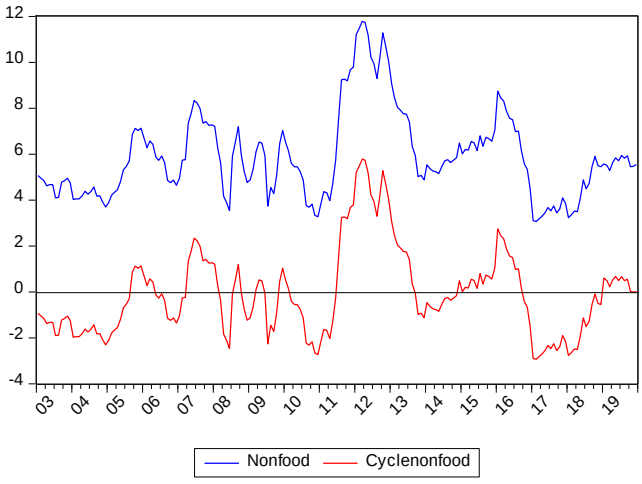


Fig. 5: Non-food inflation and estimated cycle Non-food inflation



6. Conclusion

In this paper, we attempt to provide a measure of trend inflation that aids the understanding of price dynamics. Using CPI inflation, we use a multivariate unobserved component model that decomposes the CPI headline inflation into trend inflation and a transitory inflation gap. The overtime evolution of this inflation gap measure provides a natural measure of inflation persistence that captures how quickly a shock to the inflation disappears and brings inflation back to its trend. We find that trend inflation from our unobserved component model captures the long-run dynamics of inflation in Bangladesh. We found that the cyclical components of CPI Headline, food, and non-food inflation are highly persistent.

The implications of high inflation persistence for the monetary policy are the follows i) public perception about the inflation objective of the central bank is not well anchored. As a result, inflation expectations are much more dependent on past inflation i.e. more backwards-looking than forward-looking; ii) a high degree of persistence means that inflation will not be stabilized in a short period following a shock. This suggests that to bring inflation back to its target level, BB should react more vigorously than if persistence were low; iii) similar levels of persistence across the different types of inflation indicators (headline, food, and non-food) suggests that extracting the most volatile components of the headline inflation indicator does not generate a new inflation indicator that is less persistent than the original. Therefore, contrary to common belief, a more volatile variable is not necessarily less persistent.

Bangladesh Bank can formulate and conduct its monetary policy in such a way that it ensures that actual inflation does not deviate for too long from its target inflation; expectations of economic agents can be anchored. A key benefit of establishing such a strong nominal anchor is that the monetary authorities will be less likely to induce large swings in economic activity to control inflation.

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Foreign Exchange Market Structure and Exchange Rate Volatility in Bangladesh

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Abstract

Foreign exchange rate volatility is closely related to profits on investments and the efficiency of foreign exchange market. Hence volatility in foreign exchange rates is an important factor for both investors and policymakers. Considering this, the present study attempts to examine the volatility of exchange rate behavior in terms of returns and volume of daily transactions in the foreign exchange market of Bangladesh during July 2014 to June 2018, applying GARCH family models (i.e. PARCH, EGARCH, and IGARCH). The results show that volatility clustering is present in foreign exchange rate returns since the volatility of risk is responsive to past shocks and the past volatility influences the current volatility of exchange rate returns. Moreover, the return is positively related to its volatility. The existence of leverage effect is also evidenced in the Bangladesh foreign exchange market because positive past shocks increase volatility more than the negative past shocks of the same magnitude. These findings indicate that, the appreciation and the depreciation of Bangladesh Taka against USD do not necessarily cause symmetric variation in the exchange rate returns.

Keywords: Exchange rate, Volatility, ARCH, GARCH

JEL Classification: C52, C58, E44, F31

Introduction

Analyzing foreign exchange rate (FX) volatility i.e. fluctuation of the exchange rate with respect to time is essential for corporate decision-makers because such unpredictable movement presents exchange rate risk and uncertainty in the operational environment and increases profit uncertainty. The policymakers, on the other hand, keep an eye on the foreign exchange rate volatility for making economic decisions as it has effects on capital flows and international trade that are crucial for the balance of payments of a country. In addition, FX rate volatility adversely affects the long-term decisions by stirring the volume of global marketing and decisions to allocate resources for investment, sales and procurement policies of governments as investor's confidence to invest in a particular country is inversely related to high volatilities in the exchange rate. Because of its important economic and financial implications, monitoring the exchange rate volatility is gaining greater attention in developing countries like Bangladesh.

Kemal (2005) observes that in the medium term, FX rate can influence the balance of payments and level of the overall economic activity while affecting the local consumers and traders in the short run. With significant trade and financial account openness in the last two decades, Bangladesh economy has become considerably more integrated with the global economy. Despite the dominance of domestic demand, the role of foreign flows in conditioning the growth process in Bangladesh has become important over time. The domestic economy now reflects global economic developments reasonably quickly. The deceleration in Bangladesh's growth associated with the current global slowdown is also testimony to the increased global integration of the domestic economy. Recent global developments have significantly transformed the environment in which monetary policy operates. As

[10] The authors are from The Chief Economist's Unit of Bangladesh Bank. The authors are grateful to Dr. Md. Habibur Rahman, Executive Director, Bangladesh Bank for suggesting new explorations that led to a better understanding of the findings of the study. The authors are alone responsible for the views or opinions expressed in this paper and not in any way the institution where they are working. The authors welcome comments and suggestions for improvement of the content and those may be forwarded to md.yousuf@bb.org.bd

a consequence, in addition to the usual economic challenges, monetary policy today is faced with the following key challenges like:

- Transmission of the uncertainty of global environment into the domestic economy;
- Transmission of the volatility of exchange rate and the corresponding adverse impact through the trade, financial, commodity price, and business confidence channels.

The unprecedented momentum in global financial integration in the last two decades has led to an ever-increasing interest among researchers to understand the linkages between exchange rate volatility and monetary policy. In order to curb exchange rate volatility, policymakers and researchers employ quantitative models to determine which macroeconomic and financial factors have important influences on exchange rate volatility.

In line with the above consideration, the objectives of the study are:

a) To analyze how exchange rate volatility behavior is associated with the foreign exchange market structure in Bangladesh and the market behavior as well as the responses of exchange rates with changes of major macroeconomic variables and
b) To measure the volatility of exchange rate returns and volatility of transactions in Bangladesh and compare these to India as the neighboring country has multidimensional channels of influences on the Bangladesh economy.

In the era of the financial globalization process, monetary policy authorities give a high weight to reduce the negative consequences of exchange rate fluctuations on inflation dynamics. To the best of our knowledge, ample studies were focused on the developed markets FX volatility but only a few studies examined FX volatility of Bangladesh. So, this study attempts to contribute further to the few literature on Bangladesh FX market volatility. Moreover, this study differs from the studies conducted earlier on Bangladesh as this study uses updated data along with contemporary econometric tools and techniques to overcome some methodological limitations of the earlier studies on exchange rate volatility. Different GARCH family models have been used in the study to capture the main characteristics of the time series, such as volatility clustering and leverage effect. Moreover, most of the studies on Bangladesh only focus on exchange rate volatility rather than the overall market activities such as transaction volume. The issue of transaction volume is important because unexpected events may affect the transaction volume which has an impact on exchange rate volatility especially reflected on market demand and supply. Accordingly, this study considers the transaction of the FX market and volatilities together instead of considering them separately.

The rest of the study is organized as follows. Following the introduction in section 1, Section 2 reviews some relevant literature on the exchange rate volatility. Section 3 discusses the features of the foreign exchange market structure and operations in Bangladesh. Section 4 specifies data and methodology used in the study and section 5 highlights the results of the models. Finally, section 6 offers conclusion and policy recommendations.

2. Review of the Literature

In the modern integrated world, the exchange rate plays a vital role not only in foreign trade but also in domestic price stability. Chongcheul Cheong, et al (2006) examine the dynamic interrelations between exchange rate uncertainty, international trade, and trading competitiveness in prices, using UK data. The empirical results derived from vector autoregressive (VAR) models show that a shock to exchange rate volatility negatively affects trade volumes, and such negative effects are greater than the effects on trade price levels. Bhanumurthy (2006) finds that a majority of the dealers feel short-term changes in the Indian rupee/US dollar market are basically influenced by the micro variables such as information flow, market movement, speculation, central bank intervention, etc. Khullar and Sethi (2011) measure the volatility of FX market in India found that the exchange rate of EURO is much more

volatile than the YEN and US Dollar in the Indian foreign exchange market when comparing their daily volatilities. For all the three currencies under this study, they found generally an increasing trend in volatility when volatility is compared along the different time span taken into consideration such as from daily to weekly to monthly.

Among the articles on Bangladesh, Ahmed (2009) analyzes the relationship between exchange rate volatility and international trade growth in Bangladesh. The result shows that the exchange rate volatility has a negative and major effect on trade both in short run and long run with Western European and North American countries. Using GARCH type models, Alam and Rahman (2012) measured the volatility of exchange rate using daily data for the period of July 2006-April 2012 found that the past volatility of exchange rate significantly influenced current volatility. However, in this study limitations like excess skewness and kurtosis issues were detected but not properly addressed. Moreover, the lag specification of the mean equation was not properly addressed in their paper. Estimation with these may show misleading findings.

Younus (2014) finds that Bangladesh's export to India is sensitive to India's Rupee depreciation and Bangladesh's imports are very sensitive to the relative price level changes. Rahman &Ghosh (2013) detect that the forecasted exchange rates have not been exactly convergent to the market exchange rates and the volatility has been mounting. Hossain & Ahmed, (2009) conclude that expansionary monetary policy has a high exchange rate pass-through with high market pressure. Moreover, lowering the REER volatility has positive impact on overall exports.

Kamal Uddin et al (2013) investigate the fluctuation in the exchange rate of Bangladesh observes that stock of money and increase in debt service burden results in a real depreciation of currency while increasing foreign exchange reserve results in a real appreciation of the currency. Moreover, political instability has a significant negative effect on the value of the domestic currency. Another study by Abdullah et al (2017) examine exchange rate volatility using daily exchange rates for 7 years (January 1, 2008 - April 30, 2015) found that, in contrast with the normal distribution, the application of Student's t-distribution for errors helped the models satisfy the diagnostic tests and show improved forecasting accuracy. This study has also limitations since only the AR process is used in the mean equation but ARMA process may be more appropriate.

Our approach differs from the current literature that we measure the volatility of exchange rate using GARCH type models including GARCH in Mean equation with the objectives of measuring Foreign exchange rate volatility and also examining the foreign exchange market structure in Bangladesh. We not only measure the volatility of the exchange rate but also the volatility of transactions volume. Moreover, in this study, we compare the foreign exchange market of Bangladesh with that of India, a major trade partner.

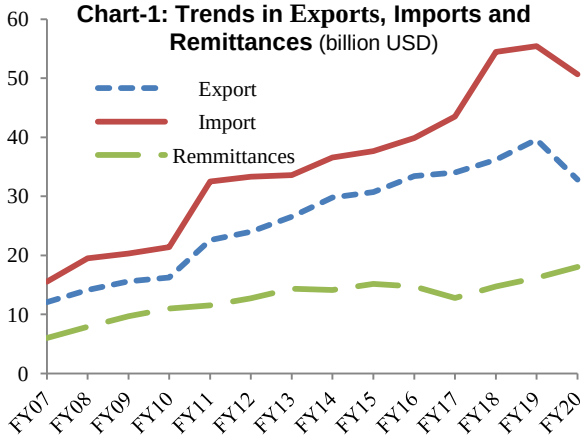
3. Features of the FX Market: Structure and Operations

3.1 Volume of Transactions is increasing over time: All types of current transactions (excluding interbank) such as export earnings, import payment, remittance earnings are transected by the authorized dealer banks deal with customers increased over time (chart-1).

