Adjusting the growth model to sustain its success

Bangladesh CEM External Consultation
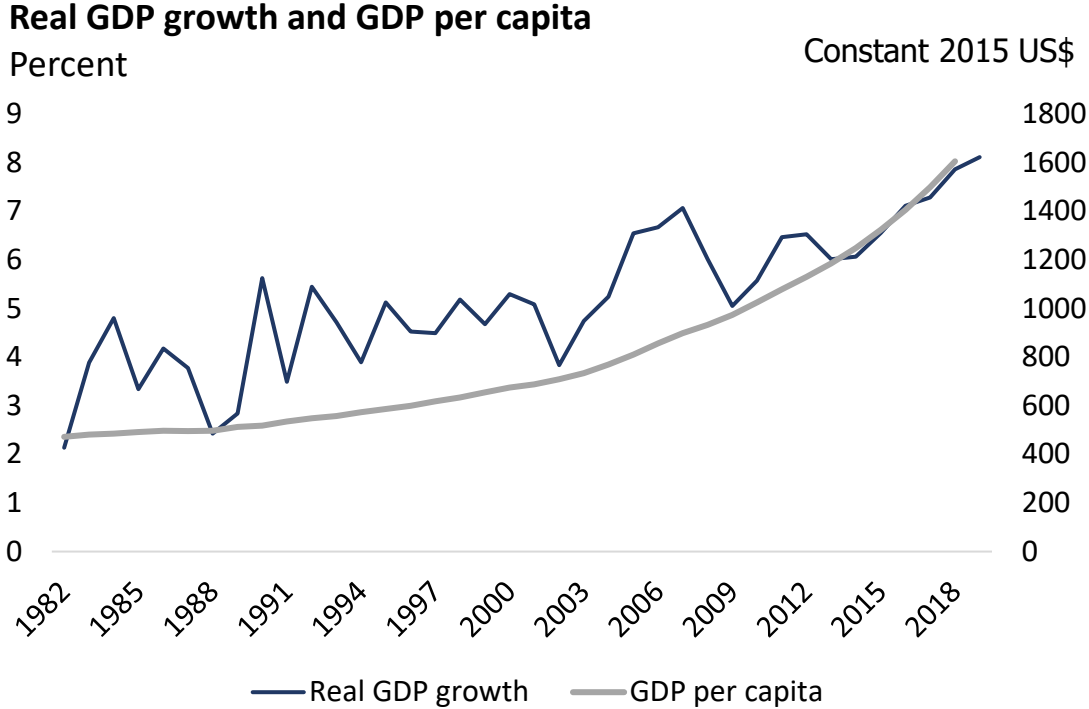
SANEM-World Bank Webinar

February 20, 2022

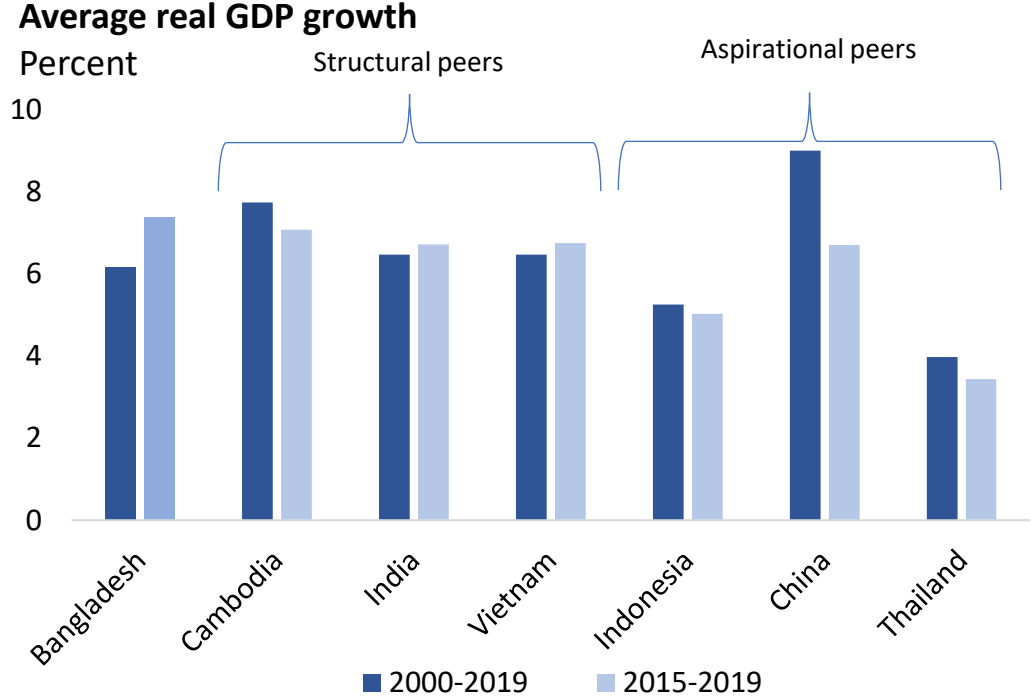rcmbeyer@worldbank.org

Bangladesh has been exceptionally successful.

Pre-COVID growth has been accelerating and compares favorably with peers.

Growth has been accelerating over time

Real GDP growth and GDP per capita

Percent — Constant 2015 US$

Source: WDI.

Growth has recently been higher than in any of the peer countries

Average real GDP growth

Percent — Structural peers — Aspirational peers

Source: WDI
Note: See details on peer selection in Appendix A.

- Bangladesh's economic growth rate over the last three decades has been one of the highest in the world: in real per capita terms it has been 4.0% per year on average, which puts it into the top decile of growth rates for this period and well above the 2% historical average which Summers and Pritchett (2015) find for all countries since 1950.
- As in most countries, economic growth translated into higher living standards with much improved social and health outcomes.

Structural transformation and productivity growth have continued.

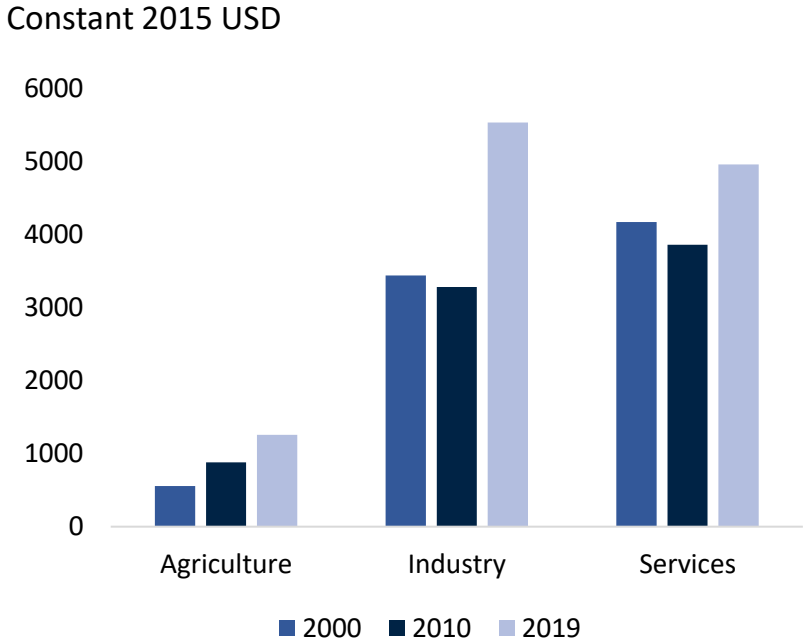## Employment is moving from agriculture to industry and services.

Total employment
Millions
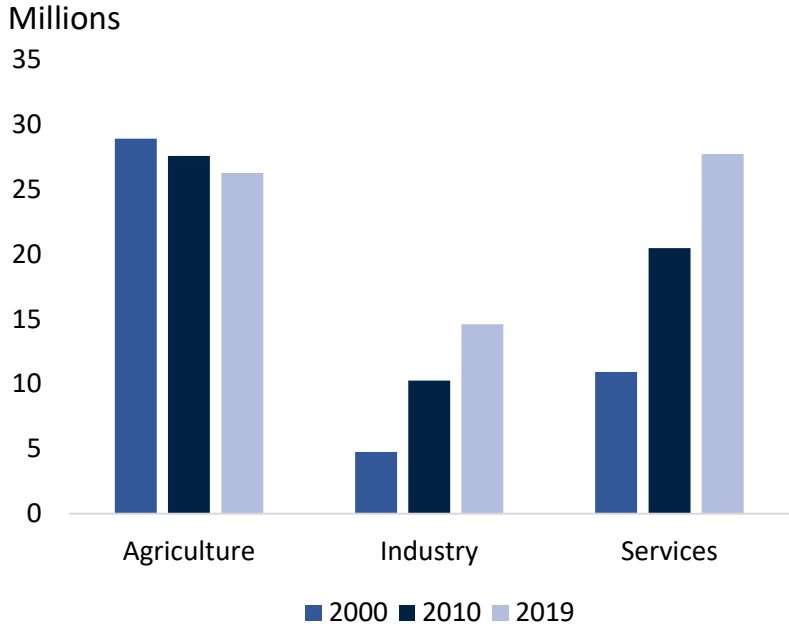
Note: Based on data from MPO, value added is measured as Gross Domestic Product (GDP) in constant 2015 USD.
Source: Macro Poverty Outlook.

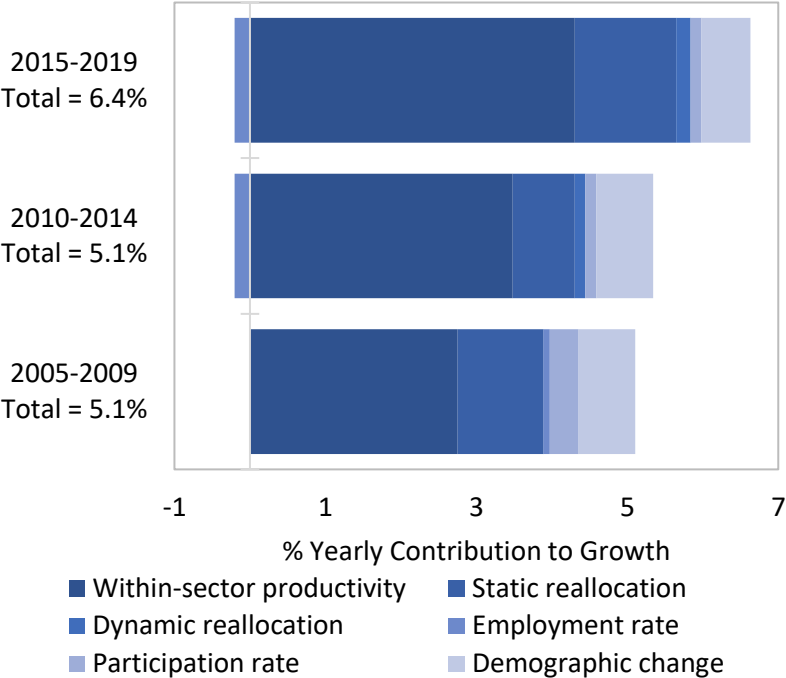## Value added per worker has been increasing fast in industry.

Value added per worker
Constant 2015 USD

Note: Total employment is sourced from the MPO, employment shares from the WDI based on ILO estimates. The working age population assumed to be ages 15-64.
Source: Macro Poverty Outlook and WDI.

Within-sector productivity growth contributed the most to growth of per capita value added

Decomposition of per capita Value Added

% Yearly Contribution to Growth

- Within-sector productivity
- Static reallocation
- Dynamic reallocation
- Employment rate
- Participation rate
- Demographic change

**Source:** World Bank Macro Poverty Outlook.

- With RMG exports increasing, light manufacturing created new and more productive jobs.
- With increased urbanization, employment in services increased.

