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FDI-growth and trade-growth relationships during crises: evidence from Bangladesh

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Abstract

This study examines foreign direct investment (FDI)-growth and trade-growth relationships in Bangladesh during three major crises: the economic crisis of 2007–2008, the commodity crisis of 2016, and the coronavirus (COVID-19) pandemic of 2020. The augmented autoregressive distributed lag (AARDL) bounds testing approach and Bayer and Hanck cointegration are employed on time-series data spanning the period 1974–2020. The results suggest that exports have positive effects on economic growth, while imports have insignificant effects in both the short run and long run. Total trade (the sum of exports and imports) has a positive but weakly significant effect on economic growth only in the long run, whereas FDI exhibits a positive effect in both the short run and long run. Although the crises are not found to affect economic growth directly or through trade (i.e., no dampening effect on trade-led growth), they are found to distort FDI-led growth in both the short run and long run. As robustness tests for long-run elasticities, the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) cointegration techniques are implemented, yielding results similar to those obtained with the AARDL.

Keywords: Crises, Trade-led growth, FDI-led growth, Augmented ARDL, Bangladesh

JEL Classification: C01, F14, F21

Introduction

A general consensus among academics and policymakers is that foreign direct investment (FDI) and international trade act as, among others, the major drivers of economic growth in developing countries. As a result, FDI-growth and trade-growth relationships have been extensively investigated in the growth-related empirical literature. In the second half of the last century, particularly in the 1970s, research was centered on strategies regarding either import substitution or export promotion of manufactured products (Voivodas 1973; Williamson 1978). Moving into the 1980s and 1990s, export-led growth received extensive attention from researchers (Balassa 1985; Feder 1983). Additionally, some studies have also examined the effects of imports and total trade (the sum of exports and imports) on economic growth (Deme 2002; Gómez et al. 2011).

Since 1990, the international financial market has witnessed increasing FDI flows. Foreign capital plays a substantial role in accelerating economic growth in countries that lack sufficient domestic savings—both private and public—and depend heavily on

external finance for industrial expansion (Sarker and Khan 2020). Consequently, many developing countries have liberalized their financial policies to attract FDI.[1] The major driving force behind global FDI flows has been the prospect of lower production costs (Bevan et al. 2004). Given that developing countries can offer labor and other factors of production at low costs, they have attracted a considerable portion of global FDI flows, although developed countries have traditionally received the lion's share.

However, crises may have dampening effects on international trade and FDI inflows due to shrinking aggregate demand and increasing uncertainty in macroeconomic performance, respectively (Ucal et al. 2010). The world total trade (the sum of exports and imports) declined by 13% in 2009 and by 9% in 2020 because of the 2007 economic crisis and the 2020 coronavirus (COVID-19) pandemic, respectively. The 2016 commodity crisis resulted in a less severe reduction in world trade (World Bank 2021). Following the economic crisis of 2007, global FDI flows fell by 16% in 2008, global output contracted in 2009, and FDI declined further by 40% in 2010 (Poulsen and Hufbauer 2011). Falling commodity prices in 2016 reduced global FDI flows by 13% and slowed economic growth, although the declines were not equally distributed across regions (UNCTAD 2017). According to a recent report, global FDI flows fell by 42% in 2020 due to the COVID-19 pandemic (UNCTAD 2021a). In Bangladesh, the decline in total trade was 2% in 2009 and 13% in 2020, whereas the effect of the 2016 commodity crisis on trade was less severe. The Bangladesh economy experienced a 36% fall in FDI inflows between 2008 and 2009, an 8% fall between 2016 and 2017, and an 11% fall between 2019 and 2020 (UNCTAD 2017).

Therefore, it is evident that crises negatively affect both international trade and FDI inflows. This fact naturally leads researchers to ask whether crises affect economic growth through their dampening effects on trade and FDI inflows. Some studies have investigated the crisis-FDI relationship (Dornean et al. 2012; Mahmoud 2011; Ucal et al. 2010) and the crisis-trade relationship (Chor and Manova 2012; Curran et al. 2009; Macias et al. 2010). Some other studies have connected crises and economic growth through either FDI inflows (Asteriou and Spanos 2019; Gaies et al. 2019; Jimborean and Kelber 2017) or trade (Liu et al. 2019; Yuan et al. 2010) and found mixed results, with some finding stimulating and others finding a dampening effects of crises on FDI-growth and trade-growth relationships. The study by Asteriou and Spanos (2019) was the first to consider both trade and FDI in assessing the effects of crises on economic growth in 26 European Union (EU) countries and found a distortionary effect of crises on economic growth through FDI and a stimulating effect through trade.

However, most of the aforementioned studies are centered on European countries, with a few investigating Latin American and East Asian countries. To the best of my knowledge, no study has examined crisis-FDI-growth or crisis-trade-growth relationships in South Asian countries or Bangladesh. Since countries in different regions have different economic settings in terms of infrastructural challenges, trade openness, economic policies, financial markets, and so forth (Sarker and Serieux 2023), the findings of previous studies cannot be generalized to all countries. Hence, the study of

[1] However, FDI inflows, in some cases, may exert a negative effect by crowding out domestic investment, causing dependence, and increasing external vulnerability (Aitken & Harrison 1999).

FDI-growth and trade-growth relationships incorporating the effects of crises demands further empirical research. Since the ratio of trade to GDP in Bangladesh—an emerging economy in Asia—has exceeded 40% in recent decades and the economy depends significantly on FDI inflows for mobilizing capital investment, the recent crises might have significantly affected the economy through these two channels.[2] Hence, it is important to examine whether the global crises affected economic growth in Bangladesh by influencing foreign trade and FDI inflows.

This study investigates whether global crises affected FDI-growth and trade-growth relationships in Bangladesh. The contribution of this study is that along with the 2007–2008 economic crisis and the 2016 commodity crisis, it considers the COVID-19 pandemic, which has not yet been incorporated into the related literature. Since the current world is characterized by globalization and a liberalized economic system in which restrictions on the movement of goods and capital are being continuously relaxed, any economic or financial shock to major economies or the global economy may have a direct or indirect impact on other economies. Although these three crises are not similar in terms of nature and impacts on economic outcomes, they are expected to affect the economic growth trajectory of Bangladesh through various channels.[3] Therefore, this study might serve as the basis for future studies on the indirect impacts of crises or external shocks in other countries. Results reveal that the lobal crises had a distorting effect on FDI-led growth in both the short run and long run but had no effect on trade-led growth.

The rest of the paper proceeds as follows. Sect. "Theory and related literature" provides the theoretical underpinnings and related literature. Sect. "Methodology and data" describes the methodology and data sources. Sect. "Results and discussion" presents the results and discussion, and Sect. "Conclusion and policy recommendations" concludes the paper.

Theory and related literature

FDI-led growth

The Solow spirit of growth model argues that FDI engenders growth by accumulating capital and incorporating new inputs and foreign technologies in the production processes of recipient economies (Dunning 1970; Krueger 1987; Todaro 1982). The neoclassical growth theory assumes that FDI can channel the required funds to the deserving sectors of a capital-shortage country and increase the marginal productivity of capital,

[2] Bangladesh economy, a major exporter of readymade garments and textile products, exports some manufactured products, including pharmaceutical, plastic, leather and textiles, and agricultural products (Export Promotion Bureau 2022). Bangladesh has been able to attract a large amount of FDI in the last two decades because of its adopted policies favoring foreign investment and also because it is an attractive destination for FDI due to its cheaper labor, increasing market size, and liberalized and investment-friendly economic environment, etc. (Dutta et al. 2017).