At present 57 scheduled banks with 1010 branches and 225 money changers are doing their FX businesses in Bangladesh. Mainly two types of transactions take place in Bangladesh FX market namely interbank and other than interbank. Authorized dealer banks are engaged in interbank transactions while both banks and money changers are engaged in transactions with the customers. In addition to the formal markets such as banks and money changers, there are some informal transactions which are called curb market transactions. In spite of major transactions occurred in USD, the interbank market is divided into 'US Dollar' and 'Non-Dollar' segment (includes all currencies other than USD, but calculated in equivalent USD units).

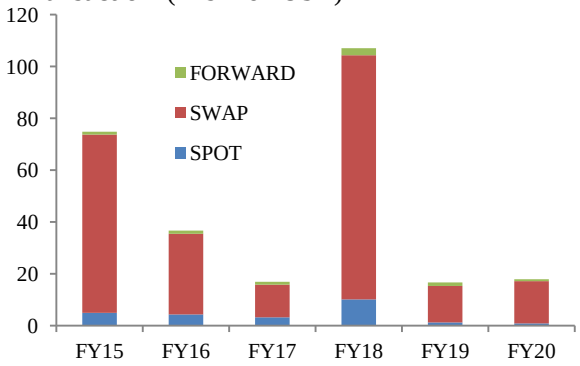
Among the typical foreign exchange instruments such as Spot, Forward and SWAP; the SWAP remained the dominant trading instrument during our sample period in Bangladesh foreign exchange market (chart-2). During FY20 the percentage share of SWAP, Spot and Forward transactions were 91%, 5% and 4% respectively while during FY19 the percentage share of SWAP, Spot and Forward transactions were 84%, 7.5% and 8% respectively. Decline in transaction of Spot and Forward as reflected in the percentage share of their transactions in FY20 compared to FY19 may be attributable to the higher weighted average exchange rate in FY20 than that of in FY19 (chart-3). So, a relationship between the exchange rate and the transaction type is also observed in Bangladesh FX market.

Chart-1: Trends in Exports, Imports and Remittances (billion USD)



Source: Bangladesh Bank

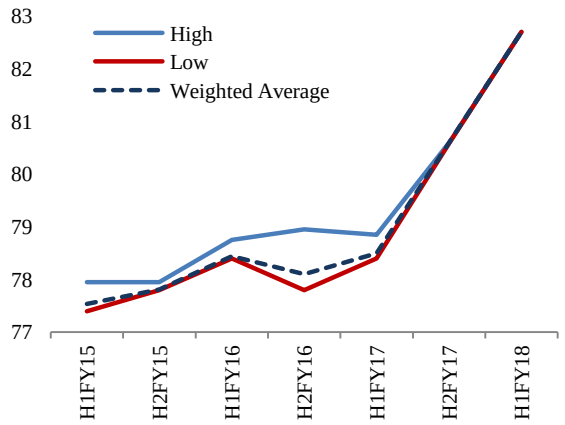
Chart-2: Interbank Foreign Exchange Transaction (In billion USD)



Source: Bangladesh Bank

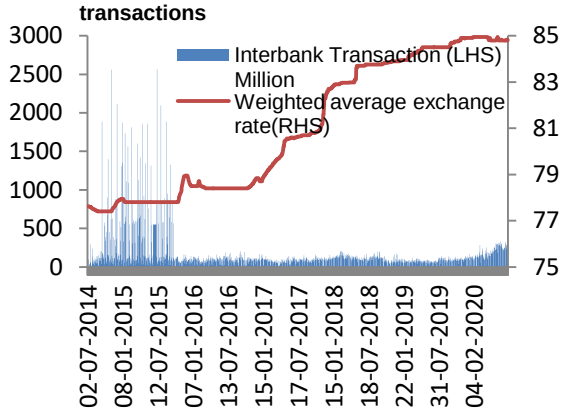
3.2 Exchange rate and transaction volume have the opposite relationship: The exchange rate is broadly determined by the market forces such as the interactions of demand for and supply of the foreign currencies. However, Bangladesh Bank (BB) for the purpose of monetary management oversees the FX market movements vis-a-vis the exchange rate and occasionally intervenes in the market to ensure liquidity and stability of the exchange rate thereby helps build the confidence of the market. In the interbank foreign exchange market the transaction volume has fallen sharply since October 2015, when Taka–USD exchange rate shot up and the transaction further declined after another pick up in the exchange rate since mid-2018. The dominance of the market forces reflected in the negative relationship between the weighted average exchange rate and the volume of interbank foreign transaction is shown in the chart-4. The degree of correlation between them is 0.26 which is statistically significant at the 1% level.

Chart 3: Interbank USD-BDT Exchange Rate
BDT per USD



Source: Bangladesh Bank

Chart 4: Exchange rate movements and daily turnover foreign exchange transactions



Source: Bangladesh Bank

During FY15-FY16 supply of foreign exchange in the market was adequate putting appreciation pressure on the taka (chart-3) as a result BB purchased US dollar 3,758.45 million, 4,131 million, and 1,931 million during FY15, FY16 and FY17 respectively. On the other hand, from the second half of FY17, it was observed that demand of foreign exchange in the market goes beyond the supply creating depreciation pressure on taka, as a result, BB sold US dollar 2311 million and 3911 million during the second half of FY18 and FY19 respectively (chart-5). But in FY2, BB sold 835 million and bought 877 million.

3.3 FX market of Bangladesh follows economic fundamentals: The correlation matrix in table-1 shows that the nominal exchange rate is negatively correlated with current account balance and the degree of correlation is 0.60 which is statistically significant at 1% level.

Chart 5: Foreign Currency Purchage and Sale by BB (million USD)

Table:1 The Correlation Matrix

Correlation t-Statistic Probability	Exchange rate	Current account balance	Growth in private sector foreign debt	Domestic interest rate
Nominal Exchange rate	1.00			
Current account balance	-0.60 -3.43 0.003	1.00		
Growth in private sector foreign borrowings	-0.08 -0.39 0.70	0.23 1.08 0.29	1.00	
Domestic interest rate	-0.27 -1.28 0.21	0.44 2.27 0.03	0.44 2.22 0.04	1.00

Private foreign borrowing has an off-putting effect on the exchange rate as the data in correlation matrix support this argument. Accordingly, exchange rate shows an expected negative relationship with the domestic interest rate as the interest rate differential moves along with the movement of the domestic interest rate. The business and enterprises increase their borrowing from abroad instead of domestic financial institutes when the domestic interest

rate is relatively high. The degree of negative correlation between the exchange rate and the growth of private sector foreign borrowings is 0.08 quietly not remarkable and also statistically insignificant even at the 10% level. The relationship between the domestic interest rate and the exchange rate is indirect as the high-interest rate attracts more capital inflow which turns down the exchange rate by mounting the supply of foreign currency. Data used in the correlation matrix rightly demonstrates a negative correspondence with exchange rate by 0.27 degree of association but is statistically insignificant even at the 10% level.

4. Data and Methodology

To explore the volatility in the Bangladesh foreign exchange market, the daily foreign exchange rate of BDT per USD and daily transaction volume for the period of 2nd July 2014 to 27th June 2018 with 979 observations has been collected for the study from Bangladesh Bank. A the same time, to examine the influence of different economic variables on the volume of interbank foreign exchange transaction, yearly data on export, import, remittance, private sector foreign debt, current account balance, the domestic interest rate has been collected from BB website. To compare the volatility of Bangladesh foreign exchange market with neighboring India, data on Indian rupee-USD exchange and daily transaction volume has been collected from Reserve Bank of India (RBI) on a daily basis. Because exchange rate series are nonstationary the study converted the exchange rate series into the rate of return on the exchange rate by the following logarithmic transformation due to Alam and Rahman (2012) and Abdullah et al (2017) and uses the transformed series in our analysis. The adopted the logarithmic transformation to make the daily returns series stationary by using the following formula:

$$R_t = log\left(\frac{ER_t}{ER_{t-1}}\right) * 100$$

Here, R_t is the return on the exchange rate at period t; ER_t and ER_{t-1} are the exchange of the BDT per USD at period t and $(t-1)$. This formula for return has already been used by other authors for example, Kamal et al (2011) and Ece Oral (2012).

4.1 Model Specification:

4.1.1 GARCH Models: GARCH models are assumed to be appropriate for understanding the dynamic behavior of exchange rate variables and derive variance series for volatility. Volatility is the common feature of the most financial series. To model volatility, Engle (1982) first introduced the autoregressive conditional heteroskedastic (ARCH) model. To predict volatility the model requires estimating a large number of parameters. To solve the problem Bollerslev(1986) proposed the generalized autoregressive conditional heteroskedastic (GARCH) model which reduces the number of required lags.

Appropriate specification of the mean equation plays an important role in the GARCH model. Any misspecification of the model will not be able to detect the autocorrelation problem in volatility model. So, the study uses three different models for mean equations where the first equation contains only constant, second equation includes *p* order autoregressive term with a constant and third equation follow an ARMA (p, q) process. Mean Equations are as follows:

$$R_t = \omega + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$R_t = \omega + \varphi_1 R_{t-1} + \ldots\ldots\ldots + \varphi_p R_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$R_t = \omega + \varphi_1 R_{t-1} + \varphi_2 R_{t-2} + \ldots\ldots\ldots + \varphi_p R_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} \ldots + \theta_q \varepsilon_{t-q} \quad (3)$$

GARCH_M (1, 1): $R_t = \omega + \lambda e_t + w_t$ where $w_t = e_t \eta_t$ (4)

The general form for the variance equation: $e_t = \sqrt{w_t}\, z_t$ where $z_t \sim iid(0,1)$

Based on the specification of w_t in variance equation several possible models within the GARCH family can be done as different models have aimed to capture different feature of volatility. To specify the variance equation to model volatility presence in the exchange rate returns, following models of the GARCH family have been used to measure volatility in exchange rate returns.

GARCH (1, 1): $w_t = \theta + \propto e_{t-1}^2 + \beta w_{t-1}$ $\theta > 0, \propto \geq 0, \beta \geq 0$ and $\propto + \beta \leq 1$

PARCH (1, 1): $w_t^\rho = \theta + \propto (|e_{t-1}| - \mu e_{t-1})^\rho + \beta w_{t-1}^\rho$ $\rho > 0,\ |\mu| \leq 1$

EGARCH (1, 1): $lnw_t = \theta + \propto \left|\frac{e_{t-1}}{\sqrt{w_{t-1}}}\right| + \mu \left(\frac{e_{t-1}}{\sqrt{w_{t-1}}}\right) + \beta lnw_{t-1}$

IGARCH (1, 1): $w_t = \propto e_{t-1}^2 + (1 - \propto) w_{t-1}$ $\{\alpha + (1 - \alpha)\} = 1$ and $0 < \alpha < 1$.

$\propto$ is the coefficient that measures the extent to which a volatility shock today feeds through the next period volatility, while $\propto + \beta$ is usually considered to be a measure of the persistence of volatility shock and it measures the rate at which this effect dies over time.

The PARCH model is an extension of GARCH with an extra term added to account for possible asymmetries or leverage effect. In the above PARCH model, ρ denotes the power parameter that requires condition $\rho > 0$, and μ is the parameter capturing asymmetry or leverage effect, which requires the condition $|\mu| \leq 1$.
A typical feature of financial data is that negative shocks generate more volatility compared to positive shocks. It has been shown that the symmetric GARCH models may not capture some important features of the data since they assume symmetric response of volatility to positive and negative shocks. The EGARCH is an asymmetric model that specifies the logarithm of the conditional volatility and avoids the need for any parameters constraints. In the EGARCH specification, μ is the asymmetry parameter measuring leverage effect, $\propto$ is the size parameter measuring the magnitude of shocks, and β is the persistency parameter.

5. Results and Discussion

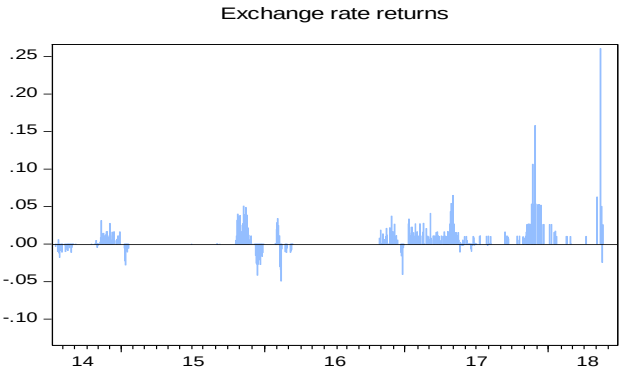
5.1 Measuring Exchange Rate and Transaction Volatility:

5.1.1 Estimation Output Taka-USD Exchange rate: Prior to measuring the volatility of exchange rate return the study estimates the summary statistics and test the stationary of the exchange rate returns. The average rate of return is 0.00335 with a standard deviation of 0.015 which indicates the exchange rate return is highly volatile (table-2). This conclusion is also evident from chart-6.