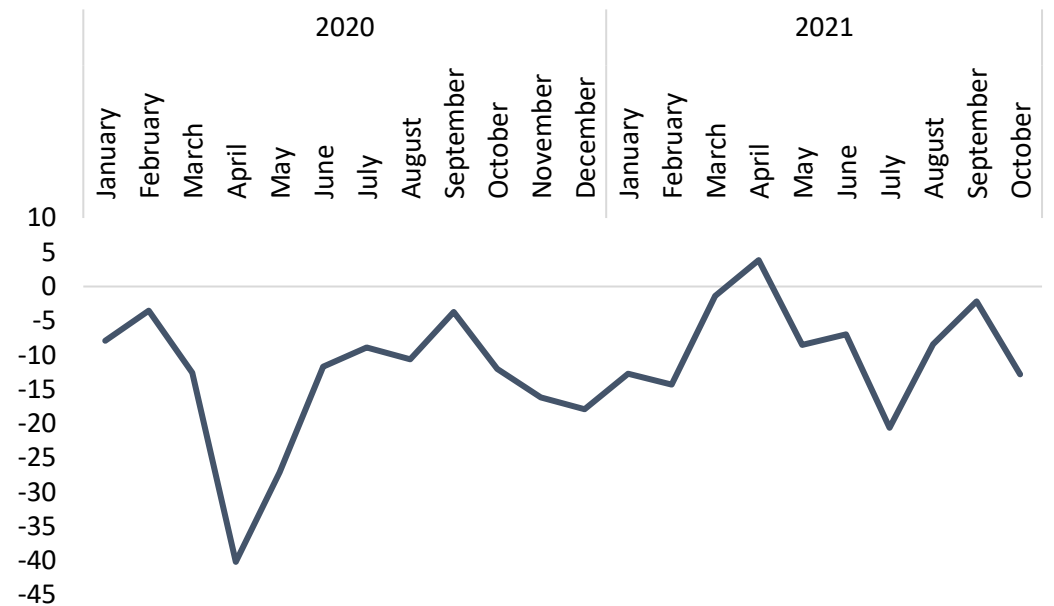# Bangladesh seems to weather the COVID-19 pandemic relatively well.

Activity Indicator for South and Southeast Asia
Index, Feb 2020=100

Legend: - - - Bangladesh — India — Indonesia — Thailand — Vietnam
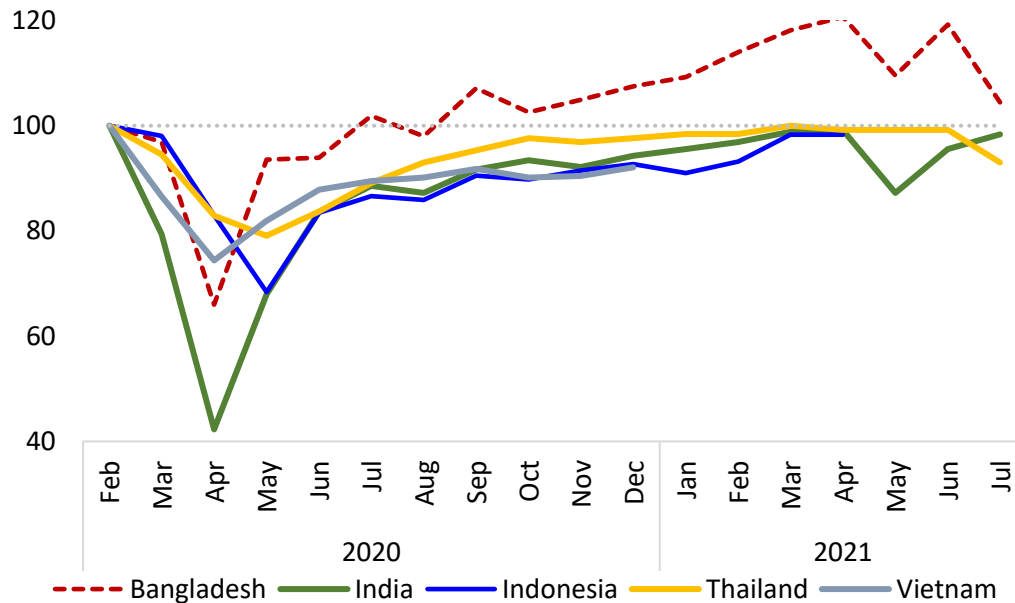
Deviation of electricity consumption from model prediction in Dhaka
Percent

Note: Activity indicator aggregates the Google mobility indexes for workforce, retail and recreation, industrial production, government tax revenue, merchandise export/non-oil export and merchandise import/non-oil import data for all countries. Electricity generation data is used for all countries except Indonesia. Non-oil export is added for Vietnam, India and Indonesia, while merchandise export is used for Bangladesh, Thailand, and Indonesia. Merchandise import data is used for Thailand, Vietnam, Bangladesh, and Indonesia, and non-oil import data for the remaining countries.

Sources: CEIC, Google mobility report, GEM, National Board of Revenue, Bangladesh Bank and Export Promotion Bureau and staff calculation.

Note: Estimated electricity consumption model explains the daily variation in consumption based on a trend, seasonality, within-week variation, holidays, Ramadan, and the temperature. Deviations from the model prediction acts as an indicator of economic activity. See details in Appendix B.
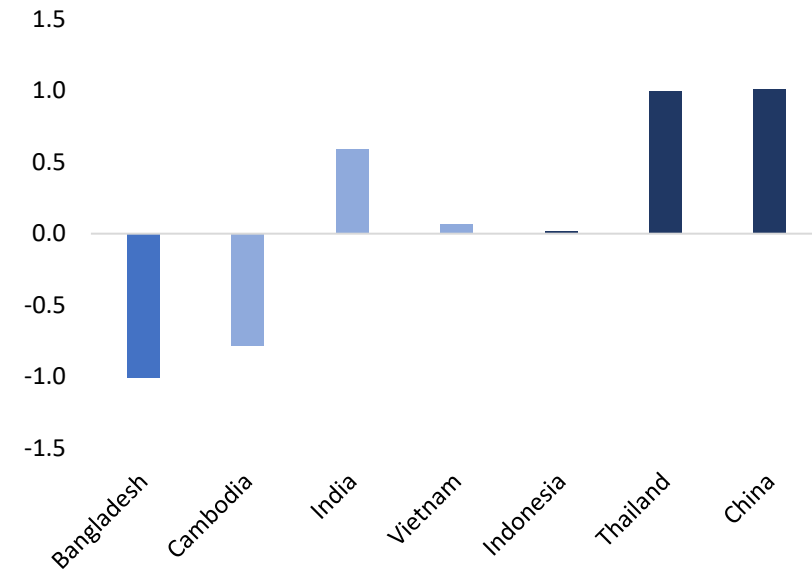
Sources: Arshad and Beyer (2021).

- There were sufficient policy buffers to support the economy strongly.
- Strong learning effects from the first lockdown.

The success is based on previous policy innovations and stability.

The success is difficult to reconcile with leading explanations of development.
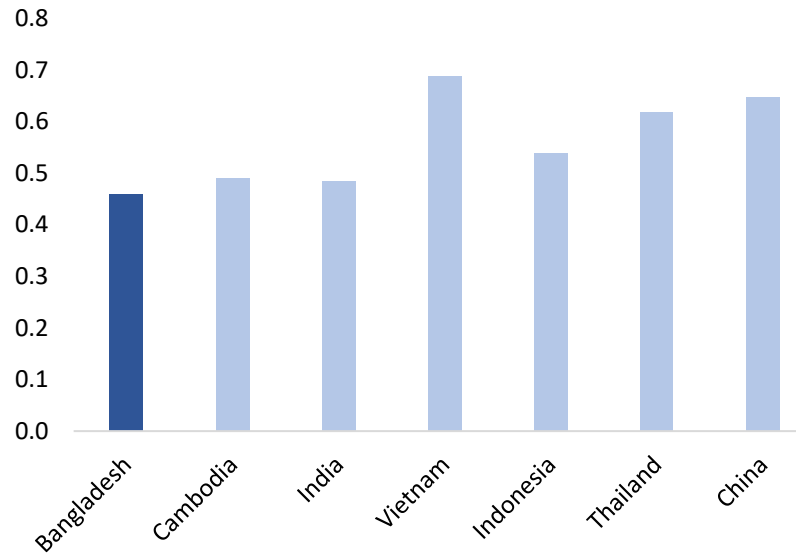
Economic Complexity Index, 2019

Note: Economic complexity is constructed using export data at the product-country level. The latest available data is for 2017.
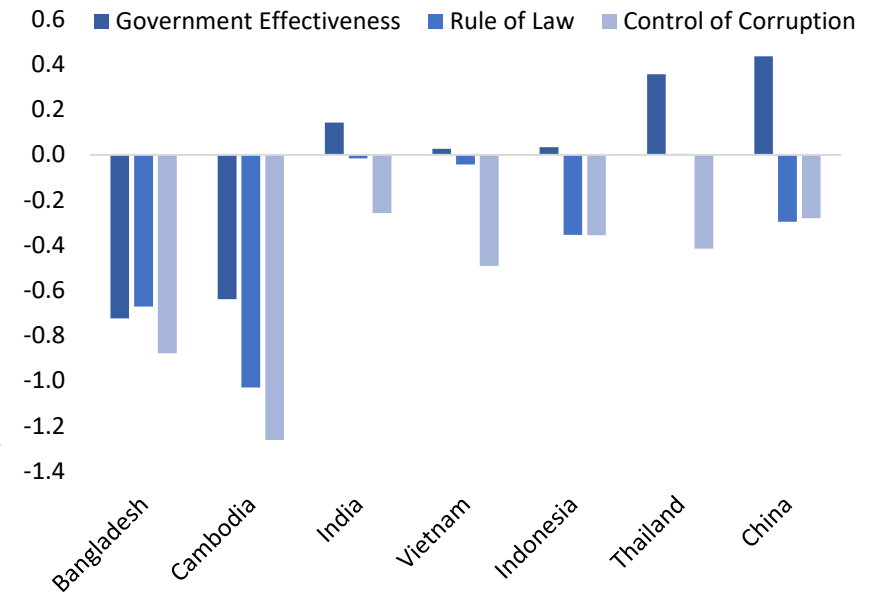**Source:** The Observatory of Economic Complexity.

- Like several other countries, particularly in East Asia, Bangladesh's development took place amid thriving exports, but its export structure is very concentrated in ready-made garments, a low-quality product.
- This conflicts with evidence emphasizing the role of export diversification (Imbs and Wacziarg, 2003; Cadot et al., 2013) and complexity (Hausman et al., 2007; Hidalgo, 2021) in macroeconomic development.

Human Capital Index, 2017

Source: Human Capital Project.

- Human capital has been low throughout Bangladesh's development. For example, only one in three children finished primary school in the 1980s. Even in 2020, after considerable improvements over time, its Human Capital Index suggests that a child born today can expect to be less than half as productive as a future worker as he/she would have been with complete education and full health, less than in Zimbabwe and Myanmar (Kraay 2019, World Bank 2021).
- This conflicts with the perception that human capital is an ultimate source of growth (Mankiw et al., 1992; Glaseser et al., 2004; Hanushek and Woessmann, 2015).

Governance Indicators Index, 2015-19

Source: Kaufmann and Kraay, Worldwide Governance Indicators.

- Institutional performance and governance are weak. In the 2019 Worldwide Governance Indicators, Bangladesh ranked only 151st in the world for rule of law (similar to Togo and Benin), 165th for government effectiveness (similar to Malawi and Djibouti), and 175th for control of corruption (similar to Gabon and Madagascar).
- This contrasts with ample evidence that conventional measures of institutional quality correlate strongly with income levels and development (e.g., Acemoglu et al., 2001).

Several studies have investigated specific factors and that may have contributed to Bangladesh's success.

- An incomplete list of studies have highlighted the importance of

  ➢ the export sector (Begum and Shamsuddin, 1998).
  ➢ the garment industry (Hausmann and Rodrik, 2005; Mottaleb and Sonobe, 2011; Ahmed et al., 2014; Kee, 2015) and its relationship with governance (Ahmed et al., 2014).
  ➢ foreign direct investment (Rhee, 1990; Kee, 2015)
  ➢ remittances (Siddique et al., 2012).
  ➢ infrastructure (Khandker et al., 2009; Khandker and Koolwal, 2010).
  ➢ female empowerment and broader social progress (Asadullah et al., 2014; Ahmed and McGillivrai, 2015).

- More policy-oriented and opinion pieces have echoed the importance of the latter (e.g. Basu, 2018) and put it into the broader macroeconomic context of public service provision (Subramanian, 2021).

- Beyer and Wacker (2021) attempt to contribute to the discussion by analyzing these aspects together in a comprehensive manner and comparative perspective.