[3] The oil price shock of the 1990s (1990–1992) is not considered in this study because trade as a percentage of GDP in Bangladesh was insignificant in the 1990s (less than or around 20%). In addition, because of the low level of industrialization, energy consumption in Bangladesh was small compared with other LDCs, and energy imports as a percentage of energy use were also low (less than 20%) in the 1990s (World Bank 2021). The East Asian currency crisis of 1997–1998 had very little or no impact on Bangladesh economy because of the nature of the capital account and financial market in the country. Although the crisis scared many investors away from emerging markets in Asia, it could not affect Bangladesh as much given the fact that foreign financial assets and direct investment at that time were not substantial. Bangladesh also did not face the possibility of capital flight or a speculative attack on Taka due to the absence of any credible foreign exchange market. As the crisis evolved, foreign investment from South Korea and Taiwan in Bangladesh substantially declined, but overall FDI inflows continued to flourish (Chowdhury 1998). Hence, the East Asian currency crisis of 1997–98 is also not considered in this study.

thus stimulating economic growth. Specifically, the neoclassical growth theory states that an economy requires a long-term capital commitment to flourish persistently (Adams 2009). Since FDI is a source of long-term and reliable capital for developing economies, economists emphasize its efficacy in augmenting economic growth.

The endogenous growth theory, on the other hand, maintains that a country's long-run growth is affected by physical investment and the efficacy of its utilization. It has been argued that FDI brings organizational, managerial, and technical skills as well as improved technology (Lucas 1988; Romer 1986), augments the stock of knowledge and skills, and spills over externalities to recipient economies (Grossman and Helpman 1991). Thus, FDI is expected to fuel economic growth by reducing the capital gap, partly offsetting research and development (R&D) investment, creating new job opportunities in host economies (Borensztein et al. 1998; Sarker 2023), and reducing the technological gap between national and international enterprises (Anwar and Nguyen 2010; Sarker and Serieux 2022). However, in recipient countries with low levels of human capital and weak technology absorption capacity, the impact of FDI on production is inadequate (Forte and Moura 2013).

The empirical literature has presented evidence supporting the role of FDI in fostering economic growth in recipient economies (Popescu 2014; Shan 2002); however, there is evidence of no significant effect as well (Alvarado et al. 2017). Using data on 15 East Asian economies, Kotrajaras et al. (2011) revealed that the favorable impacts of FDI depend on each host country's economic conditions, such as the development levels of financial markets and institutions, better governance, and suitable macroeconomic policies.

Trade-led growth

For more than a century, economic analysts have debated the association between trade policies and economic performance. The modernization theory—originating from the ideas of Max Weber and later developed by Talcott Parsons—opines that trade openness facilitates the transformation of developing economies from a pre-modern stage to a modern and civilized stage via trade with developed economies. Similarly, Ricardo (1817) hypothesized the comparative advantage theory, which states that an economy should specialize in the production and export of commodities with lower opportunity costs and import commodities with comparatively higher opportunity costs. The Heckscher–Ohlin model of international trade states that a capital-abundant (labor-abundant) country should specialize in the production and export of capital-intensive (labor-intensive) products. The neoclassical theory maintains that trade expansion is, among others, the major driver of economic growth.

Arthur Lewis, in his pioneering work "Theory of Economic Growth," argued that countries that have trade relationships with the rest of the world have an advantage in absorbing technological innovations generated in advanced countries. In the past three decades, the rapid growth in newly industrialized nations has motivated other less developed countries to change their trade policies in favor of more liberalized trade regimes.

Supporters of liberal economies argue that freer trade results in faster economic growth,[4] while protectionists argue that trade restrictions may ensure better economic performance. Consequently, the association between international trade and economic growth has been extensively examined in both the theoretical and empirical literature.[5] The empirical literature has revealed a significant effect of trade on economic growth (e.g., Deme 2002; Zahonogo 2017).

The endogenous growth theory recognizes the role of imports as an engine for long-run economic growth as well as export expansion as imports provide domestic firms with access to essential intermediate inputs and upgraded technology (Coe and Helpman 1995). In this regard, Lawrence and Weinstein (1999) and Mazumdar (2001) argued that imports may serve as a channel of R&D knowledge transfer from developed to developing countries. In most empirical studies, imports have been found to stimulate economic growth—import-led growth (Mahadevan 2007), although there is also evidence of a negative effect (Jawaid 2014).

Supporters of the export-led growth hypothesis argue that exports induce economic growth by providing countries with foreign exchange that allows for more imports of intermediate goods and advanced machinery (Bhagwati 1988; Edwards 1998). Helpman and Krugman (1985) stressed that exports expedite economic growth in a country by achieving economies of scale—specialization of production and dissemination of technical knowledge—and better allocation of resources. It is also argued that export expansion allows for specialization based on comparative advantage (Mahadevan 2007) and leads to rapid expansion of employment and real wages (Athukorala and Menon 1996). Thus, growth in exports increases productivity in exporting sectors and stimulates higher domestic spending, which is another source of GDP growth. The export-led growth literature has produced evidence supporting the idea that exports play a stimulating role in economic growth (Kavoussi 1984; McNab and Moore 1998).

Transmission of crises

Rapid globalization has made global markets increasingly interconnected, particularly with respect to international trade and cross-border financial flows. Thus, trade and financial linkages are two big channels through which crises are immediately transmitted across borders (Alfaro et al. 2004). The transmission of economic shocks from one economy or region to others—economic contagion—becomes quicker as economic integration among countries strengthens. The transmission of economic crises can be explained by theories related to FDI and trade, such as the theories of economic contagion, demand shocks and supply disruptions, and risk aversion. These theories can be classified into two broad groups: those that explain fundamental causes and those that are linked to investors' behavior (Bandara 2014).

[4] Liberal economists argue that international trade can lead nations to embrace more quickly contemporary technological change to enhance effective production (Jung & Marshall 1985; Kou et al. 2021).

[5] See Giles and Williams (2000), Krugman (1987), and McCombie and Thirlwall (1994) for surveys. This trade-growth relationship gained attention in the empirical literature, on the one hand, with the rapid economic growth achieved by newly industrialized Asian countries since the seventies and, on the other, with the Latin American import-substitution development strategy that simultaneously showed its limits and economic malfunction (Gómez et al. 2011).

Crises and FDI inflows

A healthy economy with sound economic growth and employment rates attracts foreign investors. Crises may lead to a reduction in FDI flows by influencing various macroeconomic indicators such as economic performance and productivity (Saleh 2023). The financial contagion theory states that economic crises can spread across countries through financial channels, including FDI. Crises force foreign investors to reconsider their cross-border investments. Crisis-hit countries experience financial shocks and instability, which, in turn, can cause foreign investors to lose confidence and withdraw their investments and operations from those countries, also known as "escaping behavior" (Gorg and Strobl 2003). The withdrawal of FDI may amplify a country's crisis by further destabilizing the economy and affecting the availability of investible funds.

The underlying mechanism of financial contagion can be explained by a decline in demand and an increase in costs. Crises reduce demand, thus effecting a decline in sales (Alfaro and Chen 2010). A decline in sales leads to low production and low profits or even losses, eventually decreasing FDI inflows (Urata and Kawai 2000). In addition, crises often cause inflation, higher exchange rates, and increased transaction costs for foreign investors (Alegre and Sard 2015). These increased costs compel multinational enterprises to reassess their partnerships with local firms and seek tighter control over firms' operations, making it hard to find local partners (Williams and Martinez 2012).