Table-2: Summary Statistics Taka-USD Exchange rate

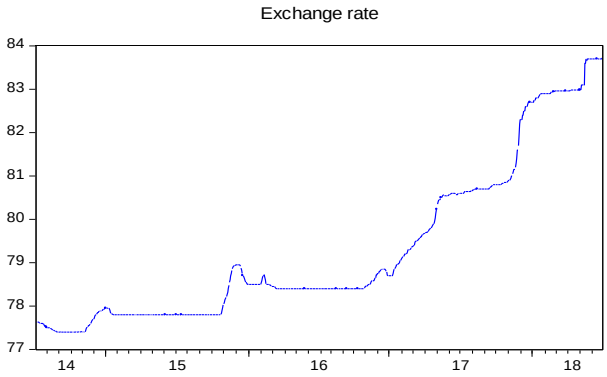
Average	Std. Deviation	Kurtosis	Skewness	JB test	P-value
0.003351	0.014966	108.6001	7.637428	464401.4	0.003

Chart-6



Source: Bangladesh Bank.

Chart-7



Source: Bangladesh Bank.

Table-3: Unit root test

	Level				First difference			
	ADF test		PP test		ADF test		PP test	
Series name	Intercept	Intercept &trend	Intercept	Intercept &trend	Intercept	Intercept & trend	Intercept	Intercept &trend
Exchange rate	1.349	-1.110	1.871	-0.901	-7.994*	-8.268*	-27.174*	-27.095*
Exchange rate return	-7.933*		-26.858*					

* Indicates significant at 1% level

Table-3 shows the exchange rate of taka/USD is non-stationary at level but becomes stationary at first difference (chart-7). The series of exchange rate return is stationary at level as revealed from ADF and PP unit root test.

In Table-4 the result of the mean equation with five GARCH models has been summarized. Mean equation indicates that the exchange rate return series follow an ARMA(1,1) process with constant. Both AR(1) and MA(1) terms are statistically significant at 1% level, which indicates that the past day exchange rate return and past day shocks significantly affect current day exchange rate returns. Since higher-order ARMA terms are not statistically significant the mean equation was not augmented with further ARMA terms. To measure the effect of volatility on return of exchange rate we estimate the GARCH_M model. The value of the coefficient λ=0.415 which indicates that return is positively related to its volatility and the coefficient is statistically significant. The F-statistic of the model is significant which indicates the presence of ARCH effect in the exchange rate return series. The existence of volatility is also evident from residual series in chart-8.

Table-4: GARCH Models

Dependent variable R_t

Variables/Coefficients	Mean equation		Model-1	Model-2	Model-3	Model-4
	ARMA	GARCH_M	GARCH	PARCH	EGARCH	IGARCH
ω	0.003 (0.003)		0.003 (0.002)	0.003 (0.002)	0.001* (8.40E-05)	0.006* (0.001)
R_{t-1}	0.901* (0.014)	0.675* (0.087)	0.926* (0.038)	0.930* (0.028)	0.992* (0.001)	0.905* (0.015)
ε_{t-1}	- 0.673* (0.019)	-0.515* (0.131)	-0.528* (0.065)	-0.588* (0.053)	-0.977* (0.001)	-0.194* (0.020)
λ		0.415* (0.031)				
θ			3.24E-06* (1.77E-07)	1.11E-11 (3.05E-11)	-1.011* (0.033)	
$\propto$			0.457* (0.041)	0.393* (0.061)	0.928* (0.037)	0.056* (0.0001)
ρ				4.314* (0.499)		
μ				-0.090* (0.035)	-0.147* (0.028)	
β			0.710* (0.0124)	0.558* (0.0356)	0.954* (0.003)	0.943* (0.0001)
Inverted AR roots	0.90	0.68	0.93	0.93	0.99	0.91
Inverted MA roots	0.67	0.51	0.53	0.59	0.98	0.19
F-statistic	5.385**		0.005	0.009	0.022	3.455**
P-value	0.021		0.943	0.926	0.882	0.063

* Indicates significant at 1% level, ** Indicates significant at 5% level

To capture variance dynamics GARCH (1,1) model has been estimated with the normal error distribution assumption. The Coefficients of the model are ($\propto = 0.457$ and $\beta = 0.710$) statistically significant which imply that the volatility of risk is responsive to past shocks and the past volatility is influencing the current volatility of exchange rate returns by 71%. Since the sum of the coefficients is greater than one (1), the residuals of the model are non-stationary.

To test the presence of asymmetric volatility effects PARCH (1,1) model has been estimated. The coefficients of $\propto$ and β are found to be statistically significant. The coefficient μ is statistically significant which indicates the presence of leverage effect. The negative value of μ implies the existence of a leverage effect where positive past values of $e_t$increase volatility more than the negative past values of the same magnitude. That is, appreciation and depreciation of taka against USD do not necessarily cause symmetric variation in the exchange rate returns.

Chart-8

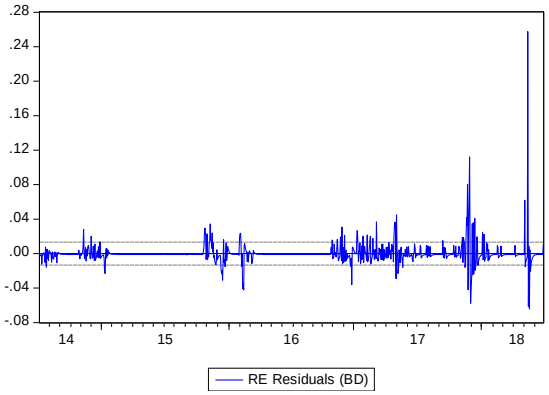
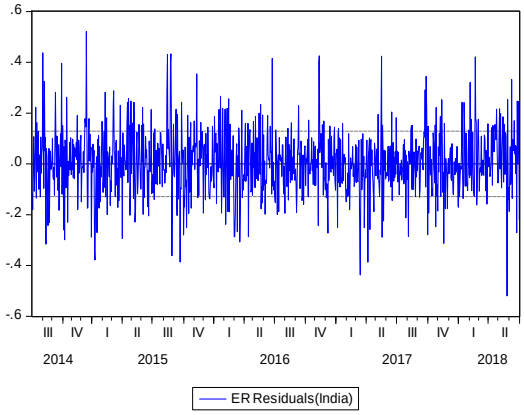


Chart-9



In the variance equation, the constant term of PARCH model is significantly different from zero. Thus the non-negativity restriction does not hold. To solve the problem of non- negativity restrictions, we use the EGARCH model. The ARMA (1,1) terms are statistically significant in EGARCH. In the variance equation, μ is significant which implies the presence of asymmetric behavior on volatility. Since EGARCH supports the PARCH result of the asymmetric behavior of volatility, the study did not estimate the TGARCH model.

In all models, the F-statistic shows that there is no ARCH effect which means no autocorrelation in the residuals.

The sum of GARCH parameters is greater than one in model-2 implies that the variance may not be well behaved. To model volatility by imposing restrictions that the sum of GARCH parameters is one leads to IGARCH specification. The result of the model shows that the restriction is valid and the model overcomes all of the diagnostic tests.

The inverted roots of the AR and MA terms are less than one in all models which imply the stability of the models.

5.1.2 Estimation Output Rupee-USD Exchange rate: Table-5 shows the exchange rate of Indian rupee/USD is non-stationary at level, but becomes stationary at first difference. The series of exchange rate return is stationary at level as revealed from ADF and PP unit root test.

Table-5: Unit root test for Rupee/USD

Series name	Level				First difference			
	ADF test		PP test		ADF test		PP test	
	Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend
Exchange rate	-1.852	-1.900	-1.877	-1.939	-30.261*	-30.253*	-30.262*	-30.253*
Exchange rate returns	-30.217*		-30.220*					

* Indicates significant at 1% level

Table-6: GARCH Models

Dependent variable R_t

Variables/Coefficients	Mean equation	Model-1	Model-3
	ARMA	GARCH	EGARCH
ω		0.004 (0.004)	0.005 (0.004)
R_{t-1}	-0.887* (0.102)	0.345 (2.161)	0.328 (2.702)
e_{t-1}	0.914* (0.090)	-0.357 (2.148)	-0.338 (2.692)
θ		0.008* (0.003)	-1.575* (0.397)
∝		0.118* (0.032)	0.226* (0.046)
μ			0.114* (0.031)
β		0.398* (0.182)	0.661* (0.094)
Inverted AR roots	-0.89	0.34	0.33
Inverted MA roots	-0.91	0.36	0.34
F-statistic	17.50*	0.448	3.50
P-value	0.00	0.503	0.062

* Indicates significant at 1% level, ** Indicates significant at 5% level

In Table-6 the result of the mean equation with GARCH models of foreign exchange returns of Indian Rupee with USD has been summarized.

Mean Equation indicates that the exchange rate return series follow an ARMA(1,1) process with no constant. Both AR(1) and MA(1) terms are statistically significant at 1% level, which indicates that the past day exchange rate return and past day shocks significantly affect current day exchange rate returns. Since higher-order ARMA terms are not statistically significant the mean equation was not augmented with further ARMA terms. The F-statistic of the model is significant which indicates the presence of ARCH effect in the exchange rate return series. The existence of volatility is also evident from residual series in chart-9.

To capture variance dynamics GARCH (1,1) model has been estimated. The Coefficients of the model for India are ($\propto = 0.118$ and $\beta = 0.398$) statistically significant which imply that the volatility of risk is responsive to past shocks and the past volatility is influencing the current volatility of exchange rate returns by almost 40%. Since the sum of the coefficients is less than one (1), the residuals of the model are stationary.

To overcome the problem of non-negativity restrictions, we use the EGARCH model. In the variance equation, μ is significant which implies the presence of asymmetric behavior on volatility. That is, appreciation and depreciation of the Indian Rupee against USD do not necessarily cause symmetric variation in the exchange rate return.
In both models, the F-statistic shows that there is no ARCH effect which means no autocorrelation in the residuals. Since the sum of GARCH parameters is less than one, the study does not estimate the IGARCH model. The inverted roots of the AR and MA terms are less than one in all models which imply the stability of the models.

5.2 Transaction Volatility for Bangladesh and India

Table-7 shows the unit root test results of the daily turnover of foreign exchange transactions both in Bangladesh and India. The result indicates that the daily turnover of foreign exchange is stationary at level in both countries as revealed from ADF and PP unit root test.

Table-7: Unit root test for Daily turnover

Series name	Bangladesh				India			
	ADF test		PP test		ADF test		PP test	
	Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend	Intercept	Intercept & trend
Daily Turnover	-3.920*	-5.095*	-32.54*	-31.234*	-23.97*	-24.261*	-25.94*	-25.78*

* Indicates significant at 1% level

In Table-8, the result of the mean equation with GARCH models of daily turnover of foreign exchange has been summarized. Mean Equation indicates that the transaction volume series follow an ARMA(1,1) process with no constant in case of Bangladesh and with a constant in case of India. Both AR(1) and MA(1) terms are statistically significant at the 1% level, which indicates that the past day turnover and past day shocks significantly affect current daily turnover. The existence of volatility is evident from residual series in chart-10 and 11.

To capture variance dynamics GARCH(1,1) model has been estimated. The Coefficients of the model for Bangladesh are ($\propto = 0.0745$ and $\beta = 0.8929$) statistically significant which imply that the volatility of risk is responsive to past shocks and the past volatility is influencing the current volatility of daily turnover by almost 90%. The sum of the coefficients is 0.96 shows the persistence of volatility shocks. Since it is less than one (1), the residuals of the model are stationary.