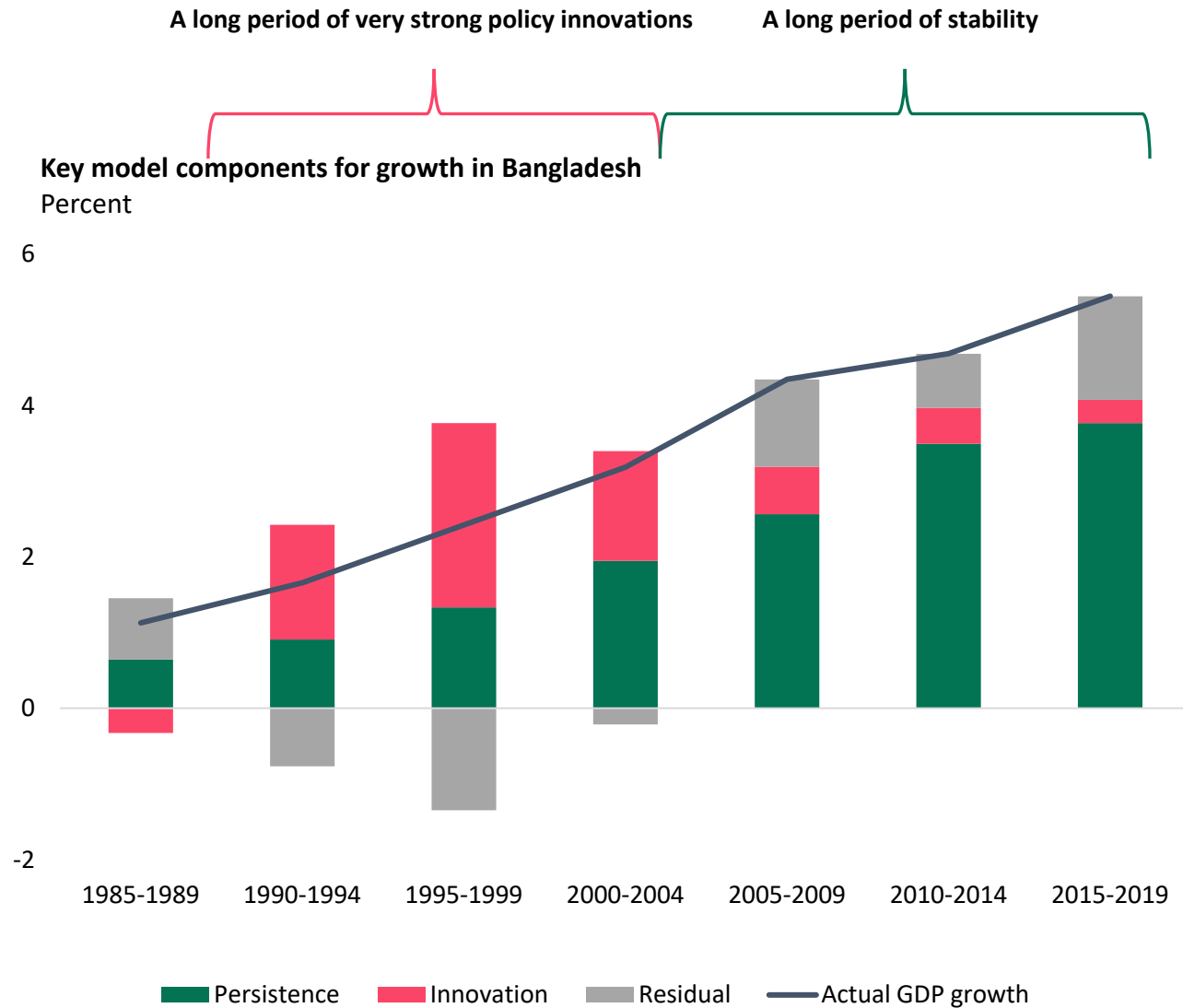# An econometric analysis of cross-country growth drivers: Introduction

- Cross-country growth regressions can offer relevant insights.
  - They can conceptualize the growth experience of countries and regions (e.g. Araujo et al., 2016, for LAC; Moller and Wacker, 2017, for Ethiopia; Geiger et al., 2019, for Ghana).
  - They can help better understand the role that individual growth drivers, e.g., the role of inequality (Berg et al. 2018, Brueckner and Ledermann, 2018).
  - Enthusiasm to explain deep ultimate drivers of growth has waned (Kraay, 2015), but more descriptive interpretation ("what have (fast-) growing countries done?) remains valid.

- Beyer and Wacker (2022) construct a new and up-to-date reference data set and provide different regression specifications to analyze correlates of economic growth.
  - The data and methodology largely build upon and update previous work of Araujo et al. (2016).
  - The unbalanced dataset covers the period from 1970 to 2019 for >135 countries.
  - Key data sources are the Penn World Tables, the World Development Indicators, as well as data from International Monetary Fund databases and from UNCTAD.
  - See Appendix B for a description of the methodology.

An econometric analysis of cross-country growth drivers: Results

Group	Specific variables	Baseline	No growth outliers
Trade and Globalization	Trade Openness	+**	+***
	FDI	+**	+**
	Export diversification	-	-
	Export diversification suqared	+	+*
	Terms of Trade changes	-	-
Finance	Private Credit	+	+**
	Financial crisis	-***	-***
Infrastructure	Infrastructure	+***	+***
Macro	Government consumption	-	-**
	Inflation	-**	-***
	Real Effective Exchange Rate	+**	+
Other	Political violence	-***	-*
	Persistence	+***	+***

Note: See detailed results in Appendix C.

Explaining Bangladesh's success: a period of structural change followed by stability to reap the benefits.

A long period of very strong policy innovations

A long period of stability

Key model components for growth in Bangladesh

Percent

Legend: Persistence | Innovation | Residual | Actual GDP growth

X-axis: 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2014, 2015-2019

Y-axis: -2, 0, 2, 4, 6

- The period 1990 to 2004 belongs to the top percentile (!) of all growth contributions in our sample over any 15-year episode since 1970.

- Sustaining and increasing growth over such a long period is rather unusual, as growth experiences tend to be episodic (Easterly et al., 1993; Hausmann et al., 2005; Koren and Tenreyro 2007; Aguiar and Gopinath 2007; Pritchett and Summers, 2015).

- The positive residual in the last episodes could either imply that Bangladesh benefited more than other countries from previous reforms, or instead point to unexplained GDP growth. Additional analysis points to the latter (see Appendix D).

Growth impulses were driven by several factors.

Growth contribution of different policy innovations
Percent

Legend: Trade and Globalization, Finance, Macro, Infrastructure, Political Violence
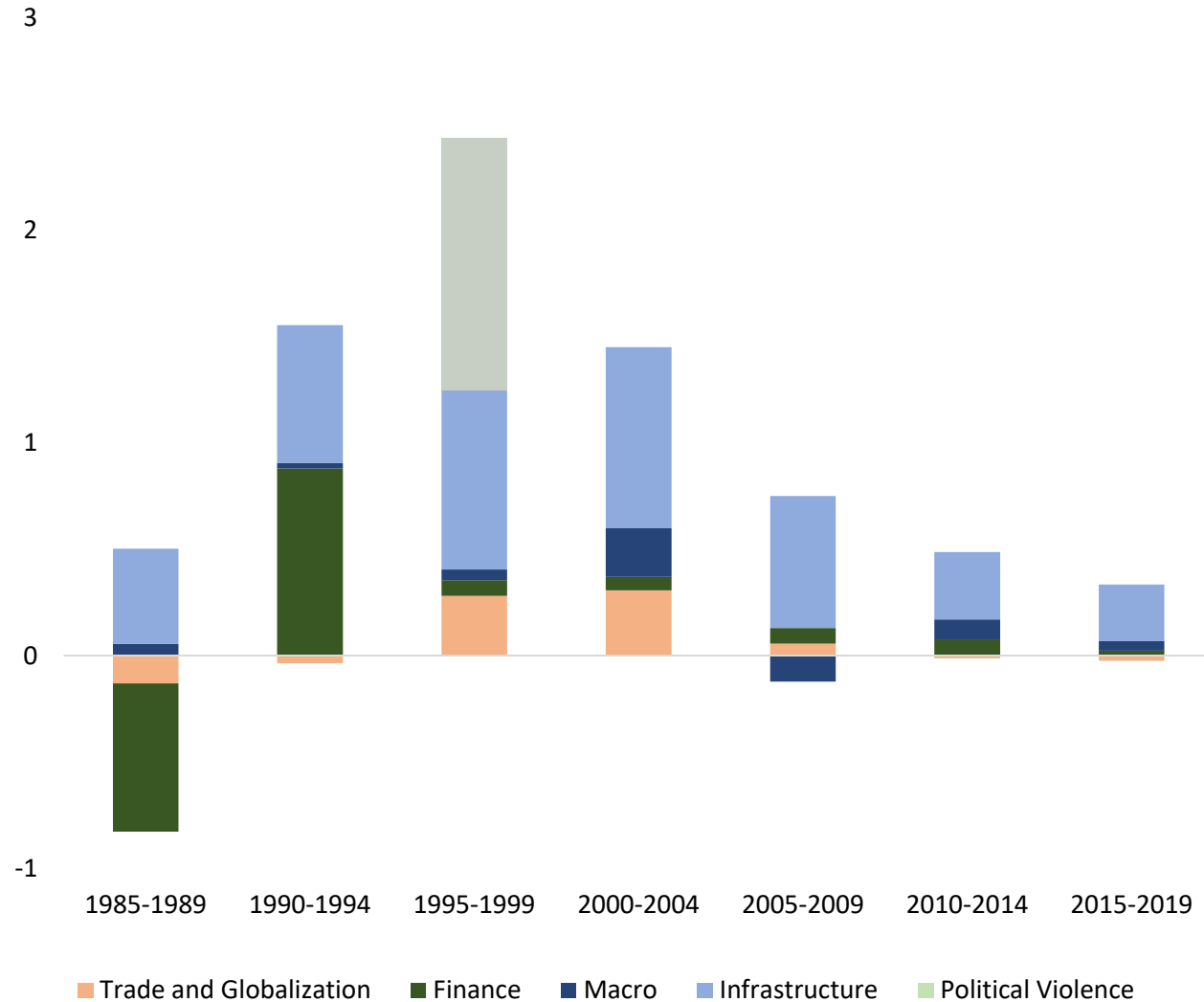
- Major growth impulses came from
  - fast improvements in infrastructure
  - less political violence
  - overcoming of financial sector weaknesses
  - trade opening
- We attribute those improvements to economic reforms starting in the mid-1980s, which strengthened markets and public investment, and the post-1990 reforms allowing more private sector participation in trade, finance, and land ownership.
- Macroeconomic stability allowed reforms to support economic growth over time, but innovations in trade and finance waned off. New reform efforts are needed to boost trade and upgrade the financial sector.

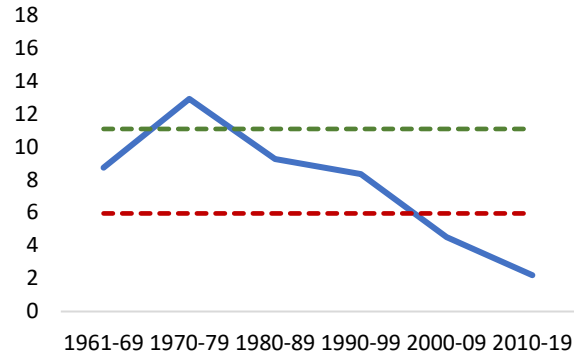Sustaining the success will require adjustments to the growth model.

Economic booms do not tend to be permanent, and it is difficult to stay among global growth leaders.

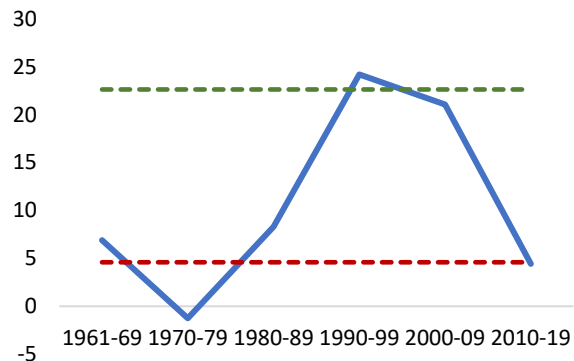## Growth of successful economies since the 1960s is volatile.