Risk aversion theories state that the global investment climate is frequently risky and unpredictable during economic crises. Investors may become more cautious and risk-averse when they are unsure of the economic and political circumstances of a nation in crisis. They might decide to invest in safer places, postpone or cancel planned FDI initiatives, or do both (Hosseini 2005). This decline in FDI can negatively impact crisis-hit economies, leading to job losses and slowing down economic growth (Asteriou and Spanos 2019). However, the extent to which crises have a negative effect on FDI inflows depends on the economic performance of the crisis-hit economy.

Crises and trade

Crises can affect an economy's trade through various channels, such as demand shocks, supply disruptions, and exchange rate fluctuations. For instance, economic crises frequently result in a decrease in business and consumer confidence, thus lowering the demand for goods and services (Klapper and Love 2011). This fall in demand in turn exerts a significant influence on global trade (Auboin and Engemann 2014). Reduced demand from crisis-hit nations can affect trading partners and lower trade volumes; these changes reverberate across global supply chains. Similarly, economic crises can alter trade flows by disrupting global supply chains. Production disruptions and shortages of intermediate goods might result from crises in major exporting nations or important suppliers (Blome and Schoenherr 2011). These interruptions may spread through supply chains and affect the ability of other nations to produce and export goods (Chongvilaivan 2012). As businesses struggle to find essential materials, trade volumes may fall, causing the crisis to spread through trade channels.

A crisis can lead to currency devaluation, thus reducing the demand for imports due to reduced income and lowering the international export competitiveness of other countries (Bilbao-Ubillos and Fernández-Sainz 2022). In contrast, exports may become more competitive as a result of currency devaluation, which can enhance export volumes in the crisis-hit country and reduce trading partners' export competitiveness. This fall in exports in other countries depresses their GDP growth by affecting production, which, in turn, reduces their import demand (Yuan et al. 2010). Therefore, exchange rate changes during economic crises may have an impact on international trade flows. After the 2007 economic crisis, export growth fell from 6.7% in 2007 to 2.9% in 2008 and −9.9% in 2009; import growth fell from 7.6% in 2007 to 3.2% in 2008 and −11.6% in 2009 (World Bank 2021). Due to the COVID-19 crisis, export and import growth sharply fell from 1.1% and 1.7% in 2019 to −9.0% and −9.3% in 2020, respectively (World Bank 2021). Trade openness, on the other hand, can also stimulate economic growth of some economies during crises because countries may further liberalize trade policies as part of a reform package (Asteriou and Spanos 2019; Liu et al. 2019).

Therefore, crises tend to affect countries that heavily depend on foreign investment for restructuring and industrializing their economies and whose trade volume constitutes a substantial part of their GDP. Foreign investors may invest less in the event of declining demand and evolving uncertainty resulting from crises. For example, after the economic crisis emerged in 2007, global FDI flows significantly reduced from a record high of US$ 1.91 trillion in 2007 to US$ 1.49 trillion in 2008 and US$ 1.24 trillion in 2009. After the 2016 commodity price shock, FDI flow started falling again, from US$ 2.07 trillion in 2016 to 1.44 trillion in 2018. Further, following the COVID-19 crisis at the beginning of 2020, it decreased sharply, reaching 1 trillion in 2020—a record low after 2005 (UNCTAD 2021b). The decreasing flow of foreign capital led to a shortage of investible funds and a subsequent decline in production and GDP growth (Asteriou and Spanos 2019; Breitenlechner et al. 2015). However, there is evidence of FDI accelerating economic growth during crises (Gaies et al. 2019; Jimborean and Kelber 2017).

Bangladesh, being a developing country, heavily depends on foreign trade and FDI inflows as instruments of rapid economic growth. The economy encountered a similar sharp fall in export and import growth after both the 2007 economic crisis and COVID-19 crisis, while the economy experienced a different trend in FDI inflows compared with global FDI flows. Due to the nature of the economy and composition of GDP, any negative shocks in trade, particularly in exports, and FDI inflows resulting from any uncertainty are likely to have dampening effects on FDI-growth and trade-growth relationships. Thus, it is worth investigating whether the crises that are considered in this study had any direct negative effect on economic growth or an indirect dampening effect on FDI-growth and trade-growth relationships in Bangladesh.

Methodology and data

Model specification

The hypothesis tested in this study is whether the considered three crises affected FDI-growth and trade-growth relationships in Bangladesh. The model is built on the standard Cobb–Douglas production function and is distinctly augmented, including

FDI inflows, exports, imports, total trade, real capital stock, labor force, broad money (M3),[6] and crises. The function is expressed as follows:

$$Q_t = A_t L_t^{\alpha} K_t^{1-\alpha}; \qquad 0 < \alpha < 1 \tag{1}$$

where Q_t denotes real output, L labor force, and K real capital stock. A denotes technological progress, which is assumed to vary over time. Following Kumar and Paramanik (2020), Dritsaki and Stamatiou (2018), and Okere et al. (2022), among others, technological progress is considered a function of trade, FDI inflows, and broad money (M3). Thus, A is defined as follows:

$$A_t = \psi . TR_t^{\beta} FDI_t^{\gamma} M3_t^{\delta} \tag{2}$$

where TR_t indicates total trade (the sum of exports and imports) and $M3_t$ is used as an indicator of financial depth (i.e., the size of the financial sector). The argument is that a large and developed financial market and the availability of finance stimulate economic growth through multiple channels, including manufacturing growth. The inclusion of this variable also lowers the risk of falling prey to omitted variable bias. ψ is a time-invariant constant. Therefore, the production function in Eq. (1) becomes:

$$Q_t = \psi . TR_t^{\beta} FDI_t^{\gamma} M3_t^{\delta} L_t^{\alpha} K_t^{1-\alpha} \tag{3}$$

The log transformation of Eq. (3) will be as follows:

$$lnQ_t = \theta_0 + \beta lnTR_t + \gamma lnFDI_t + \delta lnM3_t + \alpha lnL_t + (1-\alpha) lnK_t + \varepsilon_t \tag{4}$$

where $ln\psi = \theta_0$, and ε_t is the white-noise error term. Further, the model is augmented by introducing a dummy variable that accounts for the three crises and their interaction terms with FDI and trade as follows:

$$lnQ_t = \theta_0 + \beta lnTR_t + \gamma lnFDI_t + \delta lnM3_t + \alpha lnL_t + (1-\alpha) lnK_t + \eta C_t + \theta_1 (C \times lnTR)_t + \theta_2 (C \times lnFDI)_t + \varepsilon_t \tag{5}$$

where C_t denotes crises, which is a dummy variable that takes a value of 1 for the years 2007, 2008, 2009, 2016, 2017, and 2020 and 0 for all other years. Real GDP (lnQ_t) is simply the yearly aggregate output in Bangladesh taken as the 2010 constant US$ value. To capture the individual effect of trade on economic growth amidst crises, total trade is decomposed into exports and imports. The sign and significance of the coefficients of the interaction terms (θ_1 and θ_2) explain how crises affect economic growth through FDI inflows and international trade.