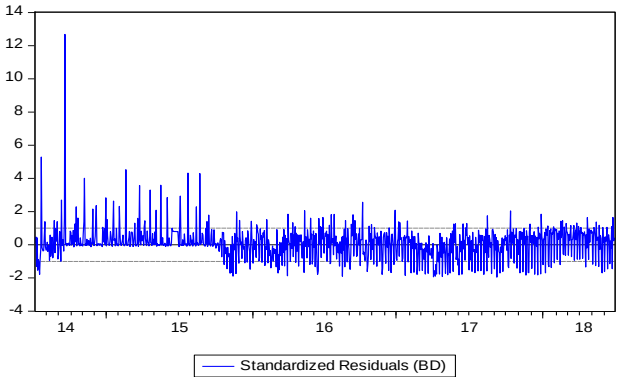
Table-8: GARCH Models

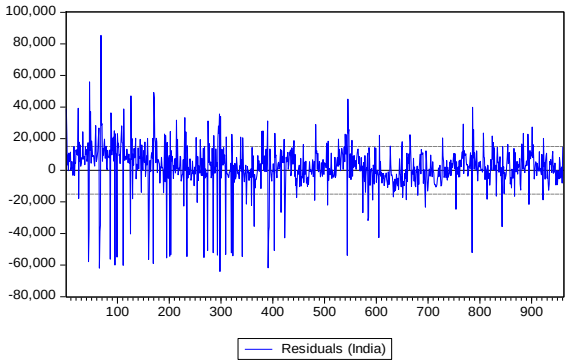
Dependent variable: Daily Turnover

	Bangladesh		India	
	Mean equation	Variance Equation	Mean equation	Variance Equation
Variables/Coefficients	ARMA	GARCH	ARMA	GARCH
ω	139.52 (202.35)	84.089* (3.397)	54806.8* (870.38)	51932.3* (645.92)
R_{t-1}	0.997* (0.0016)	0.952 (0.0203)	0.660* (0.072)	0.383* (0.095)
e_{t-1}	-0.957* (0.0077)	-0.905* (0.0336)	-0.452* (0.076)	-0.1031* (0.120)
θ		207.68* (58.83)		824078.62* (61607.34)
$\propto$		0.0745* (0.020)		0.468* (0.067)
β		0.8929* (0.0198)		0.2433* (0.042)
Inverted AR roots	0.99	0.95	0.66	0.38
Inverted MA roots	0.96	0.91	0.45	0.10

* Indicates significant at 1% level, ** Indicates significant at 5% level

Chart-10 **Chart-11**





The Coefficients of the GARCH(1,1) model for India are ($\propto = 0.468$ and $\beta = 0.243$) statistically significant which imply that the volatility of risk is responsive to past shocks and the past volatility is influencing the current volatility of exchange rate returns by almost 71%. The sum of the coefficients is 0.711 shows the persistence of volatility shocks. Since it is less than one (1), the residuals of the model are stationary. So, it can conclude that the volume of daily foreign exchange turnover of the Indian foreign exchange market is more volatile than that of the Bangladesh foreign exchange market.

6. Conclusion and Recommendations

The size of the foreign exchange market in Bangladesh is small in terms of volume of transactions and the use of instruments. However, the size of the market is increasing over time. There is a negative relationship between exchange rate movement and the current account balance. This phenomenon indicates that Bangladesh foreign exchange market follows the economic fundamental of the country. The negative relationship between the exchange rate and the growth of private sector foreign borrowing is low and statistically insignificant. Moreover, the relationship between the nominal exchange rate and the domestic interest rate shows a weak and statistically insignificant that indicates a more indirect relationship between the variables as capital flows are not entirely open in Bangladesh.

The first order auto-regressive behavior of foreign exchange rate returns was evidenced in ARMA process while GARCH (1,1) model support the presence of volatility clustering i.e. the volatility of risk is responsive to past shocks and the past volatility is influencing the current volatility of exchange rate returns. The PARCH (1,1) model confirms the existence of leverage effect i.e. the positive past shocks increase volatility more than the negative past shocks of the same magnitude so the appreciation and depreciation of BDT against USD do not necessarily cause symmetric variation in the exchange rate return. The existence of volatility clustering and the leverage effect in the foreign exchange market of Bangladesh indicates the weak form of efficiency of the market. To make the foreign exchange market more dynamic, vibrant and competitive market size should be expanded with proper management in place.

This study reveals that high importance should be given to both monetary and non-monetary factors in the open-economy framework to detect the possible impacts on trade and capital flows. The empirical findings of this study would guide the monetary authority in formulating and conducting monetary policy and help achieve the ultimate goal of monetary policy.

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Estimating the Neutral Interest Rate for Bangladesh

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Abstract

The Neutral Interest Rate (NIR) is the unobservable real interest rate expected to prevail when GDP is growing at its trend rate and inflation is at central bank's target. The NIR provides policy-makers with an indicative benchmark, by telling them whether a given level of the interest rate is higher or lower. Moreover, it indicates the level of real interest rates where monetary policy is neither contractionary nor expansionary. The concept of NIR has recently received much attention as it yields important information about the stance of monetary policy. Many central banks estimate it for setting the policy rate to preserve price stability. This paper estimates NIR for Bangladesh for the period July 2008-June 2018 applying historical averaging and statistical filtering of time series data (Hodrick-Prescott filter) estimation techniques for different real interest rates such as repo, reverse repo, 30-day Bangladesh Bank bill, 91-day treasury bill, call money, bank deposit, bank lending, 5-year treasury bonds and 10-year treasury bonds. The paper finds that the estimated NIR based on real repo rate for Bangladesh lies in the range of 0.94% to 2.87% for the period under review. Taking the estimated NIR into consideration, the paper found that the monetary policy stance was largely accommodative rather than anti-inflationary. However, NIR is coming down in recent years. Therefore lowering the monetary policy rate is consistent with the economic situation of the time.

Keywords: Neutral Interest Rate, Real Interest Rate, Monetary Policy Stance.

JEL classification: E32, E43, E52

1. Introduction

Interest rates are the tool of choice for economists and practitioners in influencing economic activities and conducting monetary policy. Low-interest rates are considered to stimulate economic activities and high rates to restrain it. But how do one measure whether the prevailing interest rate is high or low in the absolute sense? To answer this question, it is useful to consider the concept of the 'neutral interest rate' introduced by Wicksell in 1898 and fully integrated into modern macroeconomics by Woodford in 2003. Wicksell argued that it is not a high or low-interest rate in the absolute sense does not directlyinfluence the demand for productive resources like labour, land, and capital, rather it does so indirectly by affecting the movement of prices. Therefore, what matters is not the absolute level of the current interest rate, but its level relative to the neutral interest rate. Now the question is what

[11] The authors are from Chief Economist's Unit and Research Department of Bangladesh Bank. The authors are grateful to Dr. Md. Habibur Rahman, Executive Director, Bangladesh Bank for suggesting new explorations that led to a better understanding of the findings of the study. However, the views and opinions expressed in the paper are those of the authors and do not reflect the position of Bangladesh Bank. Comments and suggestions are welcome by the authors and may be forwarded to salahuddin.naser@bb.org.bd

is the neutral interest rate. The neutral interest rate (NIR, henceforth) is the real short-term interest rate expected to prevail when GDP is growing at its trend rate (output equaling or converging to its potential), and inflation is at central bank's target. The NIR corresponds to the concept that there exists some unobservable real interest rate, which, in the absence of frictions, equilibrates demand and supply conditions of the aggregate economy. In this sense, the NIR is also referred to as the equilibrium interest rate.

The NIR could be informative for policymaker as a:

i) reference point for interest rates set by central banks;
ii) basis for long-term fiscal sustainability calculations;
iii) benchmark for growth estimates; and
iv) iv) measure for projecting long-term rates in financial markets.

The rate provides a broad indication of the level of real interest rates where monetary policy is neither contractionary nor expansionary. In this sense, a neutral real interest rate can be thought of as a benchmark, where a contractionary real interest rate is sometimes referred to as 'above neutral', and a stimulatory real interest rate is 'below neutral'. The gap between the current real interest rate and the neutral real interest rate can be thought of as a rough measure of the monetary policy stance.

The NIR provides policy-makers with an indicative benchmark, by telling them whether a given level of the interest rate is higher or lower. However, it does not tell the policy-maker the exact level at which to set interest rates. To decide on the appropriate interest rate setting, the policy-maker needs to decide how expansionary or contractionary monetary policy needs to be, and for how long that stance needs to be maintained. These decisions will depend on several factors such as the policy-makers assessment of the

i) strength and persistence of the inflationary pressure that they are trying to offset. Generally, stronger and more persistent inflationary pressures will lead to higher interest rate settings;
ii) preferences regarding the trade-offs between deviations of inflation from the target and;
iii) volatility in other economic variables, such as output or the real exchange rate.

As the NIR is not directly observable, it must, therefore, be derived from real interest rate data, with all the uncertainty that entails. Another difficulty is that the neutral real interest rate varies across time. and economic situations. Now, if the neutral interest rate cannot be observed how can one tell whether the market interest rate is above or below the neutral rate? There are many methods (structural model, filtering, and historical average) that are generally employed to estimate the NIR. Many central banks estimate it for setting the policy rate to preserve price stability. To the best of our knowledge, no study was found regarding the estimation of the NIR for Bangladesh. In this backdrop, this paper attempts to estimate the NIR for Bangladesh, probably, for the first time, by employing two different methods such as historical average and Hodrick-Prescott (HP) filter methods as these are most popularly used and easy to estimate techniques.

Besides this introduction, this article is structured as follows. Section 2 presents relevant empirical literature review, section 3 discusses the movements of the real interest rates in Bangladesh, section 4 presents the data and methodology used for the study section 5 reviews the results and findings of the study, and section 6 evaluates the stance of monetary policy in Bangladesh. Finally, section 7 offers concluding remarks.

2. The Empirical Literature Review

Naturally, monetary policymakers should have a deep interest in the level of the natural interest rate because it presents a guidepost as to whether the monetary policy is too tight or too loose, just as in Wicksell's (1907) original view. The problem is that the natural rate is fundamentally unobservable. It is a hypothetical construct that cannot be measured directly. Instead, to get a sense of where the natural rate is, economists have employed various empirical methods that attempt to derive the natural rate from actual data.

Exusting literature suggests the following four approaches that are commonly used to estimate the NIR:

- extracting the natural rate as the long-run trend of a real rate time series (Hamilton et al. (2015));
- using a small scale semi-structural model of the economy and with the help of the Kalman filter jointly extract both short-term shocks and long-term trends (Laubach and Williams (2003; 2016));
- using a medium-scale DSGE model where the natural rate is the rate that would prevail if prices and wages were flexible (Barsky et al. (2014), Del Negro et al. (2017), Cúrdia et al. (2015)); and
- using information from financial markets (from the yield curve) to estimate the level of the natural rate of interest.

Laubach & Williams (2003; 2016) used their model on quarterly U.S. data over the period 1961:1 to 2000:4, and jointly estimated the U.S. natural rate of interest, its potential output and trend growth rate. The authors found a substantial variation in the U.S. neutral rate during this period in the US. For instance, the rate found for the 2000 was of 3%. The list of articles that made a similar to estimate NIR showed that the natural rate of interest for advanced economies was on average between 2.5% and 5% for emerging market economies (Table 1). H.K. Behera et.al (2015) applied the Kalman Filter approach to estimate NIR using quarterly Indian data over the period 1996:2 to 2015:1, and found that the neutral interest rate of India for the period Q4of 2014-15 lied between 1.6 percent and 1.8 percent.