Real GDP growth in Botswana
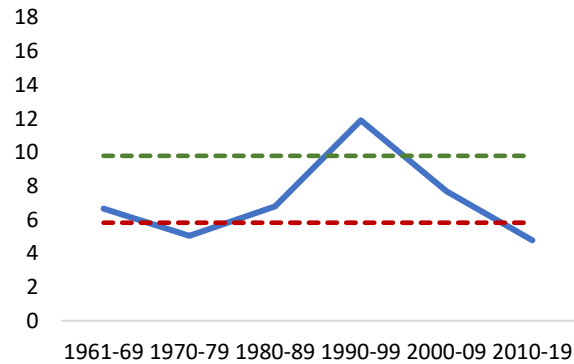Percent
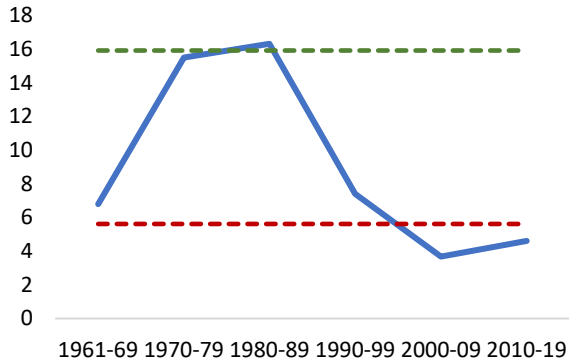
Real GDP growth in Korea
Percent

Real GDP growth in Equatorial Guinea
Percent

Real GDP growth in Egypt
Percent

Source: Penn World Tables, 10.0.
Note: The four countries top the sample of 111 countries for which data are available from 1960-2019. Singapore is excluded because it is a city-state.

Few countries belong to the most successful ones over long periods.

Top 10* fastest growing economies, by decade
(countries that features in top 10 in the previous decade are highlighted in green)

1970-79	1980-89	1990-99	2000-09	2010-19
Botswana	Botswana	Eq. Guinea	Nigeria	Ethiopia
Korea	Korea	Iran	Eq. Guinea	Ivory Coast
Gabon	Zimbabwe	Egypt	Syria	Ireland
Malta	Eq. Guinea	Argentina	Zimbabwe	Panama
Algeria	Singapore	Singapore	Jordan	Togo
Seychelles	Taiwan	Mali	Congo	Kenya
Nigeria	Hong Kong	El Salvador	Iran	Bangladesh
Indonesia	Egypt	Korea	Venezuela	DRC
Taiwan	Cyprus	Malaysia	T&T	Benin
Singapore	Morocco	Ireland	Singapore	Bolivia

Source: Penn World Tables, 10.0.
Note: The five countries top the sample of 111 countries for which data are available from 1960-2019.

- Only 3 to 4 countries in the top 10 manage to do so again in the following decade.

- No country managed this feat in the most recent decade (2010-19).

Preserving macroeconomic stability will require new efforts.

## The financial sector is becoming a concern.

- Bangladesh has not been affected much by the Asian Financial Crisis and the Global Financial Crisis.

- However, it may become less insulated and riskier going forward:

  - External borrowing will need to increase to finance investments, exposing Bangladesh more to global financial markets.
  - The financial sector will become larger, so recapitalizing banks will become more costly.
  - The financial sector is not yet prepared for that: it has structural weaknesses and financial sector regulation is not aligned with Basel III.

## Climate shocks will become more frequent.

- Learning from the 1974 floods and from frequent natural disasters made Bangladesh one of the countries most resilient to natural disasters.

- However, climate change will lead to new challenges:

  - Natural disasters will become more frequent and potentially more devastating.
  - New natural disasters may emerge.
  - Changing temperatures will result in large internal migration .
  - Climate adaptation will require very large public and private investment (a topic that the upcoming Bangladesh CCDR will discuss).

To few people benefit from better jobs.

- Employment seems to stagnate over the last decade.

Total employment
1,000 people, 15+
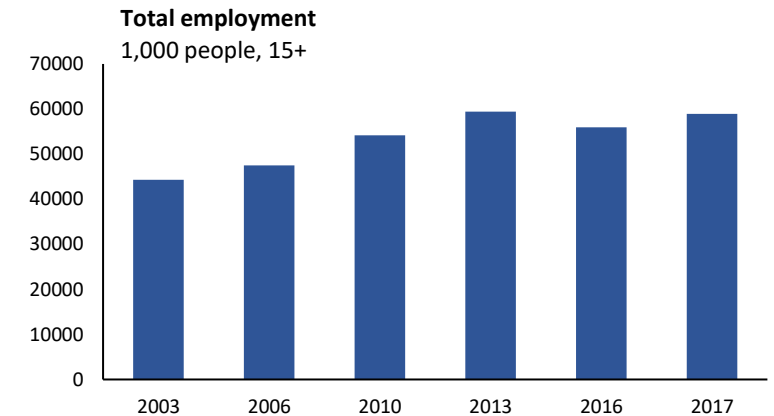
- The share of informality is increasing rather than declining.

Share of informal employment
Percent

Services Manufacturing
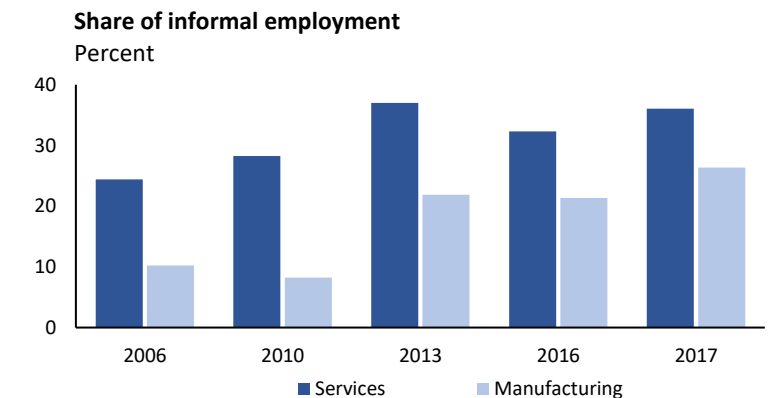
New growth impulses will be needed; peers suggest opportunities.

Model-predicted growth without additional policy innovations
Percent
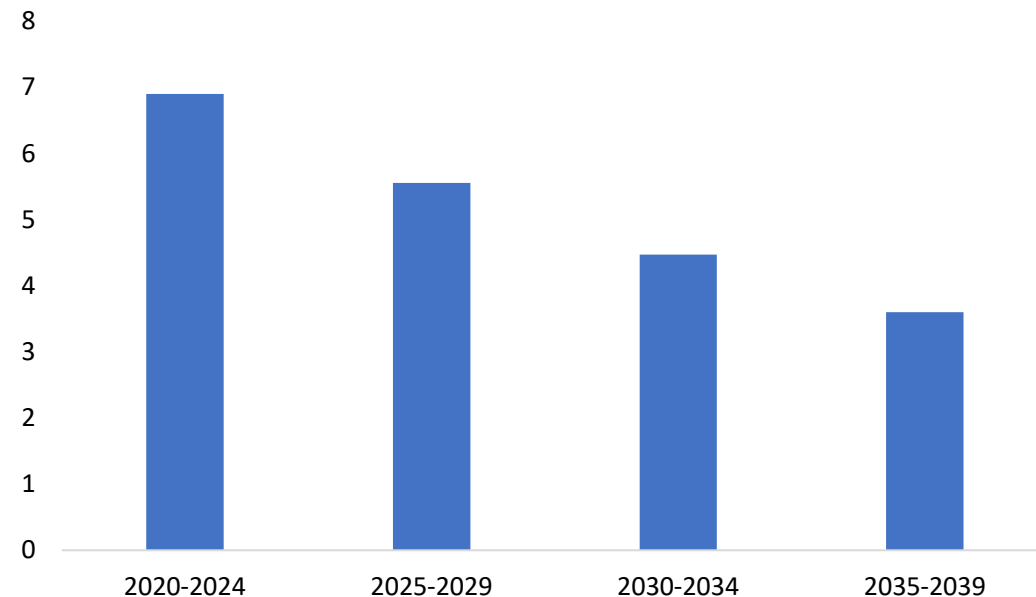
Cumulative GDP impact of catching up with peers
Percent of current GDP per capita
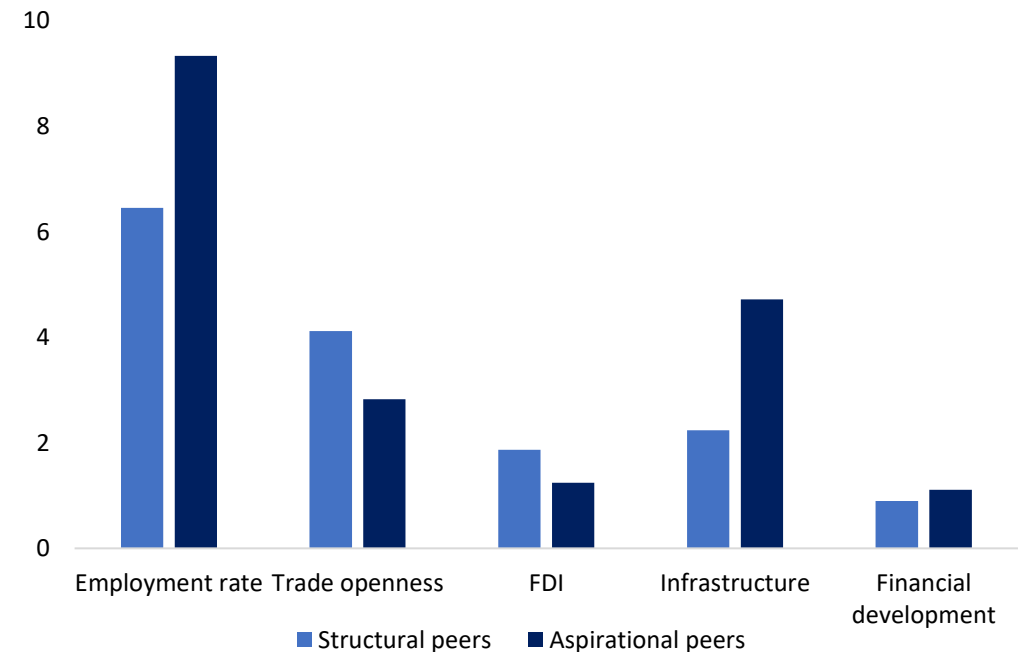
- ➤ Peers suggest that there are opportunities for faster development: more women in employment, more trade, more investment, more infrastructure.
- ➤ Econometric analysis suggests that credit, investment, and trade have indeed positive impacts on GDP in Bangladesh. See Appendix F for more details.

With strong reforms, high growth rates can be sustained.

To sustain its success, the growth model needs to be adjusted

- Vulnerabilities in the **financial sector** need to be addressed to preserve financial stability and foster credit growth. Costs of financial intermediation should decline, and investment channeled to more productive sectors and firms. Deeper capital markets would allow for raising much needed long-term finance for climate adaptation.

- Previous **trade reforms** need to be refined and adapted to address new challenges related to LDC graduation, environmental regulations in export markets, increasing competition, and changing demand patterns. Reforms should target export competitiveness and export diversification and seek new opportunities arising from digitalization.

- Better **urbanization and connectivity** could contribute to sustaining fast productivity growth and help absorb climate migrants. Successful transition to higher productivity in Dhaka would imply movement of low value manufacturing to next tier cities.

- **Long-standing challenges** related to lagging female labor force participation, low human capital, and weak governance will need to be addressed to reach high income status in the future.

- These priorities are aligned with government priorities as specified in the *8th Five Year Plan* and the *Vision 2041*.

An analysis based on WB Long-Term Growth Model

- Beyer and Sinha (2021) employ the World Bank's Long-Term Growth Model Public Capital Extension (LTGM-PC) to evaluate different growth scenarios for Bangladesh.

- The LTGM-PC builds on the Solow-Swan growth model and incorporates several growth drivers related to productivity, human capital, and demographics.