Labor force (lnL) and capital stock (lnK) are indispensable parts of the Cobb–Douglas type of production function due to their contribution to total output. They have been widely used in research on FDI-growth and trade-growth relationships. Although a large body of empirical literature has used gross fixed capital formation as a channel for engendering growth, real capital stock, generated from gross fixed capital formation (GFCF) using the perpetual inventory model, is used in this study as an appropriate measure of capital. Following the extant literature (Akinlo 2004;

[6] M3 is a measure of total money supply in an economy that includes M2 as well as large time deposits, institutional money market funds, short-term repurchase agreements, and other larger liquid assets.

Vadlamannati and Tamazian 2009), real capital stock is generated based on the following formula:

$$K_t = (1 - \delta)K_{t-1} + I_t \tag{6}$$

K_t, in Eq. (6), is the real capital stock in year t, K_{t-1} is the real capital stock in year $t-1$ (previous year), and I_t is the real investment in year t (defined as gross fixed capital formation measured in the 2010 US$ constant value; e.g., Akram and Rath 2018). The symbol, δ, is the capital depreciation rate for Bangladesh economy. The initial capital stock is defined as follows:

$$K_0 = I_0/(g + \delta) \tag{7}$$

where K_0 is initial capital stock, I_0 is initial capital investment, δ is as defined before, and g is the average growth rate of capital investment used to generate the initial capital stock for the considered period of this study. Following similar modeling in the empirical literature (e.g., Adeleye et al. 2021; Adusei and Adeleye 2020), the interaction coefficients (θ_1 and θ_2) can be interpreted as follows:

- If $\theta_1 = 0$ and $\theta_2 = 0$, it implies that the interaction of crises with trade and FDI inflows has no significant effect on economic growth.
- If $\theta_1 > 0$ and $\theta_2 > 0$, crises boost economic growth.
- If $\theta_1 < 0$ and $\theta_2 < 0$, the overall impact of trade and FDI inflows on economic growth depends on the magnitude of the negative coefficient.
- If the negative sign of θ_1 and θ_2 outweighs the positive sign of β and γ, crises distort the impact of trade and FDI inflows on economic growth.
- If the negative sign of θ_1 and θ_2 is less than the positive sign of β and γ, the distortionary influence of crises is not sufficient to inhibit the positive effects of trade and FDI inflows on economic growth.

Estimation technique

Augmented autoregressive distributed lag bounds test

Goh and McNown (2015) demonstrated that reporting only the *F*-test for overall significance and the *t*-test on the lagged dependent variable in the autoregressive distributed lag (ARDL) bounds testing model is insufficient and may lead to degenerate case 1 pointed out by Pesaran et al. (2001).[7] To avoid this problem, McNown et al. (2018) proposed an additional *t*-test or *F*-test on the lagged levels of independent variables in the ARDL model and named it "augmented ARDL" (AARDL). Therefore, all three tests should be conducted and reported to distinguish between evidence of cointegration and degenerate cases. Hence, the AARDL bounds testing approach to cointegration proposed by McNown et al. (2018) is applied in this study to investigate FDI-growth and trade-growth relationships.

[7] Pesaran et al. (2001) pointed out a "degenerate case" when the overall *F*-test and *t*-test on the lagged level of the dependent variable are statistically significant while the coefficients of the lagged levels of the independent variables are not different from zero. In this case, the significance of the *F*-test arises from the lagged level of the dependent variable, implying that the dependent variable is indeed stationary.

This method is flexible in terms of application because it allows data series to be of a different order of integration—a mixture of zero-order integration ($I(0)$) and first-order integration ($I(1)$)—whereas other cointegration methods, such as those proposed by Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990), require all variables to be $I(1)$.[8] However, AARDL is not applicable if any variable is $I(2)$. This method provides consistent estimates for a small dataset as well (Haug 2002) and offers more options for selecting lag for both dependent and independent variables while simultaneously handling endogeneity problems in variables. For our considered framework, this model can be specified as follows:

$$\begin{aligned}\Delta lnQ_t = \alpha_0 &+ \sum_{i=1}^{m} \beta_{1i} \Delta lnQ_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lnTR_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta lnL_{t-1} + \sum_{i=0}^{q} \beta_{4i} \Delta lnK_{t-i} \\ &+ \sum_{i=0}^{r} \beta_{5i} \Delta lnM3_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta (C \times lnTR)_{t-i} + \gamma_1 lnQ_{t-1} + \gamma_2 lnTR_{t-1} + \gamma_3 lnL_{t-1} \\ &+ \gamma_4 lnK_{t-1} + \gamma_5 lnM3_{t-1} + \theta_1 C_{t-1} + \theta_2 (C \times lnTR)_{t-1} + \varepsilon_t \end{aligned} \tag{8}$$

$$\begin{aligned}\Delta lnQ_t = \alpha_0 &+ \sum_{i=1}^{m} \beta_{1i} \Delta lnQ_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lnFDI_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta lnL_{t-1} + \sum_{i=0}^{q} \beta_{4i} \Delta lnK_{t-i} \\ &+ \sum_{i=0}^{r} \beta_{5i} \Delta lnM3_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta (C \times lnFDI)_{t-i} + \gamma_1 lnQ_{t-1} + \gamma_2 lnTR_{t-1} + \gamma_3 lnL_{t-1} \\ &+ \gamma_4 lnK_{t-1} + \gamma_5 lnM3_{t-1} + \theta_1 C_{t-1} + \theta_2 (C \times lnFDI)_{t-1} + \varepsilon_t \end{aligned} \tag{9}$$

where Δ is the first difference operator, and ε_t is the white-noise error term. In Eqs. (8) and (9), the terms with summation indicate short-run dynamics, while those without summation represent long-run effects. C_{t-1} in both equations is a dummy variable accounting for the effects of the three crises considered in this study. The null hypothesis is that there is no level relationship in the long run and no effect of the crises, i.e., the corresponding coefficients are zero.

In this study, two sets of asymptotic critical values provided by Pesaran et al. (2001) and Sam et al. (2019) are considered—one for $I(0)$ series and another for $I(1)$ series. When the value of the F-test on overall significance is less than the lower-bound critical value and the absolute value of the t-test is lower than the absolute lower-bound critical value, the null hypothesis of "no long-run relationship" cannot be rejected. On the contrary, when the value of the F-test is greater than the upper-bound critical value and the absolute value of the t-test is greater than the absolute upper-bound critical value, the null hypothesis is rejected, indicating long-run relationships between the variables. However, if the values of the test statistics are neither less than nor greater than the lower-bound and upper-bound critical values, respectively, the decision regarding long-run relationships is inconclusive.

The following error correction models are used to analyze the short-run dynamics.