Table 1: Neutral Real Interest Rate of different Countries: Survey of Articles

Author/s	Country	Method	Period	Neutral Rate (%)
ADVANCED ECONOMIES				
Laubach & Williams (2003)	USA	Kalman Filter	2002	3.0
Crespo-Cuaresma et al. (2004)	Euro Area	Cycle-Trend Decomposition	2002	1.5-2.0
Lam & Tkacz (2004)	Canada	DSGE	2002	1.25-2.0
Basdevant et al. (2004)	New Zealand	Kalman Filter	2003	3.12
Garnier & Wilhelmsen (2005)	Euro Area	Kalman Filter	2004	2.0
Clark & Kozicki (2005)	USA	Kalman Filter	2005	2.5
Amato (2005)	USA	Time-Varying Parameter	2004	3.0
	UK		2004	4.0
	Germany		2004	2.75
Mésonnier & Renne (2007)	France	Kalman Filter	2002	1.5
Bernhardsen & Gerdrup (2007)	Norway	Kalman Filter, Taylor Rule	2007	2.5
EMERGING ECONOMIES				
Brzoza-Brezezina (2004)	Poland	SVAR, Kalman Filter	2003	4.0
Humala & Rodríguez (2009)	Peru	Kalman Filter	2008	8.0
Öğünç & Batmaz (2011)	Turkey	Kalman Filter	2006	7.5
Behera, Pattanaik & Kavediya (2015)	India	Kalman Filter	2015	1.6-1.8

Table-1 shows that the highest NIR of 2008 was 8 percent for Peru. The lowest NIR in 2002 was 1.25-2.0 percent for Canada. It also shows that all neutral rates were positive.

In a recent paper, Jim Hamilton et al. (2015) used moving averages of the actual real rate of interest over a relatively long period of time as a proxy for the natural rate of interest. The measure is very useful to understand low-frequency changes in the actual real rate of interest. L. Thomas A. and M. Christian (2015) argued that the average of the real interest rate could be used as a proxy of neutral rate where the determinants of the neutral rate are constant over time.

3. Movement of Real Interest Rates in Bangladesh

The NIR must be extracted from the observed real interest rate data. Towards estimating the NIR the focus should be on the behavior of the real interest rate, defined as the nominal short-term rate minus inflation. From chart-1 it is evident that real interest rates of instruments such as repo, 91-day treasury bill, 30-day Bangladesh Bank bill and call money declined mostly from July 2006 to June 2011 with some volatility. During July 2006 to December 2011, particularly after the global crisis, the average real interest rates of 91-day treasury bill, repo and call money were -2.29 percent, -0.80 percent, and -0.09 percent respectively, reflecting the easy monetary policy stance and accommodative fiscal stimulus. From January 2012 these rates started to move upward. The average real interest rates of repo, 91-day treasury bill and call money were 0.81 percent, 0.12 percent and 0.35 percent respectively during January 2012 and June 2018.

Chart -2 shows the real bank deposit rate was also negative from July 06 to December 2011 with some fluctuations. During the period, the average real interest rate on bank deposit was -1.46 percent. From January 2012 the real bank deposit rate started to become positive, the average rate was 0.56 percent between January 2012 and June 2018. On the other hand, the bank lending rate was positive throughout the whole period of July 2006 to June 2018. It appears that the real rates were negative when inflationary pressure was high and the real rates became positive when inflationary pressure moderated.

Chart 1: Movement of Real Interest Rates

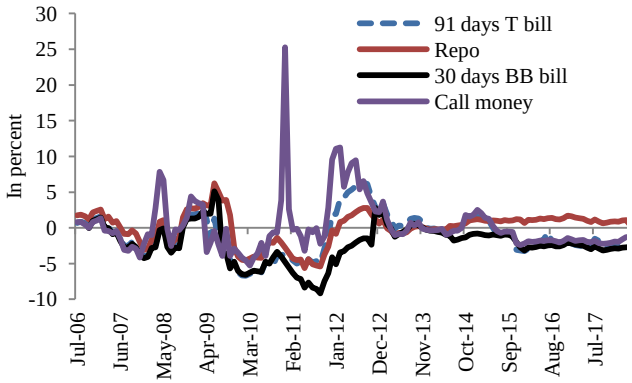
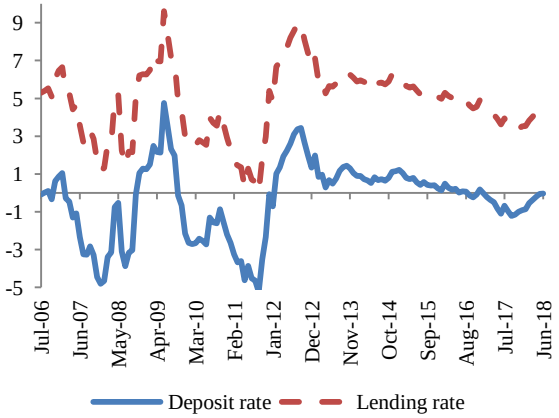


Chart 2: Real bank Interest Rates (In Percent)



4. Data and Methodology

To estimate the NIR for Bangladesh, the paper considers real interest rates of different instruments (repo, reverse repo, 30-day Bangladesh Bank bill, 91-day treasury bill, call money, bank deposit, bank lending, 5-year treasury bonds and 10-year treasury bonds) for the period of July 2006 to June 2018. The NIR is associated with the real interest rate. All NIRs are real interest rates but all real interest rates are not neutral. The interest rates that prevail in

the banking systems are in nominal terms. So, the paper at first converts the observed nominal interest rates of different instruments to real interest rates by subtracting the inflation (point-to-point) from the respective nominal interest rates. There is no straightforward technique to estimate the NIR. Different methods such as structural model, filtering and historical average are generally employed to estimate the NIR. This paper estimates the NIR by applying historical average and filtering methods.

In order to estimate the NIR for all the relevant real interest rates (91-day treasury bill, repo, reverse repo, 30-days Bangladesh Bank bill, call money rate and bank deposit rate, bank lending rate, 5-year and 10-year treasury bonds), the paper divides the whole sample period into two sub-sample such as:

i) July 2006 to December 2011, and
ii) January 2012 to June 2018

based on negative and positive mean as shown in Chart-7. It is seen from chart-7. The mean of the different real interest rates (inflation-adjusted) are quite different and diverse across the different sample period. For example, during July 2006-December 2011, mean of the real repo and deposit interest rates are negative while they are positive from January 2012 to June 2018.

The estimated NIRs for different countries are shown in Table-1. The most notable finding from the survey of articles is that the estimates of the natural interest rates never turned negative. So the estimated neutral interest rate is expected to be a positive number. Moreover, the report of the expert committee to review and strengthen the monetary policy framework for India recommended adoption of a simple policy rule defined in terms of a real policy rate which should be positive, on average, when inflation exceeds the inflation target, and the Monetary Policy Committee (MPC) should decide the magnitude by which it may be positive. This finding is qualitatively in line with the findings of Laubach and Williams (2003), who also find a positive natural interest rate.

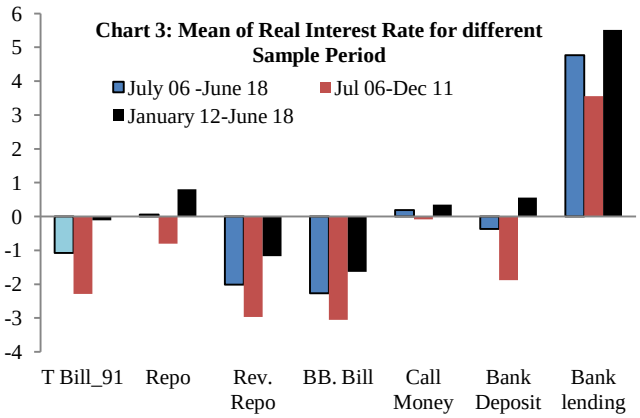
Chart-3 shows that the average real interest rates of all the variables (except lending rate) were negative within July 2006 and December 2011. On the other hand, it is found that during January 2012 to June 2018 the average real interest rates of repo, call money, deposit and lending rates were positive. Thus, the paper considers the positive variables i.e. repo, call money, deposit and lending rates for the period from January 2012 to June 2018 to estimate the NIR for Bangladesh. For estimating the NIR using the historical average method, the average of the positive real interest rates of repo, call money rate, bank deposit, bank lending rates over a business cycle have been considered. The average would, therefore, give us an estimate of the NIR for respective instruments.

Another simple method often applied for assessing the changing level of the neutral rate is the use of univariate filters for extracting the trend from the real interest rate. In this paper, Hodrik-Prescott (HP) filter is applied to different real interest rates.

5. Results and Findings

5.1 Historical Averaging Method:

To estimate the NIR by the historical average method the paper first compute the cycle-specific mean of the real interest rates of repo, Call money, bank deposits and Lending rate. The chart 4-7 show that the cycle mean for repo varies from 0.94 percent to 2.87, for call money rate the cycle mean varies from 1.75 percent to 2.36 percent, for bank deposits the cycle mean varies from 0.90 percent to 1.86 percent and for lending it varies from 4.79 percent to 5.51 percent.



Sourse:Estimate of the authors.

Table 2: Estimated Neutral Interest Rate (%)

Name of Variable	Historical Average	HP Filter
Repo	0.94-2.87	0.76
Call Money	1.75-2.36	-2.13
Bank Deposit	0.90-1.86	-0.59
Bank Lending	4.79-5.51	3.77

Source: Estimate of the authors.

5. Results and Findings

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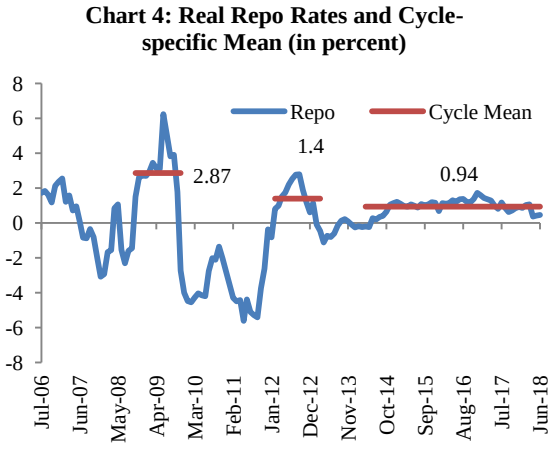


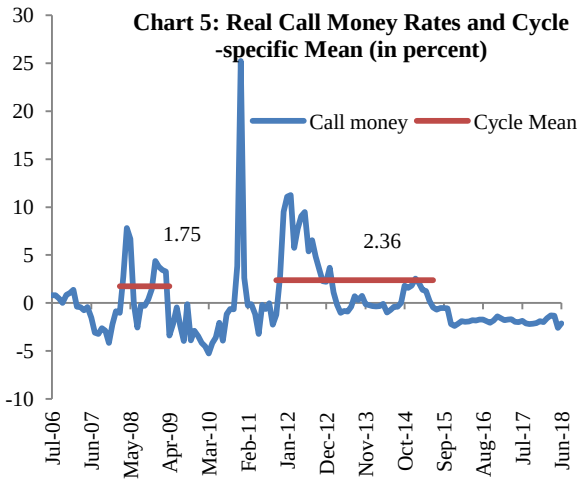


Chart 7 : Real Lending Rates and cycle-specific mean (in percent)

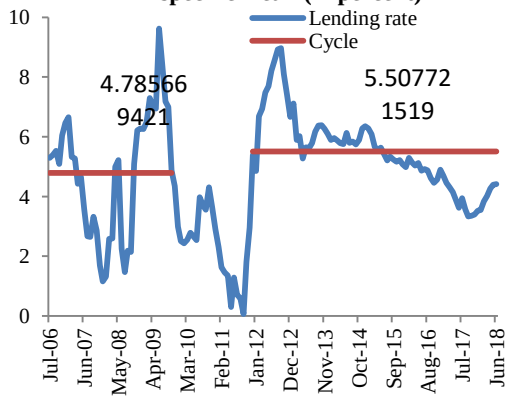
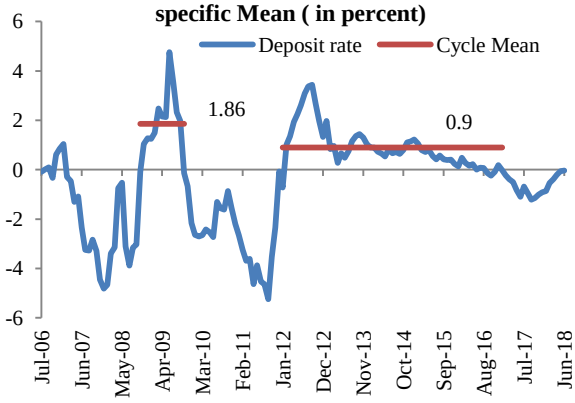


Chart 6: Real Deposit Rates and Cycle - specific Mean (in percent)



5.2 HP method:

Hodrik-Prescott (HP) filtering method applied on real interest rates of different instruments (repo, call money, deposit and lending) are presented in Table-2 and chart 8-11. All of the rates show a similar pattern. NIR for Repo, was -1.32 percent in January 2012 and 0.76 percent in June 2018. Call money neutral rate was -1.74 percent in January 2012 and -2.13 percent in June 2018. Bank deposit neutral rate was -0.48 percent in January 2012 and -0.59 percent in June 2018. Bank Lending neutral rate was 4.78 percent in January 2012 and 3.77 percent in June 2018.