- The model is calibrated for Bangladesh to construct a baseline projection, which is considered the most likely scenario given the current state of the economy. It exploits historical data, peer and global benchmarks, and recent findings from the literature.

- Beyer and Sinha (2021) extent the model to analyze potential impacts from climate change and declining remittances, but they find only moderate impacts until 2041.

- The model can be used to study the impact of changes in different growth drivers.
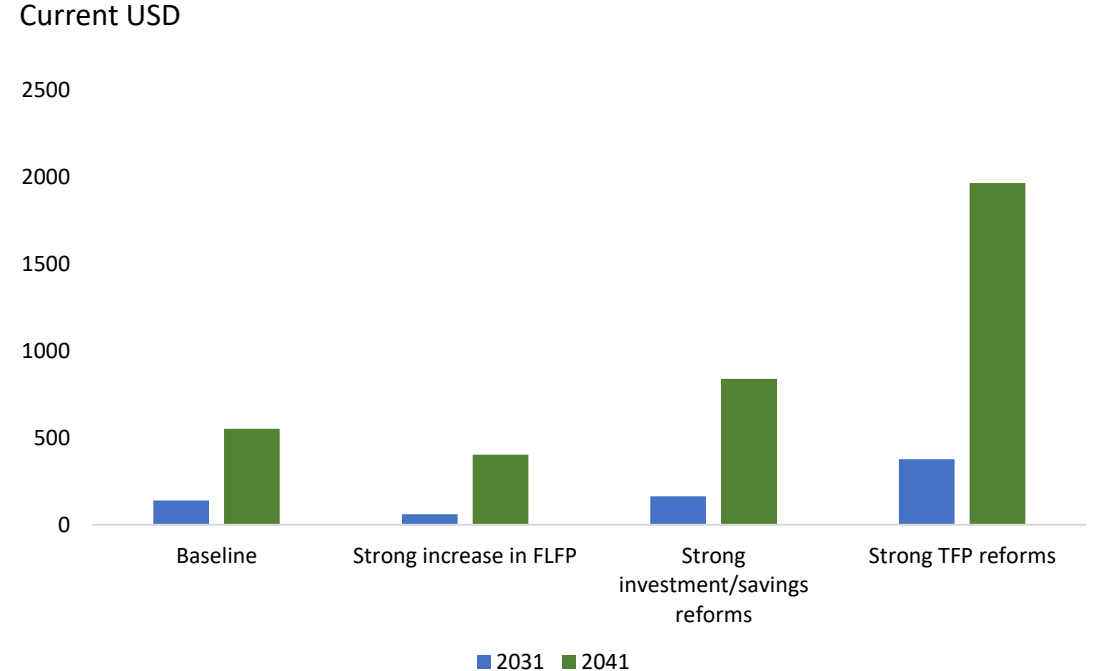
With strong reforms, Bangladesh can accelerate its development and avoid declining long-term growth.

Strong reforms to strengthen TFP growth, female labor force participation, and investment can boost growth, especially when done together.

Real GDP growth: different reform scenarios
Percent
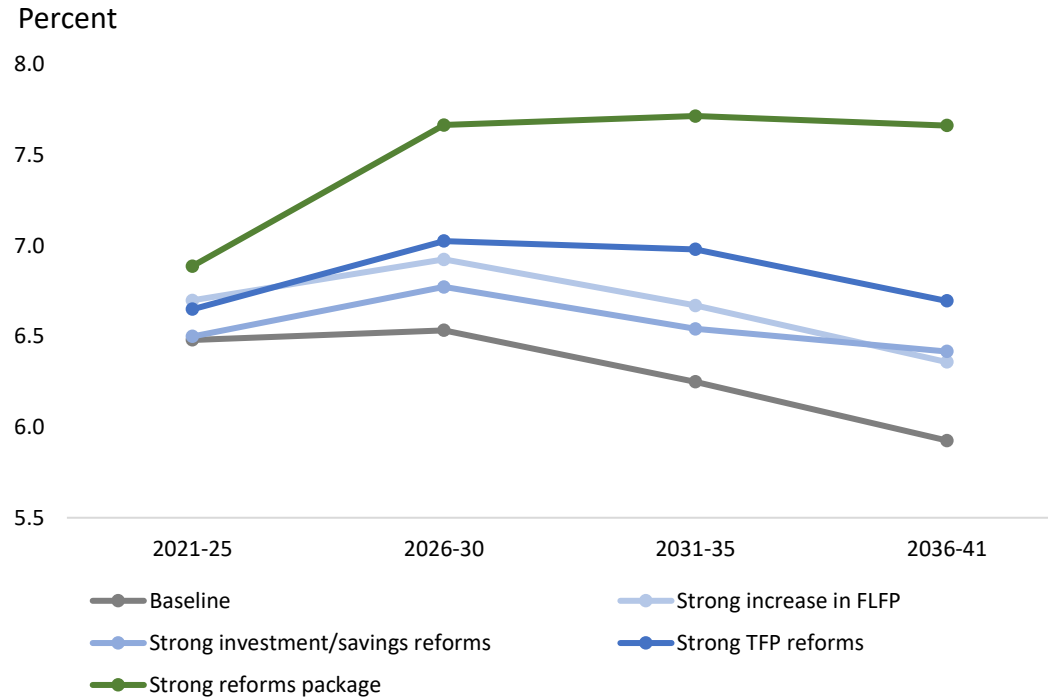
Gains from different reforms
Current USD

Note: See details on reform scenarios in Appendix H.

- In the baseline, growth is projected to decline after the 2030 mainly due to capital deepening and slower population growth (see Appendix H).
- With a strong reform package Bangladesh can avoid declining long-term growth and accelerate its development.
- Before the recent rebasing of GDP, achieving the government GDP per capita targets seemed challenging in the baseline. After the rebasing, upper-middle income status is likely to be reached in 2031 (see Appendix H).

Thank you

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Appendix

Appendix A: A data-driven approach to select structural and aspirational peers

- Similarity with other countries is measured in four steps: (1) Calculate simple average of each indicator for each country during the selected period, (2) Rank all countries per indicator, (3) Calculate absolute difference between target country's rank and all other countries' rank, (4) Calculated weighted mean of the absolute differences of all five indicators for each country.

- For the structural peers, we include countries that have had a similar structure as Bangladesh in recent years and consider the following demographic and socioeconomic variables: **(i) total population, (ii) age-dependency ratio, (iii) share of rural population, (iv) level of GDP per capita, (v) share of manufacturing, and (vi) Human Capital Index**. Based on these variables, we compute a weighted distance between Bangladesh and all other countries based on their relative position in the global distribution. The four countries with the lowest distance are Myanmar, India, Cambodia, and Vietnam. We exclude Myanmar from the peer countries because it has a lot of missing data. While this approach is data driven, the emerging peer countries seem very plausible and share important features with Bangladesh that were not targeted explicitly.

- To select the aspirational peers, we rely on the same procedure but only include countries with a GDP per capita above US$4,000 (constant 2020 US$) in 2019. Based on the weighted distance, we chose Indonesia, Thailand, and China as the aspirational peers. Although a few countries have a smaller distance than China (Tunisia, Algeria, South Africa, and Romania), we include China because it plays a more important role in discussions of comparative economics.

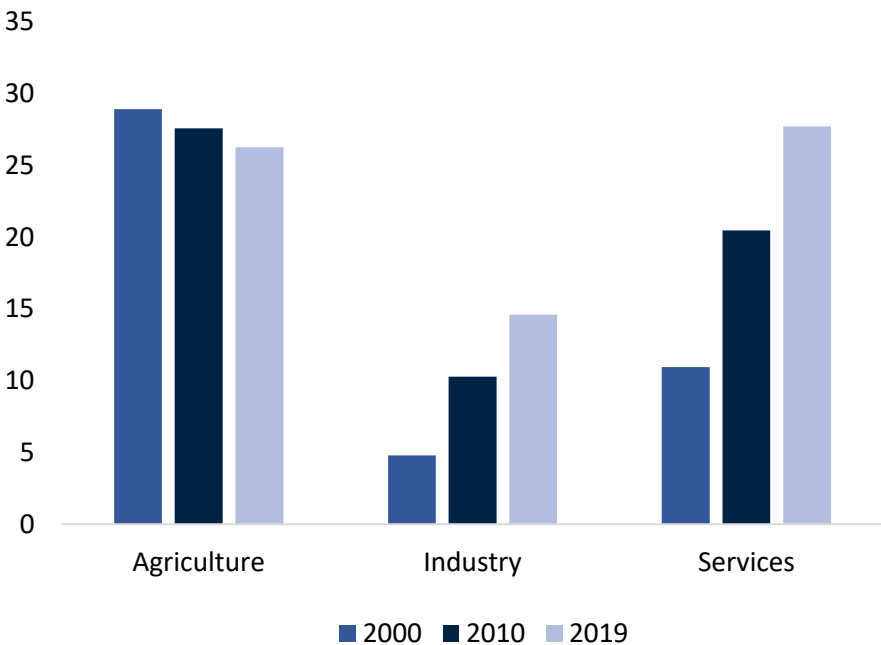**Average distance of peers**

Ranks
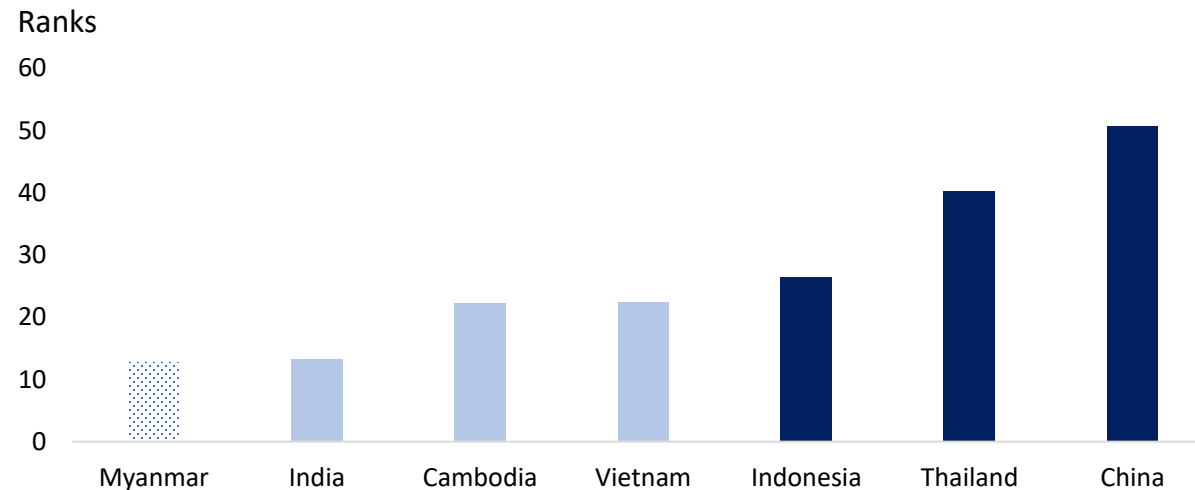
Note: Countries are ranked per indicator and then the absolute difference between the position of Bangladesh and all other countries is computed. The final weighted distance is the mean of the absolute differences across all indicators.

Appendix B: Structural transformation continued over the last two decades.

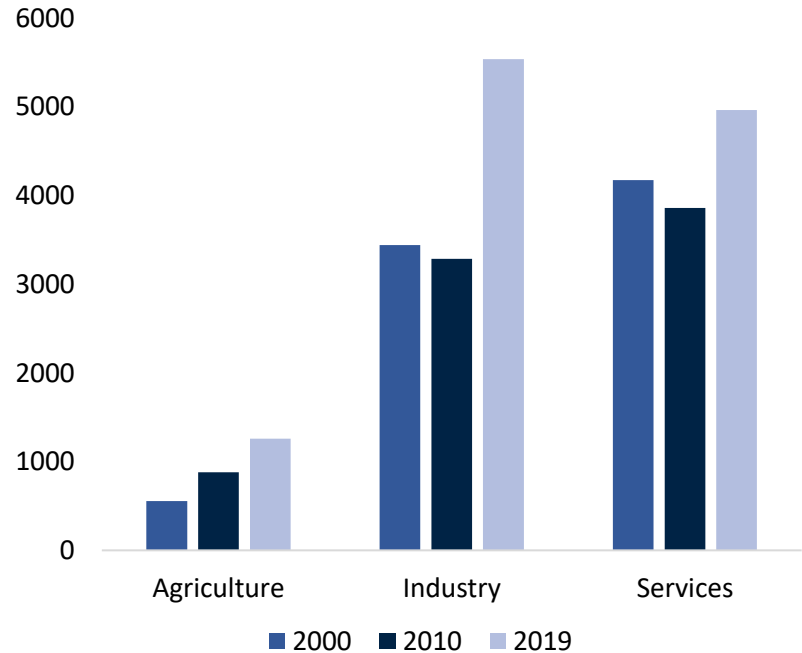| Employment is moving from agriculture to industry and services.	Value added per worker has been increasing fast in industry.	Over a third remains employed in agriculture with just a third of average productivity.