[8] Johansen (1995) developed a framework for modeling the data series of $I(2)$. However, it is not applicable if any variable in a dataset has a different order of integration.

$$\Delta lnQ_t = \alpha_0 + \sum_{i=1}^{m} \beta_{1i} \Delta lnQ_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lnTR_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta lnL_{t-1} + \sum_{i=0}^{q} \beta_{4i} \Delta lnK_{t-i} + \sum_{i=0}^{r} \beta_{5i} \Delta lnM3_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta (C \times lnTR)_{t-i} + \theta_1 C_{t-1} + \omega_1 EC_{t-1} + \tau_t \quad (10)$$

$$\Delta lnQ_t = \alpha_0 + \sum_{i=1}^{m} \beta_{1i} \Delta lnQ_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lnFDI_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta lnL_{t-1} + \sum_{i=0}^{q} \beta_{4i} \Delta lnK_{t-i} + \sum_{i=0}^{r} \beta_{5i} \Delta lnM3_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta (C \times lnFDI)_{t-i} + \theta_1 C_{t-1} + \omega_2 EC_{t-1} + \tau_t \quad (11)$$

where the coefficients (β_{si}) indicate short-run dynamics. The term *EC* denotes error correction, measuring each period's speed of adjustment toward equilibrium after a shock, and ω_1 and ω_2 are the corresponding parameters. The expected value of ω_s is $-1 \leq \omega_s \leq 0$, where a value of 0 implies no convergence and -1 denotes perfect convergence, i.e., any shock in the current period is perfectly adjusted in the next period. Several diagnostic tests are implemented to demonstrate the validity of the used model. First, the Harvey *F*-test determines whether the residuals of the model are homoscedastic. Second, the Breusch–Godfrey *LM* test checks for serial correlation. Third, the Ramsey RESET test assesses model specification. Fourth, the Jarque–Bera test is used to check for the normality of the residuals of the model. Finally, the plots of the cumulative sum (CUSUM) and CUSUM of squares tests indicate the stability of the models and estimated parameters.

Robustness tests

To check for the robustness of the estimated cointegration results, this study employs the Bayer and Hanck (2013) cointegration test. The Bayer and Hanck cointegration test facilitates an improved power of estimates that is based on methods outlined by Banerjee et al. (1998), Boswijk (1995), Johansen (1991), and Engle and Granger (1987). It combines the individual cointegration test results and incorporates the computed significance level (*p*-value) of these four tests. This test is built on Fisher's equation, as illustrated by Bekun et al. (2019), as follows:

$$EG - JOH = -2\left[\ln (P_{EG}) + ln(P_{JOH})\right] \quad (12)$$

$$EG - JOH - BO - BDM = -2\left[\ln (P_{EG}) + ln(P_{JOH}) + ln(P_{BO}) + ln(P_{BDM})\right] \quad (13)$$

where EG, JOH, BO, and BDM indicate Engle and Granger (1987), Johansen (1991), Boswijk (1995), and Banerjee et al. (1998) tests, respectively, and P_{EG}, P_{JOH}, P_{BO}, and

P_{BDM} are their respective levels of significance. The null hypothesis of "no cointegration" is rejected if the estimated test statistics exceed the critical values provided by Bayer and Hanck (2013). The fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) tests are utilized to confirm the robustness of the AARDL long-run results.

Data

The data employed are annual time series for 47 years, ranging from 1974 to 2020. The period before 1974 is excluded because of missing values in the dataset.[9] The data on GDP, exports of goods and services, imports of goods and services, total trade (the sum of exports and imports), gross domestic capital formation, gross fixed capital formation, and broad money (M3) are all extracted as 2010 US$ constant values. The labor force indicates the total number of working-age people, i.e., people aged between 14 and 64 years. These data are drawn from the World Bank's World Development Indicators (WDI) database. Data on FDI inflows are obtained from the UNCTAD database and converted to 2010 US$ constant values using the GDP deflator (which is taken from the WDI). The capital depreciation rate is taken from the Penn World Table version 10.0. All data, except the labor force, are in millions of US$. Refer to Table 9 in the appendix for the definitions of variables.

Bangladesh presents an interesting setting for investigating the research question as it has demonstrated stability in major macroeconomic variables and persistent growth in GDP for many years. The economy, for example, has recorded stable GDP growth of above 5%, which primarily results from developed microcredit programs and garment industries. In terms of foreign trade, Bangladesh inherited a policy of import-substituting industrialization with import protection and a pegged exchange rate (Yunus and Yamagata 2014). These policies started to change in the late 1970s with deregulation and limited trade liberalization as part of an export-oriented industrialization policy. Since the beginning of the 1990s, trade policies have been amended in favor of more liberalization with a managed floating exchange rate. IMF and World Bank guidelines accelerated the pace of trade liberalization policies, with a view to adopt an export-led growth strategy in the country.

To promote exports, the Bangladesh government invested heavily in improving trade infrastructure and established the Export Processing Zone Authority (BEPZA) in 1980, under which many export processing and economic zones were created. Numerous incentives have been provided to attract foreign investment in these zones, such as tax holidays for 5 years and the banning of labor unions, etc. A Special Bonded Warehouse Scheme[10] has been implemented, to allow firms to produce exclusively for export and to import duty-free inputs; further, a Duty Drawback System has been introduced to provide some duty-free inputs or rebates on duty levied on imported inputs for exporters (Dawson 2006). The Board of Investment (BOI) was established in 1989 and later merged with the Bangladesh Investment Development Authority (BIDA), formed in

[9] This is done to ensure that there are no missing or extreme values in the dataset. The reason for using data from 1974 is to enhance the credibility of the results, as the use of potential lag lengths is likely to reduce the number of observations in the estimated results.

[10] Examples of industries that operate under the Special Bonded Warehouse Scheme include ready-made garments. It is a major contributor to the country's export earnings.

2016, to promote and facilitate private investment. Moreover, to increase the inflow of foreign capital, the Bangladesh government gradually lifted restrictions on capital and profit repatriation and opened up almost all industries to foreign investment (Adhikary 2011).

Figure 1 displays time-series plots of real GDP and its growth rate, exports, imports, total trade, and FDI inflow. As it shows, real GDP has been steadily growing and at a faster pace after 2000. The growth rate of GDP has been hovering around 5% since 1990 and has gone above that since 2005. It declined after 2007 and went up again in 2010. In 2020, the growth rate fell sharply due to the COVID-19 crisis. The levels of exports and imports were low before 2000, and both started increasing sharply in 2003 with little fluctuation. Total trade (the sum of exports and imports) followed the same trend as exports and imports. FDI inflow was insignificant before 1995; it started rising thereafter owing to the financial deregulation in favor of liberalization.

Table 1 displays the descriptive statistics of the main variables of this study. All variables, except the labor force, are in million US$ units. There is significant variation among variables, as indicated by the standard deviation. The values of skewness are less than 1 for most of the variables, implying a moderately skewed distribution. For three variables—GDP, capital, and M3—the skewness values are slightly more than 1. The values of kurtosis for all variables, except labor force, are greater than 2, and for GDP and capital, it is greater than 3. A variable with a kurtosis value of 3 is considered to have a normal distribution (the Eviews 12 student version is used in the analysis).

Results and discussion

Unit root results

As the ARDL bounds test suggests, variables must be integrated of order 0, $I(0)$, or 1, $I(1)$ in order to be cointegrated. To check for the order of integration of variables, two linear unit root tests—Dickey–Fuller generalized least squares (DF-GLS) proposed by Elliott et al. (1996) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) proposed by Kwiatkowski et al. (1992)—and one nonlinear unit root test, Kapetanios–Shin–Shell (KSS) proposed by Kapetanios et al. (2003), have been employed. The KSS test is used to accommodate the possibility of nonlinear dynamics in some series. Kapetanios et al. (2003) extended the ADF test based on an exponential smooth transition autoregressive process and introduced a new unit root test to check for linear unit roots against a nonlinear stationary process. As the stationary test results reported in Table 2 suggest, all variables are either $I(0)$ or $I(1)$, which provides a basis for applying the AARDL bounds testing approach as other cointegration tests that require all variables to be $I(1)$, such as those used in Engle and Granger (1987) and Johansen (1988), are not applicable.