Chart 8:Actual and Neutral Repo Rates (in percent)

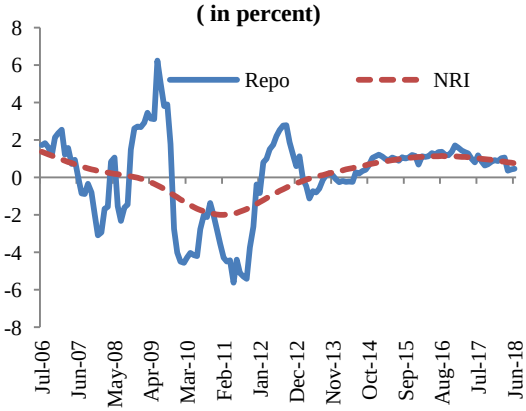


Chart 9 : Actual and Neutral Call Money Rates (in percent)

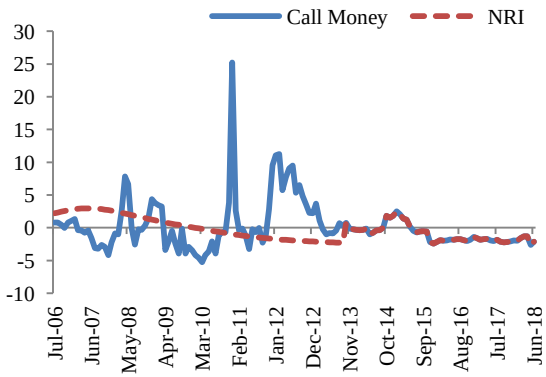


Chart 10 : Actual and Neutral Deposit Rates (In Percent)

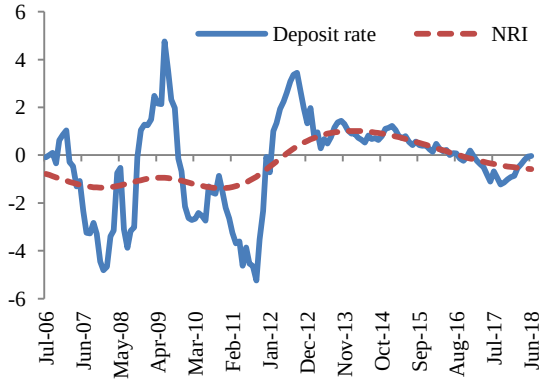
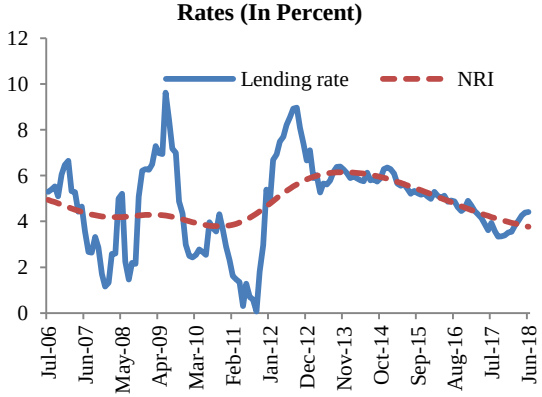


Chart 11: Actual and Neutral Lending Rates (In Percent)



6. Evaluating the Stance of Monetary Policy in Bangladesh

Each of the variables, (repo, call money, deposit, and lending) is associated with different neutral interest rate. Among these, the choice of interest rate to evaluate the stance of monetary policy depends upon which interest rate is used as a policy rate. There are cross country differences in what is used as the policy interest rates. Bangladesh Bank considers repo as the policy interest rates. So, the study focuses on the neutral repo interest rate and its divergence from the real repo rate to evaluate the stance of monetary policy.

Chart 12: Interest Rate Gap of Real Repo (Percentage Point)

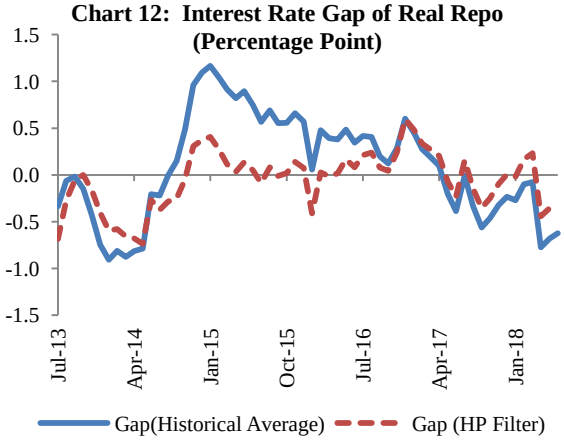


Chart 13: Actual and Neutral Repo Rates (In Percent)

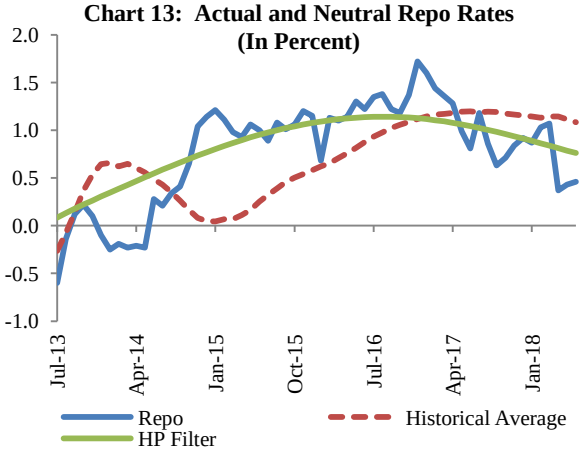


Chart-12 shows the interest rate gaps i.e., 24 months moving average real repo rate minus NIR estimated applying two alternative approaches, yield largely similar results. The interest rate gap narrowed, particularly for the last few years, displaying the preciseness of the two measures. Chart-13 presents the neutral repo rate estimated adopting two different statistical techniques against the 24 months moving average real repo rate to get an idea about the stance of monetary policy. Chart-13 shows that even the average real repo rate has some fluctuations; it is fairly consistent with the estimated NIR for repo and broadly following the movements of it. NIR for repo was increasing through FY15-16 because of the high demand for investment and average real repo rate track the neutral rate. The

NIR was slowing down after FY17 because of the moderate demand for investment as a contagion effect of the global slowdown.

Moreover, both the estimates of NIR suggest that the real repo rate was below its natural counterpart for an extended period suggesting the accommodative stance of monetary policy pursued by Bangladesh Bank for the last five years. Especially, in the recent time (from the start of FY18) real repo rate came down below the NIR. This finding suggests that monetary policy was not tight enough and the policy stance remained accommodative in the recent period. With an accommodative policy stance, the most favourable information for the policymakers is that the monetary policy has the scope to adopt a higher repo rate to rein any inflationary pressures in the near future.

7. Conclusion

The estimated results show that the monetary policy stance remained accommodative, as the repo neutral rate remained below the average real repo rate, for most of the period under review. Particularly in the recent period, the accommodative monetary policy stance of Bangladesh Bank evidenced a clear interest rate gap between neutral repo rate and the average real repo rate that turned negative. The low level of interest rates experienced in recent times is largely attributable to a reduction in the neutral rate of interest, which reflected cautious behavior on the part of households and firms. The monetary policy stance was seen to be very close to the neutral rate in the recent times which suggests that the monetary policy adopted by Bangladesh Bank largely accommodated the decline in the neutral rate in order to mitigate the adverse effects of the financial crisis. The neutral rate of interest was falling recently and hencethe lowering of the repo rate can be considered to be consistent with the recent economic situation. Looking ahead, the study expects the temporary headwinds on investment to abate as the economy returns to its trend growth trajectory and the neutral rate to return closer to historical levels.

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Movements of Residential Prices in Bangladesh: An Empirical Analysis

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Abstract

The objective of the study is to examine the movements of residential prices in Bangladesh by calculating a residential price index (RPI). The study calculates a residential price index by using secondary data on residential price of Dhaka city for the period 1998Q3-2019Q2 on quarterly basis. Monthly data on residential price transactions was collected from Delta Brac Housing Finance Corporations Limited (DBH) for Dhaka, Chattogram and Sylhet Cumilla and Noakhali. We calculated RPI for Dhaka city although we have collected data from three other cities, as the data for Dhaka city cover 90 percent of the whole data set. The RPI has been estimated by applying weighted average and hedonic regression methods. The estimated index shows that the movement of RPI of Dhaka city was increasing till 2012Q3, declined after 2014Q3 and started to increase after 2017Q3 till 2018Q2. Afterwards, the price index fell down and showed a stable trend. The index shows an upward and less fluctuating trend in hedonic regression method (time dummy moving average) as this method includes several characteristics other than price. While flat sale increased since 2003 to 2010Q1, flat sale decreased significantly ater 2019Q4 caused by a slump in economic activities since the COVID-19 pandemic emerged. The result also shows that price of large flat is higher than small and mediam and flat sale of medium size is higher (60%-65% in total sale) than that of small and large. The findings of the study may be useful for the policy maker in formulating suitable housing policies and urban planning strategies.

Keywords: Property Price Index, Real Estate Market in Bangladesh.

JEL Classification: R31

Introduction

Property price has appeared as a leading indicator for real economic activities and macro-prudential measures since global financial crisis of 2007-09 in both advanced and emerging market economies. House price indices are used as a benchmark by property owners and by investors as a means to compare average returns on property and alternative assets such as stocks and bonds. In addition, it has a number of important uses: i) as a macro-economic indicator of economic growth; ii) for use in monetary policy and inflation targeting; iii) as an input to estimate the value of housing as a component of wealth; iv) as a financial stability or soundness indicator to measure risk exposure; v) as a deflator of the national accounts; and vi) as an input for consumer prices. Thus, the importance of tracking real estate prices is well appreciated by the policymakers and regulators all over the world (Eurostat, 2013).

[12] The authors are Deputy General Managers of Monetary Policy Department, Banking Regulation and Joint Directors of Monetary Policy Department, Bangladesh Bank, respectively. The views expressed are authors' own and do not reflect that of Bangladesh Bank. We would like to extend special thanks to Delta Brac Housing Finance Corporations Limited (DBH) for their data support. We would also like to express gratitude to Dr. Akhtaruzzaman Director General, BIBM, Asish Kumar Dasgupta Executive Director (Research) and Dr.Faisal Ahmed former Chief Economist of Bangladesh Bank, for their valuable comments. Comments are welcome; email to: nur.begum@bb.org.bd

In recent times academics and policymakers became concerned about the nature of property price dynamics and its role in maintaining financial stability as well as price stability. . Policy makers need to identify the sources and nature of property price fluctuation in order to maintain price stability (R. Heath 2003). Moreover, it is crucial for formulating monetary policy, financial regulatory purposes and financial stability (Gerlach, 2012). The IMF proposed a set of Financial Soundness Indicators which includes real estate prices, and the ratios of residential real estate loans and commercial real estate loans to total loans (IMF, 2003).

The property price affects the economy through three main channels. First, property prices affect private consumption through their impact on household wealth. Second, it affects housing investment and the construction industry, which tend to have relatively huge multiplier effect in the economy. Finally, these channels tend to be reinforced through the financial accelerator effect, as real estate use as collateral, thereby also affect the banks' balance sheet and their willingness to extend credit to the real economy (Brian Micallef 2017). Therefore, in order to understand the price behavior of real estate market and its impact on the economy it is important to get a reliable house price movement.