Total employment
Millions

Value added per worker
Constant 2015 USD

Labor productivity gaps
Percent of total productivity, 2019

Note: Based on data from MPO, value added is measured as Gross Domestic Product (GDP) in constant 2015 USD.
Source: Macro Poverty Outlook.

Note: Total employment is sourced from the MPO, employment shares from the WDI based on ILO estimates. The working age population assumed to be ages 15-64.
Source: Macro Poverty Outlook and WDI.

Source: World Bank Macro Poverty Outlook.

Some reasons for the structural transformation
- With RMG exports increasing, light manufacturing created new and more productive jobs.
- With increased urbanization, more employment in services.

Appendix B: Productivity growth has been high and has many sources.

Contributions to growth

Percent of real GDP growth

Decomposition of per capita Value Added

Productivity change decomposition by sectors

Note: Based on data from MPO, GDP and gross fixed capital formation are measured in constant LCU.
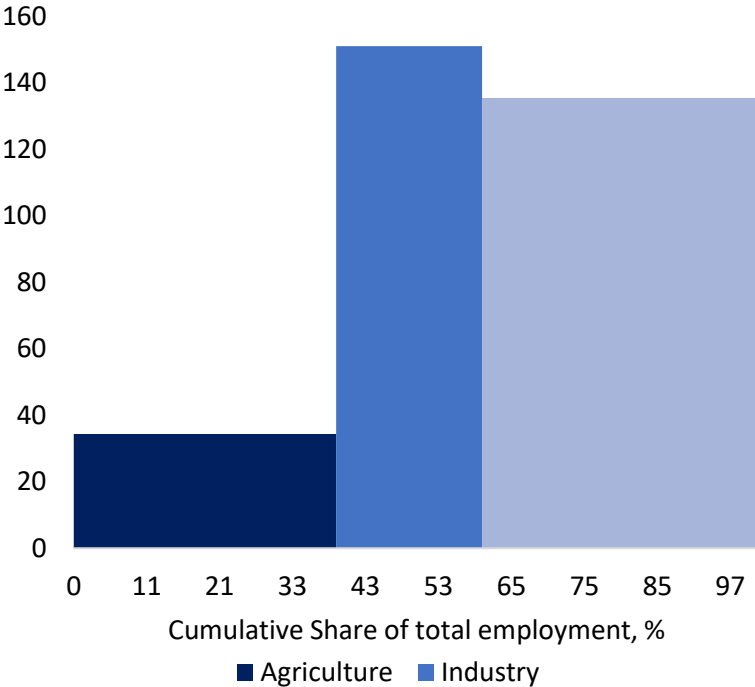**Source:** Macro Poverty Outlook

Note: Total employment is sourced from the MPO, employment shares from the WDI based on ILO estimates. The working age population assumed to be ages 15-64.
Source: Macro Poverty Outlook and WDI

Appendix C: An econometric analysis of cross-country growth drivers

- Beyer and Wacker (2021) estimate the following standard panel "growth" regression:

  $\ln(\text{GDP p.c})_{ct} = \theta \ln(\text{GDP p.c.})_{c,t-1} + \beta_1 x_{1,ct} + \ldots + \beta_k x_{k,ct} + a_c + b_t + u_{ct}$,

  where t indexes (non-overlapping) 5-year averages, $x_1, \ldots, x_k$ capture "(policy) innovations", and the lagged dependent variable captures persistence ("echo from the previous periods").

- Beyer and Wacker (2021) estimate the model with FE OLS (with robustness checks via GMM)

- Since log-changes approximate % changes, first-differencing of the estimated equation allows them to derive growth components:

  $\Delta\ln(\text{GDP p.c})_{ct}$ $=$ $\Theta \, \Delta\ln(\text{GDP p.c.})_{c,t-1}$ $+$ $\beta_1 \Delta x_{1,ct} + \ldots + \beta_k \, \Delta x_{k,ct}$ $+$ $\Delta b_t + \Delta u_{ct}$

  Actual growth $=$ persistence $+$ policy innovation $+$ residual

Appendix D: Electricity consumption and economic activity in Bangladesh

- Electricity consumption data is available daily both nationally and at division-level. Electricity consumption i) is highly correlated with other measures of economic activity in Bangladesh, ii) can provide inferences about changes after shocks (e.g., natural disasters, and COVID-19 lockdowns), iii) causality exists, therefore, works as a high-frequency indicator of economic activity.

- To assess the impact of COVID-19, the below electricity consumption model is estimated:

$$\log Electricity_t = DW_t + WY_t + Holiday_t + \alpha\, Cooling_t + \beta Trend + \gamma Ramadan_t + \varepsilon_t$$

- Estimated electricity consumption model explains the daily variation in consumption based on a trend, seasonality, within-week variation, holidays, Ramadan, and the temperature. Deviations from the model prediction acts as an indicator of economic activity.

Electricity consumption models

Variables	Baseline Model	COVID-19 Model
	Log Electricity	Log Electricity
Trend	.00025***	.00025***
	(0.00)	(0.00)
Holiday	-.066***	-0.065***
	(0.01)	(0.01)
Cooling	.029***	0.027***
	(0.00)	(0.00)
Ramadan	. 046***	045***
	(0.00)	(0.00)
Fri	-.049***	-.050***
Sat	-.016***	-.016***
End of data	Dec 2019	Oct 2021
Working day FEs	Yes	Yes
Week of the year FEs	Yes	Yes
2020/2021 daily FEs	No	Yes
N	3,621	4274
R2	0.93	0.95

Note: standard errors in parentheses.   *p < .1, **p<.05, ***p<.01
Source: Beyer and Arshad (2022)

Appendix D: Baseline regression results and robustness checks

Model	(1) Baseline	(2) No outliers	(3) Since 1985-89	(4) Middle-income	(5) Asia only
Persistence	0.805***	0.920***	0.756***	0.803***	0.877***
	(0.0247)	(0.0162)	(0.0336)	(0.0343)	(0.0272)
Gov. Con.	-0.0172	-0.0283**	-0.0386	-0.0173	0.0118
	(0.0205)	(0.0114)	(0.0238)	(0.0215)	(0.0344)
REER	0.00558**	0.000658	0.00960**	0.000497	-0.0526**
	(0.00238)	(0.00171)	(0.00469)	(0.00312)	(0.0223)
Trade Openness	0.0722**	0.0259***	0.0774**	0.0693*	0.0202**
	(0.0297)	(0.00915)	(0.0323)	(0.0356)	(0.00949)
Private Credit	0.0143	0.0256**	-0.00346	0.0135	0.0326
	(0.0101)	(0.00989)	(0.0151)	(0.0146)	(0.0199)
Inflation	-0.117**	-0.0947***	-0.152*	-0.0354	-0.122
	(0.0576)	(0.0332)	(0.0802)	(0.0605)	(0.117)
Infrastructure	0.0899***	0.0704***	0.152***	0.148***	0.0623*
	(0.0212)	(0.0130)	(0.0294)	(0.0427)	(0.0304)
ToT changes	-0.0346	-0.00455	-0.128	-0.0105	0.0431
	(0.0477)	(0.0233)	(0.105)	(0.0578)	(0.0302)
Export. diversif	-0.175	-0.125	-0.163	0.173	-0.767
	(0.144)	(0.0939)	(0.172)	(0.327)	(0.479)
squared	0.0878	0.0759*	0.0954	-0.0382	0.379*
	(0.0634)	(0.0402)	(0.0732)	(0.138)	(0.219)
FDI	0.0151**	0.00532**	0.0106*	0.0129*	-0.00849
	(0.00699)	(0.00230)	(0.00548)	(0.00687)	(0.00736)
Polit. violence	-0.0592***	-0.0209*	-0.0504**	-0.0472**	0.0108
	(0.0165)	(0.0108)	(0.0197)	(0.0184)	(0.0215)
Financial crisis	-0.0423***	-0.0306***	-0.0269***	-0.0385***	0.0417**
	(0.0108)	(0.00666)	(0.0100)	(0.0141)	(0.0175)
Constant	1.828***	0.746***	2.206***	1.632***	1.238**
	(0.238)	(0.147)	(0.321)	(0.389)	(0.522)
Observations	1,009	840	823	540	165
R-squared	0.893	0.951	0.872	0.901	0.984
# of countries	163	163	163	90	24

Appendix E: An econometric analysis to assess GDP estimates

Methodology

- Broadly following Subramanian (2019), Beyer and Hussain (2021) estimate the following equation, where *i* denotes countries:

$$\Delta gdp_i = \beta_0 + \beta_1 \,\Delta exports_i + \beta_2 \Delta imports_i + \beta_3 \,\Delta credit_i + \beta_5 \,\Delta lights_i + \beta_6 \, Bangladesh + \varepsilon_i$$

- We first estimate the model from 1990 to 2019 (and different subperiods).

- We then estimate the model separately for two different time periods – during a particular Five-Year Plan period and otherwise, using the averages of the variables over the respective periods. We take the difference of the two Bangladesh dummies to assess whether a period has been exceptional (as Arvind Subramanian did for India).

- We also run this cross-sectional regression for value added in agriculture, manufacturing, and services.

- We also conduct a few robustness checks and estimate a panel specification with a Bangladesh time trend (instead of the dummy).

Data

- Most data are from the World Bank's World Development Indicators (private credit growth, export growth, import growth, GDP growth, as well as growth in value added in agriculture, manufacturing, and services).

- For the nighttime lights, they rely on a new dataset provided by Ma *et al.* (2020) that provides consistent data from 1992 to 2018 based on harmonized information from DMSP-OLS and VIIRS satellites. They extend the light series to 2019 for Bangladesh using the average monthly country aggregates from VIIRS data following Beyer, Hu, and Yao (2022).

- They only include middle-income countries in the baseline estimation and exclude "atypical" countries (oil exporters, small economies with a population of less than 1 million, and fragile countries).