AARDL cointegration results

The results of the AARDL bounds test estimation are reported in Table 3. The Akaike information criterion (AIC) is used to select the optimal lag length for each variable. Different lag lengths for each variable are selected across specifications, with the highest lag length being 3 and the lowest being 0. Although 7 specifications are estimated,

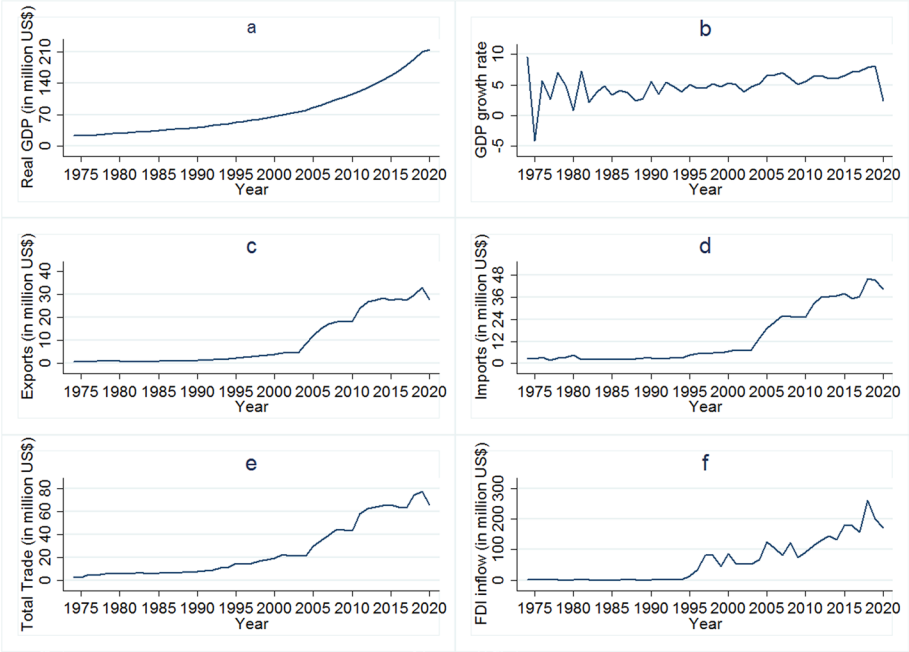

Fig. 1 Time-series representation of the main variables

Table 1 Descriptive statistics of the main variables

Variables	Obs	Mean	SD	Min	Max	Skew	Kurt
GDP	47	77,786.60	53,970.90	23,324.24	214,962.41	1.09	3.13
Exports	47	9459.63	11,057.57	641.95	33,057.42	0.91	2.14
Imports	47	13,854.76	14,656.40	1938.06	45,975.72	0.91	2.22
Total trade	47	26,039.86	23,837.67	2564.73	77,184.48	0.87	2.22
FDI inflow	47	60,529.96	69,328.86	− 1533.29	260,156.00	0.91	2.91
Labor force	47	43.39	14.85	21.35	70.16	0.15	1.76
Capital	47	174,401.23	166,455.60	22,552.00	631,675.00	1.04	3.49
M3	47	35,320.90	36,769.06	1948.44	124,168.80	1.01	2.63

All variables except labor force are in constant 2010 million US$ units. The labor force is simply in million units

specifications 4–7 are of interest as they include the interaction terms of crises with trade and FDI.

In all specifications (a "constant only" model), the values of the overall *F*-test (for the overall significance) exceed the upper-bound critical values at the 1% significance level, and the absolute values of the *t*-test on the lagged dependent variable exceed the absolute upper-bound critical values at the 1% significance level. The significance of these two test statistics indicates a long-run cointegrating relationship among the variables. To avoid degenerate case 1, as mentioned in Sect. "Augmented autoregressive distributed lag bounds test", the values of the *F*-test on the lagged independent variables are also reported, which are all significant at the 1% level. These results mean that the lagged dependent variable is not the only source of the significance of the overall *F*-test; rather, lagged independent variables are a significant part of this (i.e., independent variables

Table 2 Stationarity test results

	DF-GLS				KPSS		KSS	
	P_T		GLS					
	Level	First diff	Level	First diff	Level	First diff	Level	First diff
lnGDP	4.312**	9.279	−1.280	−4.632***	0.160**	0.113	−1.577	−3.691***
lnExort	30.067	4.562**	−1.301	−4.909***	0.120	0.121	−2.264**	0.691
lnImport	20.075	4.297**	−1.846	−8.311***	0.131	0.133	−2.529*	−2.194
lnTrade	4.557**	5.718	−2.464	−7.354***	0.108	0.112	−1.813*	−0.276
lnM3	11.935	10.440	−2.014	−4.005**	0.128	0.173**	−0.198	−4.417***
lnFDI	3.345***	5.741	−5.319***	−6.426***	0.087	0.115	−1.176	−2.171**
lnL	2.810***	0.798***	−0.105	−3.988***	0.152**	0.122	1.102	−7.442***
lnK	4.531**	17.499	−1.055	−2.922**	0.153**	0.082	−1.022	−2.103**

***$p < .01$, **$p < .05$, *$p < .1$. The null hypothesis in the DG-GLS and KSS tests is non-stationarity, whereas the null hypothesis in the KPSS test is stationarity. The DF-GLS test (both P_T and GLS statistics) rejects null hypotheses in the lower tail, while the KPSS and KSS tests reject null hypotheses in the upper tail. The 1%, 5%, and 10% critical values are: 3.96, 5.62, and 6.89, respectively, for P_T of DF-GLS test; −3.48, −2.89, and −2.57, respectively, for GLS of DF-GLS test; 0.216, 0.146, and 0.119, respectively, for KPSS test; and −2.78, −2.10, and −1.79, respectively, for KSS test

significantly affect the dependent variable, lnGDP), implying that there are long-run cointegrating relationships among the variables.

The diagnostic test results are also reported in Table 3. All specifications have a high value of adjusted R^2. The Durbin–Watson test for autocorrelation indicates that there is no autocorrelation in the residuals as its value is approximately 2 in all specifications.[11] To reconfirm autocorrelation, the Breusch–Godfrey *LM* test statistic is reported, indicating that the null hypothesis of "no autocorrelation" cannot be rejected. To test for heteroscedasticity in the residuals, the Harvey test is reported, which cannot reject the null hypothesis of "homoscedastic residuals." The Ramsey RESET test is utilized to indicate the stability of the model and estimated parameters. The value of the *F*-statistic in the Ramsey RESET test is not significant, which implies that there is no model misspecification, and the estimated parameters are stable. Lastly, the Jarque–Bera normality test indicates that all models have a normal distribution as the null of the "normal distribution" cannot be rejected.

Table 4 reports the long-run elasticities of GDP with respect to the explanatory variables. As it shows, exports have a significant positive effect on economic growth (e.g., Balassa 1985; McNab and Moore 1998), whereas imports have a negative and insignificant coefficient (e.g., the study by Awokuse (2007) on Bulgaria and Poland and the study by Aluko and Adeyeye (2020) on 29 African countries). Moreover, trade (the sum of exports and imports) has an overall positive impact on GDP (e.g., Deme 2002; Zahonogo 2017). Notably, FDI exerts a significant positive impact on GDP (e.g., Alfaro et al. 2004).