Real estate sector is a big driver of economic growth as this sector has enormous multiplier effect on economic activities Besides real estate market, this sector also stimulates demand for its backward and forward linkage industries. Moreover, the real estate now provides a sound platform of employment for engineers, architects and designers (M Siraj 2016). It is one of the largest employment-generating sectors after agriculture and readymade garments. Most of the labour force engaged in the construction sector serve the real estate sector since the real estate sector is a major part of the construction sector. According to the Labour Force Survey 2017, of Bangladesh Bureau of Statistics (BBS), 2.1 per cent of the labour force was engaged in this sector in FY00 which stood at 5.5 percent in FY17.

Over the last few years, this sector has showed as a vital role in the national economy, on an average around 8 percent of GDP (Appendix Table-2) and this sector along with its backward and forward linkage industries contributed about 12-14 percent. Additionally, every year this sector directly adds to the government revenue (in the form of VAT, registration fee, utility fee etc) on an average nearly Taka 500 cores (REHAB, 2012). The performance of the real estate sector is difficult to gauge as information scarce and many transactions are kept confidential. According to REHAB, 35 lakh people are engaged in this sector, where 269 backward linkage industries are also associated. Besides, more than 100,000 architects, graduate engineers, diploma engineers, management professionals and skilled manpower and 50 million workers are providing labour in this sector (The financial express May, 2019). In addition, currently demand for housing is highest in Dhaka city, as a result 98% of real estate developer companies operate in Dhaka and only 2% have operations outside Dhaka (Prothom alo, January 2019**).** If this sector affected severely, there will have a negative impact on its linkage industries as well as on the overall economy in the long run. Therefore, considering importance of the real estate prices on real economic activities and macro-prudential regulations we attempt to calculate a residential price index (RPI) for Bangladesh real estate sector.

The remainder of the paper is organized as follows: Following the introduction in section I, review of literature is given in section II. Section III explains the data and methodology. Section IV the development of real estate sector in Bangladesh and analyzes the estimated property price index. Finally, section V concludes the paper.

Section II: Review of Literature

Many studies attempted to analyze property price index in developed and emerging market economics. Some relevant studies in this respect are summarized below:

Reserve Bank of India (2012) calculates quarterly house price indices for nine major cites as well as at all-India level. The index is based on the official data received from registration authorities of respective state governments

on property transactions for the period 2009-2012 (base Q4:2008-09=100). The index is computed by weighted average Laspeyres method based on transaction price, where transactions are stratified into three categories, viz. , small, medium and large houses. It is observed that the annual average house price increase is around 20 per cent during the last three years. House price on an average during the past three years up to Q4:2011-12 has increased by 77 per cent. RBI (2014) also estimates quarterly HPI (base: 2010-11=100) compiled for ten major cities and different size classes for the period Q1:2010-11- Q4:2013-14. Data source and methodology are the same as mentioned above. Trends in the HPI revealed that the house price increase in the small and medium size category has moderated more sharply compared to the large size category.

Singh (2015) explains the experience of HPI in India. In India, National Housing Bank (NHB) and Reserve Bank of India (RBI) construct and release an index, RESIDEX and HPI, respectively by using Laspeyres weighted average method. RESIDEX Measure residential price changes in India and Reserve Bank compiling HPI (the data on the registration of transactions of properties including shops, land and residential houses). RBI's HPI covers all residential properties that are officially registered in the nine cities. RESIDEX covers price movement of residential properties by size and location of the dwelling units (location wise, zone wise and city wise) in 26 cities. Trends in house prices shown by these two indices do not follow uniform pattern.

Norshazwani et al. (2012) calculate the hypothetical house price index for Malaysia by using hedonic method during 2005-2012 on quarterly basis. The hypothetical price index shows the same trend as computed by the Malaysian House Price Index (MHPI). Only at certain quarters, the index is different. It might be due to the different sample of data.

Camilo Vio (2011) estimates the Chilean Residential Property Price Index (RPPI) during 2000-2011. Data collected from the Internal Revenue Service. The estimation applies methodologies based on mix adjustment stratification, hedonic model and repeat sales method. The results for the three methodologies annual growth shows increasing trend over time and same pattern. The results are still preliminary and do not constitute an official statistic of the Central Bank of Chile.

Assil (2012) computes the real estate price index (REPI) for Morocco which was jointly constructed by Bank Al-Maghrib and the Land Registry Office during the period 2006-2012. Quarterly index (base year: 2006) are calculated by repeat-sales method. This method take into account only the properties sold at least twice during the period under review. The REPI capture changes in residential property prices nationwide, by region and by major cities in the three major types, namely residential property, urban lands and commercial property. The real estate price index in Morocco, year on year, revealed that between 2006 and 2008, property prices have registered an upward trend. Thereafter, prices began a downward trend until the first quarter of 2010. From the second quarter of 2010, prices have rebounded.

Anton et al. (2016) estimate real estate price index for Barbados by using median price index (base year 1995). Data collected from land registry and revenue authority (land transactions, properties transactions). The results shows that residential real estate prices rose rapidly during 2000s and also rose immediately in 2009 and afterwards, prices have started to fall.

Many Asian countries like India, Thailand, Mongolia, China, Philippine and Vietnam have started to calculate PPI (Appendix Table-1). However, no initiative has been taken for calculating property price index in Bangladesh. To fill this gap Bangladesh Bank has undertaken an arrangement to calculate property price index. In this paper we have attempted to find out the development of present scenario as well as price movement in the real estate sector in Bangladesh. We think that the findings of the study may give some policy indications.

Section IV: Data and Methodology

Although the information on residential prices in Bangladesh is not available due to lack of transparency in the residential property market, we calculated residential price index for Dhaka city as it covers 90 percent of whole data set. Secondary data has been used for the period 1998Q3-2020Q2. Monthly data have been collected from Delta Brac Housing Finance Corporations Limited (DBH). The price indices have been calculated by applying weighted average method and hedonic regression method.

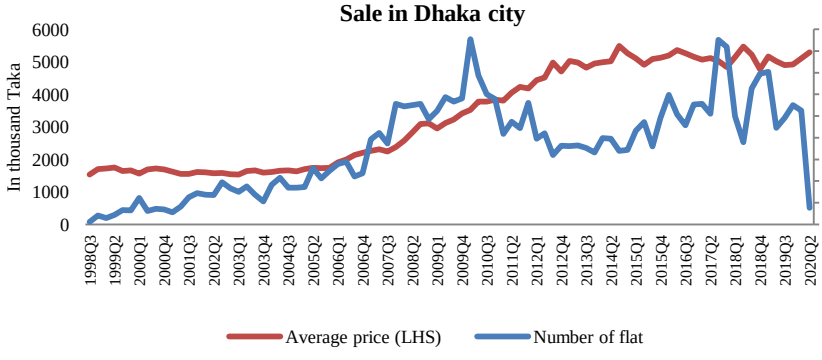
We calculate residential property price index to examine the relationship between the property price and a host of relevant variables. To calculate residential property price index we employed weighted average methods (Laspeyres) and the hedonic regression method (base: 2004Q1=100) for the period 1998Q3-2020Q2 and calculated index on quarterly basis. We segregated data by different dimensions- area wise (8 areas) and size wise (small, medium and large) for Dhaka city. Weighted average method include only flat price (quantity considered as weight).

Conversely, hedonic regression method (time dummy moving average) considers price (Natural log) as dependent variable with size (small, medium and large) and area as independent variables, as they influences house price. We used 35054 observations for whole data and 31602 observations for Dhaka city which cover 90 percent of whole data set. Daily data of residential price transactions have been collected from Delta Brac Housing Finance Corporations Limited (DBH). Each of the transaction was for flat size 500 per sqf and above and price above Tk.500 per sqf.

Section III: Development of Real Estate Sector in Bangladesh and Analysis of the Results

The real estate sector in Bangladesh has expanded over four decades. Meanwhile, the real estate business has been flourishing in Dhaka city and achieved remarkable growth (Appendix Table-2). The average price of apartment in Dhaka city has started to increase since 2006 till 2012Q3 (Chart-1). The price movement increased but fluctuating during 2012Q4 to 2014Q3. Afterwards, flat price declined may be due to most of the developer decreased flat price about 15-20 percent during the period to boost up the sale of flat. It started to increase after 2017Q4 which continued upto 2020. It may be noted that the flat price was increased 3 fold in 2020 compared to 2000 as a result of significantly rising price of construction materials, land price and registration cost (Appendix Table-3). At present registration cost is 10 percent in Bangladesh which was 14 percent and the registration cost is still higher than that of other Asian countries (Appendix Chart-1). If the registration cost is brought down to 5-6 percent, government will get higher revenue, and VAT collection from this sector will also increase. However, flat price decreased slightly after 2018Q2 and the market started to stabilize. This stability was good for the sector and the buyers gradually returned to the market.

Chart-1 Movement of Average Flat Price (per sft) and no of Flat Sale in Dhaka city



Source: Delta Brac Housing Finance Corporations Limited.

On the other hand, flat sale increased since 2003 to 2010Q1. It may be mentioned that the flat sale increased 8 fold in 2010 compared to 2000 due mainly to during the period a significant number of the buyers were non residence Bangladeshi and foreign remittances have been a major source for apartment purchase. Most of the surveys indicate that after food, the second most important use of remittances is the home construction (Murshid et al. 2002). Besides, Bangladesh Bank started refinance scheme for real estate sector in 2007 and 2008 and house finance facility raised at a maximum limit of Tk.10 million in 2010 from Tk.7.5 million in 2004. After 2010 flat sale fell significantly mainly due to discontinuation of Bangladesh Bank's refinance scheme in 2011, liquidity crisis in the banking sector, stock market crash, declining trend of remittance growth, political unrest and disruption of gas supply connection in the new apartments. In addition, house finance facility provided at a maximum debt equity ratio of 70:30 in 2012 from 80:20 in 2004. However, flat sale regain after 2015Q3 and continued up to 2017Q3 as a result of turn down of flat price, lower return on fixed and saving deposit and house finance facility by the Bangladesh Bank increased at a maximum limit of Tk.12 million in 2015. Flat sale decreased drastically after 2017Q3. At the beginning of 2018, the government declared housing loan facility of Tk 30-75 lakh to its employees with 5 per cent interest rate instead of Tk 120,000 with 1.2 per cent interest rate as home loan to its employees since in 1982 which was implemented from FY19 (The new age Bangladesh August 2018). After 2019Q4 flat sale fell down significantly due to COVID19 pandemic situation.

Size wise flat price indicate that (Small: 500sqf-1000sqf Medium: 1001sqf-1800sqf Large: Above 1800sqf), price of large flat is higher than small and mediam (Chart-2). Reason behind the high price of large flat is that most of the large flate located in Banani, Gulshan, Baridhara or Dhanmondi area where land price is high (Appendix Table-3) and the facilities of large flat is better than that of small and medium size flat. From Chart-3 it is evident that sale of medium size flat in Dhaka city is higher than that of small and large. There are some socio-economic reasons behind the strong demand for the medium size flat. The most important one is the change in family structure and income level. Besides, Bangladesh Bank started to refinance scheme of Tk. 15 lakh (up to 1250 per sq-feet) for real estate sector in 2008 which meet up of housing demand for middle income group people. It is noted that, share of medium size flat sale stood highest (60%-65%) in total flat sale (Appendix Chart-2).