Appendix E: An econometric analysis to assess GDP estimates

Regression results, 1991-2019

	Model 1	Model 2
Private Credit Growth	0.0786**	0.0821**
	(0.03760	(0.0382)
Export Growth	-0.0386	-0.0585
	(0.126)	(0.128)
Import Growth	0.297*	0.304*
	(0.165)	(0.167)
Nighttime Light Growth	0.163***	0.166***
	(0.0552)	(0.0554)
Bangladesh Dummy		1.256***
		(0.378)
Constant	0.957*	0.969*
	(0.485)	(0.491)
Observations	60	60
R-squared	0.533	0.541

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
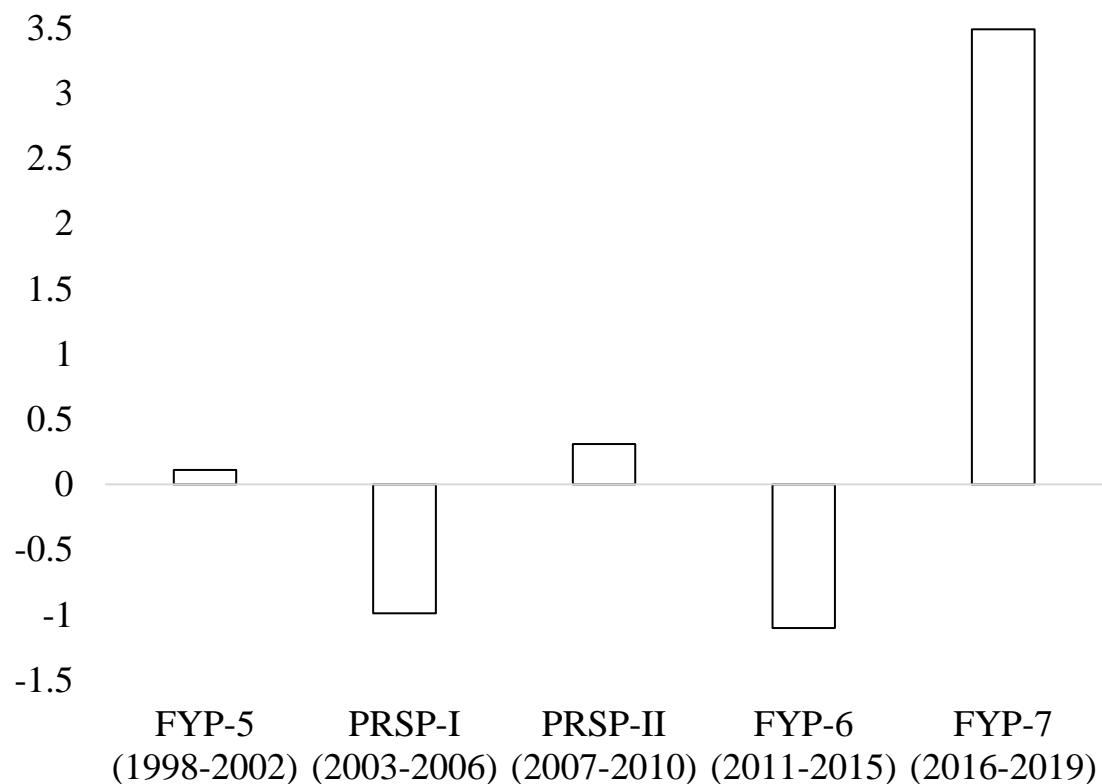**Source:** Beyer and Hussain (2021).

Appendix E: There is a large gap of unexplained growth during the first four years of the 7ᵗʰ FYP period.

Difference between Bangladesh dummy over specific periods

Percentage points

FYP-5 (1998-2002)   PRSP-I (2003-2006)   PRSP-II (2007-2010)   FYP-6 (2011-2015)   FYP-7 (2016-2019)

Note: The model includes information about import and export growth, private credit growth, and nighttime light growth and is estimated for 60 countries covering the period from 1991 to 2019. The bars show the difference between the Bangladesh dummy in the specified Period (A) and the rest of the years (B), $\beta_{6, \text{ period A}} - \beta_{6, \text{ period B}}$.
Source: Beyer and Hussain (2021).

Sectoral deviations during 7th FYP period

Percentage Points

Agriculture   Manufacturing   Services
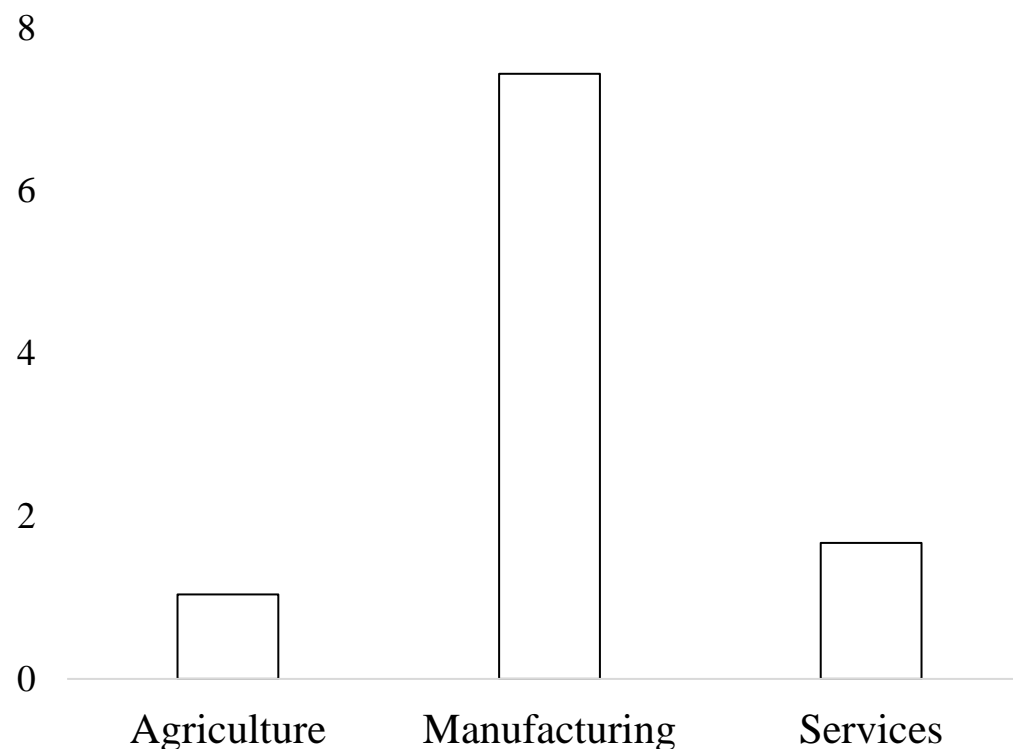
Note: The bars show the difference between the Bangladesh dummy during the 7ᵗʰ FYP period and other years across different sectors.
Source: Beyer and Hussain (2021).

Appendix F: Econometric analysis suggests that credit, investment, and trade have positive impacts on GDP in Bangladesh.

Annual and monthly time-series analyses of the relation between aggregate economic activity and financial depth, investment, and trade in Bangladesh (Hussain and Arshad 2021) shows that:

- The stock of private credit to GDP and the investment rate have causal effects on GDP per capita in the long run.

- Both the stock of credit and investment take time in percolating through the economy:
    - A one pp increase in the stock of credit to the private sector increases per capita GDP growth by 0.13 pp and per capita GDP by 3.8 pp in the long run.
    - A one pp increase in the investment-GDP ratio increases per capita GDP growth by 0.10 pp and per capita GDP by 1.8 pp in the long run.

- A stronger financial systems will yield long run dividends if it can expand the reach of credit and better target credit (which will strengthen the relationship between finance and growth).

- Total trade seems to have an even stronger impact on growth: a one pp increase in trade growth increases activity growth by 0.2 pp.

Appendix F: Econometric Specifications of finance and income analysis

Unit Root Tests on Annual Data		
Variable(s)	ADF	KPSS
Real GDP per capita with time trend	I(1)	I(1)
Per capita Real GDP growth	I(1)	I(1)
Broad Money (% of GDP)	I(1)	I(1)
Domestic Credit to Private Sector stock (% of GDP)	I(1)	I(1)
Gross Fixed Capital Formation (% of GDP)	I(1)	I(1)
Trade (% of GDP)	I(1)	I(1)

Annual Sample: 1985-2019

Unit Root Tests on Monthly Data					
Variables (seasonally adjusted)	ADF	KPSS	Growth variables	ADF	KPSS
Ln (Electricity Consumption)	I(1)	I(1)	Electricity growth	I(0)	I(0)
Ln (Broad Money)	I(1)	I(1)	Broad Money Growth	I(1)	I(1)
Ln (Credit to Private Sector(stock))	I(1)	I(1)	Private Credit (stock) growth	I(1)	I(0)
Ln (Trade Size)	I(0)	I(1)	Import CG growth	I(0)	I(0)
Ln (Import of CG)	I(0)	I(1)	Trade growth	I(0)	I(0)

Monthly Sample: Feb 2010 - May 2021

Estimated **Annual Vector Error Correction (VECM)** model:

Long run relationship equation:

$$g_t = \delta + \phi_1 F_t + \phi_2 I_t + \phi_3 T_t + \mu_t \ldots \ldots \ldots \quad (1)$$

where g_t is the measure of economic development (per capita real GDP and per capita real GDP growth rate), F_t is the financial development indicator, I_t is the investment rate, T_t is the index of openness and μ_t is the stationary error term.

Short-run Dynamics equation:

$$\Delta g_t = \lambda_1 + \lambda_2 \Delta F_t + \lambda_3 \Delta I_t + \lambda_4 \Delta T_t + \Omega \mu_{t-1} + v_t \ldots \ldots \ldots \quad (2)$$

where, the absolute value of Ω decides how quickly the equilibrium is restored. The λ_i and Ω are the short-run parameters while ϕ_i are the long-run parameters.

Estimated **Monthly Autoregressive Distributed Lag (ARDL)** model:

$$Y_t = c_0 + \sum_{k=1}^{p} \beta_k Y_{t-k} + \sum_{j=0}^{l} \alpha_{j+1} X_{t-j} + u_t \ldots \ldots \ldots 6$$

where Y is the dependent variable (electricity), p is the autoregressive order of the ARDL directly associated to Y,

X is the exogenous financial explanatory variable (monetary growth, credit growth) with *l* lags (including a contemporaneous value of X) and the residual term u.

Trade growth and growth in import of capital goods are used as fixed regressors.

Appendix F: Linkage between income and finance in Bangladesh

- A long run equilibrium relationship between income per capita, stock of private credit/GDP, investment rate and trade openness/GDP is found.

- Based on granger causality stock of private credit/GDP and investment rate has causal effects on GDP per capita in the long run, but not vice-versa.

- Based on VECM short run causality results, stock of credit/GDP to income per capita in dynamic specifications show stable and significant equilibrium error coefficient.

- The variance decomposition of shocks to income per capita indicates over time a significantly increasing proportion is explained by trade openness and credit.

- Annual Growth model findings are: i) there is long run relation between GDP growth (per capita and total) and financial sector; ii) trade growth and investment rate appear to be most important in shaping the level and dynamics of annual GDP growth.

- Monthly model findings are: i) electricity growth (y-o-y) appears to follow private sector credit in Bangladesh; ii) investment dominates the endogenous responses from other variables in the forecast error variance of monthly electricity data.

Annual VECM Models

	(1) ln (Real GDP PC)	(2) ln (Real GDP PC)	(3) ln (Real GDP PC)	(4) Per capita real GDP growth
Cointegrating Equations	1	1	1	1
M2/GDP (-1)	0.221***	0.205***		
	(0.068)	(0.062)		
Private Sector Credit (Stock)/GDP (-1)			0.038***	0.129***
			(0.002)	(0.034)
Investment/GDP (-1)	0.458***	0.422***	0.018***	0.093**
	(0.134)	(0.123)	(0.003)	(0.049)
Trade/GDP (-1)	-0.345***	-0.311***	-0.012***	0.006
	(0.055)	(0.051)	(0.001)	(0.039)
Trend (linear/quadratic)	0.009	-0.021	0.004	-
C	1.592	2.676	9.210	2.53***
ECT (-1)	-0.004**	-0.004**	-0.171**	-1.022**
R-squared	0.805	0.853	0.912	0.643
F-statistic	11.936	14.508	14.82	1.91
Prob (F-statistic)	0.000	0.000	0.000	0.096
Observations	36	36	35	34

Note: 1/Standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01.
2/Coefficients of M2/GDP and investment/GDP in Model-1 and Model-2 are too strong to make economic sense.

Monthly VECM Models

Dependent Variable	Model 1 Ln (Electricity Consumption)	Model 2 Ln (Electricity Consumption)
Cointegrating Equations	2	2
Ln (M2) (-1)	1.368***	
	(0.092)	
Ln (Cp Stock) (-1)		1.209***
		(0.033)
Ln (Import of Capital Goods) (-1)	0.307***	0.072**
	(0.093)	(0.036)
Ln (Trade) (-1)	0.243	0.055
	(0.212)	(0.086)
C	5.589	1.163
ECT (-1)	-0.097*	-0.671***
R-squared	0.279	0.371
F-statistic	5.290	5.362
Prob (F-statistic)	0.000	0.000
Observations	133	132

Note: 1/Standard error in parentheses, *p<0.1, **p<0.05, ***p<0.01.