Broad money (M3) has a positive impact on economic growth. This result implies that the level of financial depth (the size and liquidity of the financial system) positively influences economic growth. A higher M3 level typically denotes stronger financial resource availability in an economy (Chao et al. 2021). Hence, a higher level

[11] The value of the Durbin-Watson test statistic ranges from 0 to 4. A value of 2.0 means that there is no autocorrelation in the residuals. Its value between 0 and less than 2 implies positive autocorrelation, while a value between more than 2 and 4 implies negative autocorrelation.

Table 3 AARDL bound testing with *F*-test and *t*-test

	Spec. 1† (0,3,3,3,3,2)	Spec. 2 (0,2,2,3,3)	Spec. 3 (3,2,0,3,2)	Spec. 4 (2,0,0,2,1)	Spec. 5 (0,2,0,2,2)	Spec. 6 (1,3,1,2,2)	Spec. 7 (1,2,0,1,1)
F-test	15.27***	7.56***	4.85***	7.92***	10.75***	9.46***	4.92***
t-test on lagged dependent variable	−11.56***	−7.29***	−5.77***	−8.29***	−9.78***	−8.99***	−6.07***
F-test on lagged independent variables	8.65***	6.21***	7.08***	8.94***	7.64***	8.75***	9.38***
Diagnostic tests							
Ad. R^2	0.981	0.975	0.984	0.981	0.987	0.985	0.984
Durbin–Watson stat	2.737	1.948	2.079	2.142	2.425	2.273	2.381
B-G LM F-stat	1.991	0.221	1.831	0.136	1.115	0.390	0.453
	[0.125]	[0.880]	[0.139]	[0.873]	[0.347]	[0.681]	[0.645]
Harvey F-stat	1.033	1.531	0.954	0.849	1.042	1.491	0.809
	[0.464]	[0.162]	[0.529]	[0.634]	[0.460]	[0.174]	[0.674]
Ramsey F-stat	0.467	2.203	2.22	1.844	0.409	0.506	2.383
	[0.500]	[0.150]	[0.154]	[0.187]	[0.529]	[0.483]	[0.182]
J–B test	2.261	1.180	1.382	2.221	1.211	2.455	2.522
	[0.331]	[0.513]	[0.501]	[0.329]	[0.511]	[0.291]	[0.283]

***$p < .01$, **$p < .05$, *$p < .1$. *p*-values of significance are in square brackets. The number of observations in each estimated specification is 44 after adjustment

† Spec means specification. Seven different specifications are estimated

Specification 1: lnGDP = f(lnExport, lnImport, lnLabor, lnCapital, lnM3, Crises)

Specification 2: lnGDP = f(lnTrade, lnLabor, lnCapital, lnM3, Crises)

Specification 3: lnGDP = f(lnFDI, lnLabor, lnCapital, lnM3, Crises)

Specification 4: lnGDP = f(lnTrade, lnLabor, lnCapital, lnM3, Crises, Crises*lnTrade)

Specification 5: lnGDP = f(lnExport, lnLabor, lnCapital, lnM3, Crises, Crises*lnExport)

Specification 6: lnGDP = f(lnImport, lnLabor, lnCapital, lnM3, Crises, Crises*lnImport)

Specification 7: lnGDP = f(lnFDI, lnLabor, lnCapital, lnM3,Crises, Crises*lnFDI)

of M3 leads to a lower interest rate and provides individuals and businesses with greater access to credit and financing, which, in turn, enables higher consumption and investment, ultimately boosting economic growth (Calderón and Liu 2003). There is evidence of similar findings in the empirical literature (e.g., Calderón and Liu 2003; Ogunmuyiwa and Ekone 2010).

The labor force has a negative but insignificant coefficient across specifications, implying no significant impact on economic growth (e.g., Rajab and Zouheir 2023). Although labor force growth is likely to positively impact economic growth, rapid population growth with inadequate institutional and economic infrastructure can strain resources and lead to rising unemployment. In addition, an abundant labor force may serve as a disincentive to technology adoption in an economy and hinder labor productivity from rising (Park-Poaps et al. 2021). Since Bangladesh economy is characterized by rapid population growth and abundant labor—a fact reflected by the low wage level and high unemployment rate—coupled with insufficient improvement in infrastructure, education, and skills, the labor force growth might have led to an inadequate increase in returns (labor productivity) and insignificant impacts on economic growth.

The coefficient of capital stock is positive and significant in all specifications, implying a positive impact on economic growth (e.g., Ramirez 2006). The result is as

Table 4 Long-run AARDL estimation results

	Spec. 1†	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6	Spec. 7
lnExport	0.123**				0.151**		
	(0.052)				(0.072)		
lnImport	−0.042					−0.386	
	(0.054)					(0.794)	
lnTrade		0.12**		0.113**			
		(.046)		(0.049)			
lnFDI			0.021***				0.018***
			(0.007)				(0.005)
lnM3	0.110**	0.132**	0.114**	0.095*	0.069**	0.175***	0.136**
	(0.042)	(0.065)	(0.050)	(0.050)	(0.038)	(0.051)	(0.058)
lnLabor	−0.861	−0.877	−0.791	−0.842	−0.775	−0.683	−0.711
	(0.605)	(0.632)	(0.513)	(0.607)	(0.564)	(0.589)	(0.610)
lnCapital	0.221***	0.288***	0.233***	0.196***	0.180***	0.137**	0.196***
	(0.066)	(0.097)	(0.055)	(0.068)	(0.057)	(0.059)	(0.062)
Crises	0.018	0.039	0.009	0.700	0.461	0.757	0.501
	(0.014)	(0.034)	(0.019)	(0.88)	(0.692)	(0.676)	(0.570)
Crises × lnExport					0.070		
					(0.087)		
Crises × lnImport						−0.074	
						(0.026)	
Crises × lnTrade				−0.054			
				(0.073)			
Crises × lnFDI							−0.233**
							(0.095)

***$p < .01$, **$p < .05$, *$p < .1$. †Spec means specification. Standard errors are in parentheses. The number of observations in each estimated specification is 44 after adjustment

expected because the levels of domestic savings and capital stock are low in Bangladesh (i.e., it is a capital-deficient country); hence, an increase in capital stock immediately boosts productive capacity and output growth.

The global crises did not have any direct impact on economic growth, as the coefficients of the crises are insignificant in all specifications. This result implies that the economy managed to maintain economic growth by offsetting the direct impacts of external shocks. This result is tenable due to the following reasons: first, to some extent, the Bangladesh's economy has moderately diversified industries, including garments and textiles, manufacturing, agriculture, and services, that help mitigate external shocks; second, Bangladesh's home market is enormous with a sizable consumer base and massive domestic demand that acts as a buffer against external shocks; third, remittance inflows provide a stable sources of foreign exchange that supports household consumption; fourth, the shares of the agriculture and service sectors, whose productivity was not significantly negatively affected by external shocks, constitute a substantial portion of GDP, and these sectors play a crucial role in supporting livelihoods for a significant portion of the population.

Regarding the indirect impacts, the crises do not appear to have significantly affected the trade-growth relationship, as none of the coefficients of the interaction terms between crises and trade, crises and exports, or crises and imports are

significant. Alternatively, the crises did not dampen trade-led growth, specifically, export-led growth. This was possible due to the structure of the Bangladeshi export basket. Readymade garments have been a significant part of Bangladeshi export earnings since the 1990s, and their contribution to total exports continues to increase. It has constituted more than 80% of Bangladeshi export earnings since the 2013–2014 fiscal year (BGMEA 2022). Surprisingly, the export earnings of the readymade garments sector were not distorted by any crisis considered in this study, which partly substantiates why no crisis had a distorting effect on trade-led growth in Bangladesh.