Chart-2 Movements of Size -Wise Average Flat Price (per sft) in Dhaka City

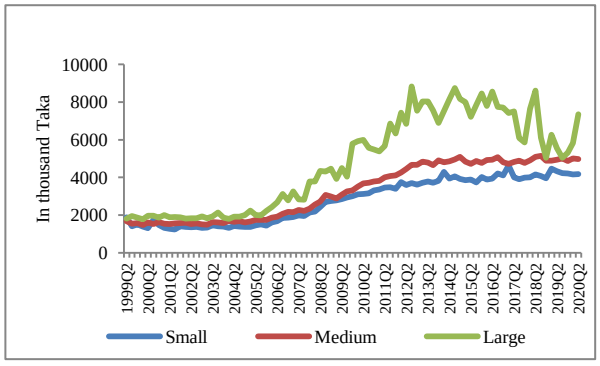
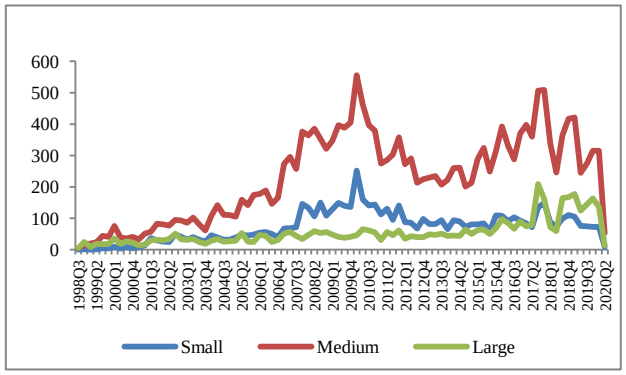


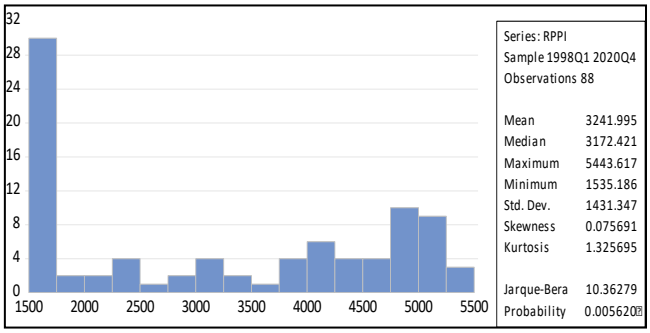
Chart -3 Movements of Size-Wise Flat Sale in Dhaka City



Source: Delta Brac Housing Finance Corporations Limited.

Chart-4 represents the descriptive statistic of average price. It is clear from the chart that the data set is not normally distributed[13] (the data are normally distributed, if the probabilities > 0.05, kurtosis equal to zero and skewness equal to 3 of a data set). Chart-5 gives a picture of the coefficient of variation of average price of Dhaka city[14]. The data set have low variance as the coefficient of variation is less than one. The coefficient of variation shows the normalized volatility which implies that house price has not fluctuated much over the years.

Chart-4 Descriptive statistics of all data set



Source: Delta Brac Housing Finance Corporations Limited and author's calculation.

Chart-5 Coefficient of variation of average price of all data set

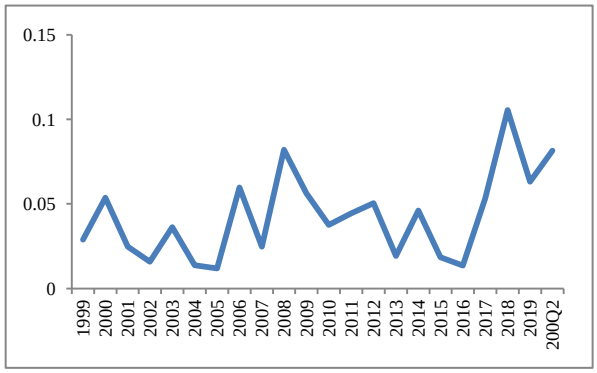
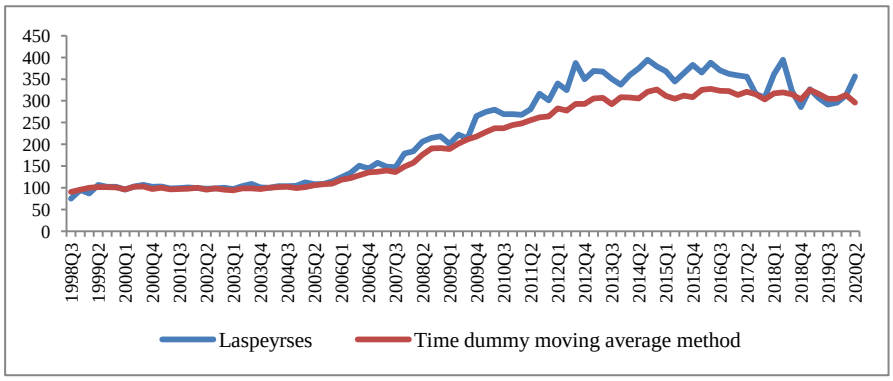


Chart-6 depicts the comparative position of residential price index of Dhaka city in weighted average (laspeyres) and hedonic regression method (time dummy moving average) methods. The Chart shows that the movement of price index (laspeyres method) was increasing till 2012Q3 and after that it was fluctuated. However, the price index show upward and less fluctuating trend in hedonic regression method (time dummy moving average) as this method includes several characteristics other than price. In this method we consider per square feet price (Natural log) as dependent variable and size (small, medium and large) and location as independent variables, as they influences house price.

Chart-6 **Movements of RPI in Weighted Average (Lasyperes) and Hedonic Regression Methods (Base: 2004Q1=100) of Dhaka City**



Source: Delta Brac Housing Finance Corporations Limited, authors' calculation.

[13] As the sample size increases, normality parameters more restrictive and it becomes harder to declare that the data are normally distributed. So for very large data sets, normality test becomes less important (webspace.ship.edu/pgmarr/geo441/lecture).

[14] The **coefficient** of **variation** is a measure of spread that describes the amount of variability relative to the mean. The coefficient of variation (CV) is defined as the ratio of the standard deviation/mean. Distributions with CV < 1 considered low-variance, while those with CV > 1 high-variance.

Section V: Conclusion

The objective of the study is to calculate residential price index in Bangladesh. Secondary data on residential price for the period 1998Q3-2020Q2 have been used for the study. The RPI calculated in the study captures the quarterly movement of residential prices in Dhaka city. The residential price index showed an increasing trend over the period but declined after 2014Q3 and started to increase after 2017Q3 till 2018Q2. Afterwards the price index fell down and show stable trend till recent time. It is worth mentioning that these indices are estimated by using data obtained from a single financial entity (DBH) and the data covers for only Dhaka city. Hence, the estimates give a partial picture of residential price dynamics scenario, which is a limitation of the study. Further research will be left by covering more cities extensively.

The study also finds out that the flat sale increased since 2003 to 2010Q1. It may mentioned that the flat sale increased 8 fold in 2010 compared to 2000. After 2010 flat sale draw down significantly. Flat sale regain after 2015Q3 and continued upto 2017Q3 as a result of turn down of flat price. Flat sale decreased drastically after 2017Q3. Meanwhile, at the beginning of 2018, government declared special home loan facilities at a 5 percent interest rate to its employees. As a result, flat sale increase after 2018Q2 but after 2019Q4 flat sale fell down significantly due to COVID-19 pandemic situation. Additionally, the study shows that price of large size flat is higher than small and medium size and medium size flat sale stood highest (60%-65%) in total flat sale.

The real estate sector has affected severely in the recent pandemic period. To breathe life into the country's housing sector some initiatives such as- the opportunity at a 5 percent interest rate is given to a flat buyer; it would be benefited for the middle class buyer to buy a flat and increasing the ceiling of home loans from existing amount will also facilitate middle-class consumers to invest in real estate. Besides, interest rate on flat loan from financial institutions should reduce which is now 11%-12%. In addition, decentralization of residential areas is needed to make the market sustainable and to create new buyers for the industry growth.

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Appendix

Table-1 Cross Country Comparison of HPI Calculation

Country	Method	Frequency	Starting Year	Data Source
India	Laspeyres	Quarterly	2003	Registry office, BFIs and survey agencies.
Thailand	Average, Stratification, hedonic	Quarterly	2009	Real estate information centre and the govt. housing bank.
Mongolia	Average, hedonic	Quarterly and monthly	2008 & 2013	Real estate agencies.
China	Average	monthly	2011	Ministry of housing and survey office of national bureau of statistics.
Philippine	Sales Price Appraisal ratio	Quarterly	2015	Central Bank of the Philippines Quarterly Report on Residential Real Estate Loans.
Vietnam	Laspeyres	Quarterly	2015	Survey based.

Source: Workshop held in STI in March, 2017.

Table-2 Sectoral Share of GDP and Sectoral growth

	Sectoral Share of GDP		Setoral Growth	
Year	Construction sector	Real estate, renting and business activities	Construction sector	Real estate, renting and business activities
FY99	7.7	9.1	8.9	3.8
FY05	9.0	8.1	8.3	3.7
FY10	6.7	7.6	7.2	3.9
FY14	7	7.0	8.1	4.3
FY17	7.4	6.5	8.8	4.8
FY18	7.5	6.3	9.9	5.0
FY19	7.6	6.1	9.6	5.5
FY20[p]	7.9	6.1	9.1	4.9

Source: Annual Report, BB. Statistical Year Book 2018, National Account, May 2020, BBS. P=provisional.

Table-3 Construction Cost Index (Building)

(Base: 1998-99=100)

Year	General	Building Mat	Transport	Labour
FY03	114.27	113.36	116.94	116.94
FY06	129.41	128.64	132.29	132.6
FY09	214.06	201.58	488.29	221.46
FY12	321.01	268.46	1468.7	378.69
FY15	461.13	396.65	1720.25	538.33
FY 18	544.79	476.91	1909.77	609.13
FY19	572.58	501.25	1981.59	643.88
FY20	597.11	523.52	2044.72	671.8

Source: Statistical Year Book 2017, BBS.

Table-4 Average Land Price (Tk./Katha)

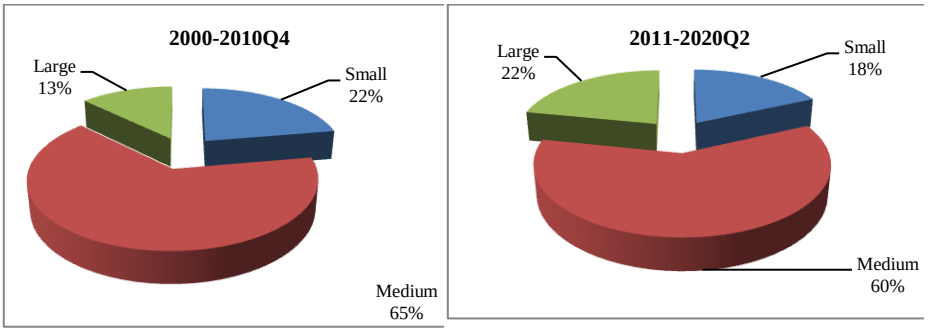
Location	**Year**					
	1975	**1990**	**2000**	**2010**	**2015**	**2020**
Baridhara	25000	600000	5000000	40000000	45,000,000	60,000,000
Gulshan	25000	600000	2200000	25000000	40,000,000	50,000,000
Banani	25000	600000	2000000	15000000	25,000,000	30,000,000
Mahakhali	25000	600000	1800000	12000000	13,500,000	15,000,000
Dhanmondi	25000	600000	2200000	20000000	35,000,000	50,000,000
Lalmatia	20000	600000	1800000	15000000	22,500,000	30,000,000
Azimpur	175000	600000	1600000	5500000	10,000,000	11,000,000
Mohammadpur	25000	500000	1200000	7000000	8,000,000	15,000,000
Shantinagar	20000	500000	1500000	10000000	11,000,000	12,000,000
Shamoli	17500	300000	1000000	4500000	5,000,000	6,000,000
Uttara	20000	300000	1000000	7500000	7,000,000	8,000,000
Gendaria	10000	400000	700000	3500000	4,000,000	5,000,000
Basabo	2000	300000	800000	3500000	3,500,000	6,000,000
Kollanpur	17500	300000	800000	3200000	4,000,000	5,000,000
Mirpur	10000	200000	700000	4000000	5,000,000	7,000,000
Badda	4000	200000	600000	3000000	3,500,000	5,000,000
Motijheel	50000	1200000	3500000	20000000	21,000,000	22,000,000
Kawran Bazar	41500	1000000	2500000	15000000	16,000,000	17,000,000

Source: Sheltech (Pvt) Limited.

Chart-1 Transaction Cost of some Asian Countries

Source: Global Property Guide , Financial Information for the Residential Property Buyer 2008.

Chart-2 Size wise share of flat sale in aggregate level during 2000-2000Q2



Source: Delta Brac Housing Finance Corporations Limited.

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