Monthly ARDL Models

Dependent Variable	Model 1 Electricity growth	Model 2 Electricity growth
Electricity growth	0.333***	0.343***
	(0.863)	(0.076)
M2 growth	0.863	
	(0.868)	
M2 growth (-1)	0.285	
	(0.886)	
Cp (Stock) growth		0.122
		(0.203)
Import of Capital Goods growth	0.016	0.013
	(0.020)	(0.020)
Trade growth	0.194***	0.193***
	(0.039)	(0.040)
C	6.948***	4.181**
ECT (-1)	-0.667***	-0.657***
R-squared	0.461	0.448
Bounds Test (F-statistic)	27.01***	25.94***
Observations	123	123

Appendix H: WB Long-Term Growth Model Baseline

Summary of baseline projections and selected model components

|	**2021–2025**	**2026–2030**	**2031–2035**	**2036–2041**
Average real GDP growth (%)	6.5	6.5	6.2	5.9
Average GNI per capita (2020 US$)	2728	3623	4771	6424
GNI per capita, last year of period (2020 US$)	3053	4035	5304	7306
Model components				
Investment rate (%)	33.5	35.5	36.9	38.0
TFP growth (%)	0.8	1.0	1.0	1.0
Population growth (%)	0.9	0.8	0.6	0.4

Note: GDP = gross domestic product; GNI = gross national income; TFP = total factor productivity.

➢ Growth is expected to decline after the 2030 mainly due to capital deepening and slower population growth.

Appendix G: Constituents of strong reform package
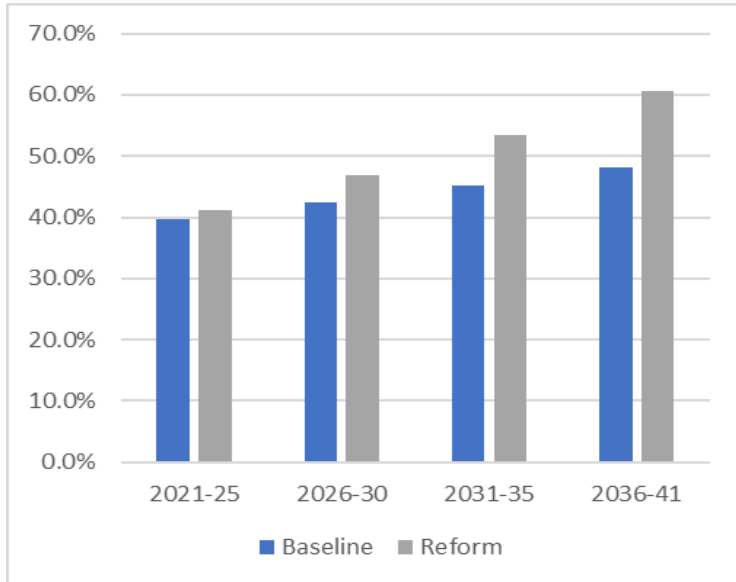
Female labor force participation
Baseline: ~0.5 pp annual growth, based on the mid-point of short- and long-term average; reaches 49.5% by 2041
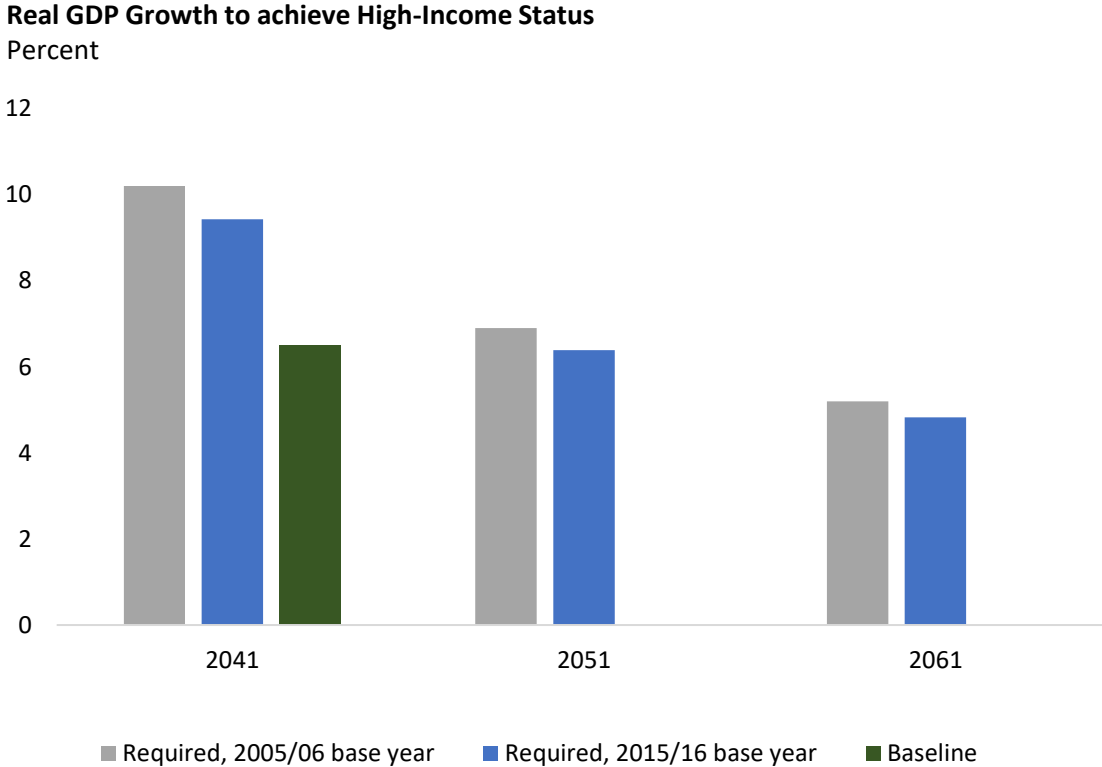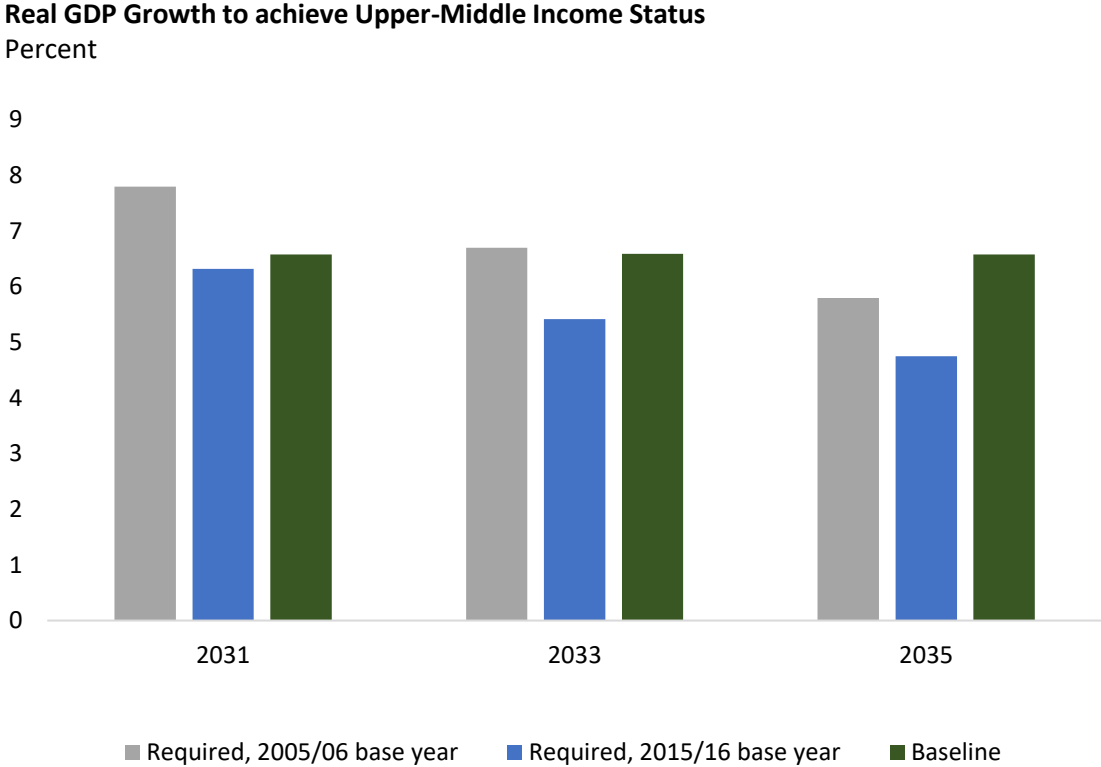Reform: *Vision 2041*; reaches 64% by 2041
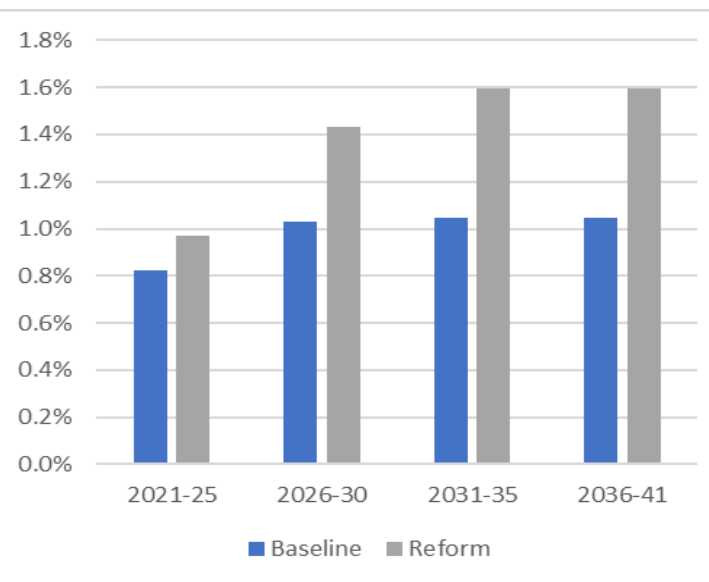
TFP growth
Baseline: Reaches 1.05% (catch-up with 75th percentile) by 2031, short-term path (2021-28) consistent with MFMoD
Reform: Catch-up with the 90th percentile by 2031 (0.55pp gap over baseline till 2031 realized gradually, example: 5bps in 2021, 10bps in 2022, ...)
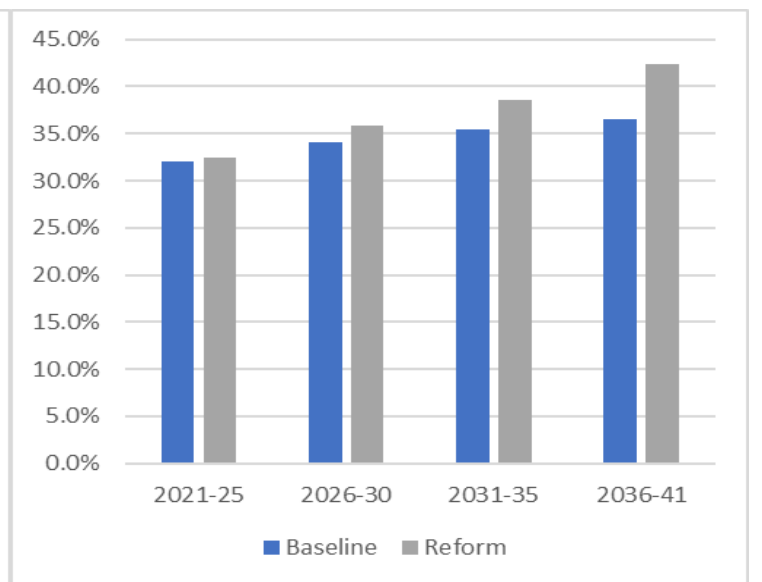
Savings rate
Baseline: Increases by 40 bps each year till 2030, and by 20 bps thereafter; reaches 37% by 2041
Reform: *Vision 2041*; reaches 44% by 2041

Appendix H: Before the recent rebasing of GDP, achieving the government targets seemed challenging in the baseline; now UMI could be reached in 2031.

Real GDP Growth to achieve Upper-Middle Income Status
Percent

Real GDP Growth to achieve High-Income Status
Percent

Legend (left chart): ▪ Required, 2005/06 base year ▪ Required, 2015/16 base year ▪ Baseline

Legend (right chart): ▪ Required, 2005/06 base year ▪ Required, 2015/16 base year ▪ Baseline

Note: For more details, see Appendix G.

Assumptions

- Population growth taken from UN population projections till 2050. The terminal value in 2050 is 0.17% and we assume 0.15% from 2051-2061.
- Nominal growth of remittances is assumed to decline from 8.4% per year in 2021 to 2.0% per year by 2041 in line with the specification in the *Vision 2041*. We assume it remains constant thereafter.