However, the coefficient of the interaction term between crises and FDI is negative and significant, implying that the crises dampened FDI-led growth in Bangladesh. In addition, the negative and significant value of the interaction term between crises and FDI outweighs the positive and significant value of the FDI coefficient, indicating that the crises distorted the positive effect of FDI on economic growth. Figure 1 shows visible crashes in the FDI inflow trend before 2010 (two crashes between 2005 and 2010), after 2016, and in 2020. These sudden crashes stemmed from the crises and the resulting slowdown in global economic activities (Joshua et al. 2020) despite Bangladesh's efforts to maintain a fair level of FDI inflows. Although FDI inflows have been a source of GDP growth in Bangladesh, the sudden fall in FDI inflows in those years (Fig. 1) affected economic growth negatively. This substantiates, at least partly, why the crises distorted FDI-led growth in Bangladesh.

The results of the short-run dynamics with error correction are presented in Table 5. Both exports and imports exhibit similar short- and long-run effects. Specifically, the coefficient of exports for the current year in specification 1 is 0.077, which is significant at the 1% level, suggesting that a 1% increase in export earnings leads to an increase of 0.077% in real GDP. This relationship is noteworthy due to the considerable share of exports in Bangladesh's GDP; thus, any sudden increase in exports will have an immediate impact on real GDP growth. FDI demonstrates a positive and significant impact on GDP growth in the short run as well like its long-run effect (as seen in specifications 3 and 7). FDI has played a pivotal role in driving economic growth in Bangladesh in recent decades (Ahamed and Tanin 2010; Khatun and Ahamad 2015; Rayhan 2014). Hence, an increase FDI inflows can immediately affect economic growth. As regards financial depth, M3 has a positive impact on economic growth in the short run and long run. Labor force, unlike its insignificant long-run effect, has a positive short-run effect, and capital, similar to its long-run impact, has a positive impact on economic growth in the short run.

The crises do not exert any significant direct impact on economic growth in the short run (i.e., its coefficient is not significant in any specification). Additionally, none of the coefficients of the interaction terms of crises with trade variables (i.e., exports, imports, and total trade) are significant, implying that the crises had no short-run effect on trade-growth relationships. Nevertheless, the coefficient of the interaction term between crises and FDI is negative and significant, and its absolute value is more than the positive significant coefficient of FDI, which implies that the crises dampened FDI-led growth also in the short run. Finally, the coefficient of error correction (*EC*) is negative and significant with considerably high values in all specifications. This means that there is a

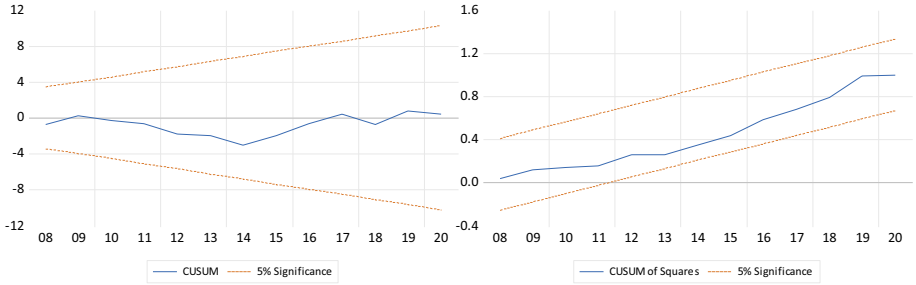

Fig. 2 Plots of CUSUM and CUSUM of squares for specification 1

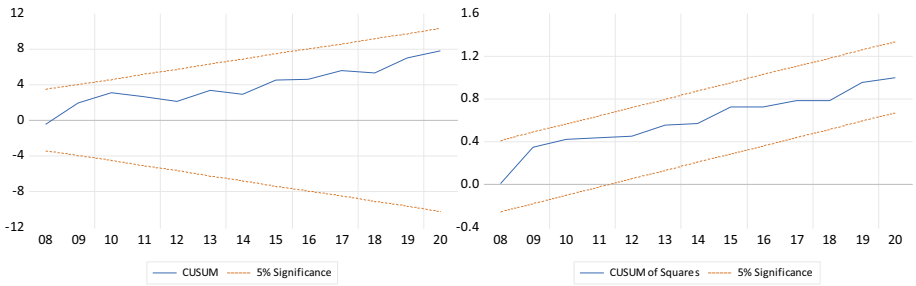

Fig. 3 Plots of CUSUM and CUSUM of squares for specification 2

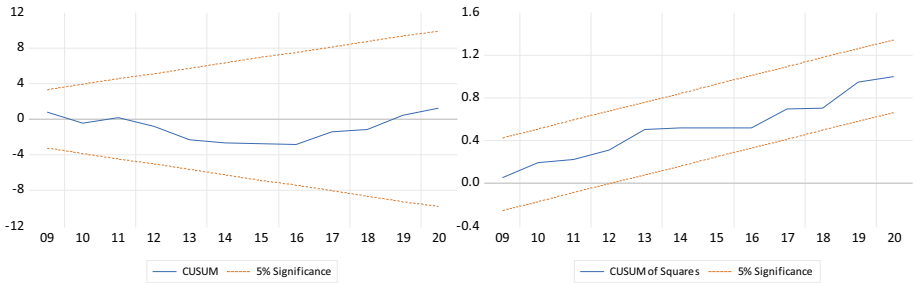

Fig. 4 Plots of CUSUM and CUSUM of squares for specification 3

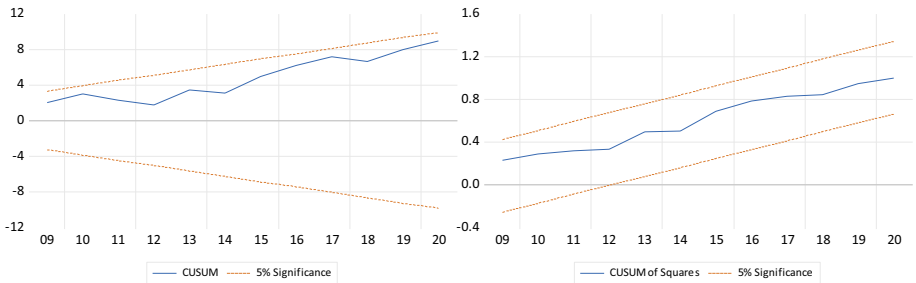

Fig. 5 Plots of CUSUM and CUSUM of squares for specification 4

quick adjustment toward long-run equilibrium relationships after a shock occurs in the short run.

As an additional diagnostic test of the stability of the models, this study presents plots of the cumulative sum (CUSUM) of recursive residuals and CUSUM of squares of

Table 5 Short-run and ECM results

	Spec. 1† **(0,3,3,3,3,2)**	**Spec. 2** **(0,2,2,3,3)**	**Spec. 3** **(3,2,0,3,2)**	**Spec. 4** **(2,0,0,2,1)**	**Spec. 5** **(0,2,0,2,2)**	**Spec. 6** **(1,3,1,2,2)**	**Spec. 7** **(1,2,0,1,1)**
$\Delta lnGDP_{-1}$			0.285	−0.262**		−0.342*	−0.326**
			(0.257)	(0.110)		(0.177)	(0.119)
$\Delta lnGDP_{-2}$			0.474***				
			(0.161)				
ΔlnExport	0.077***				0.025**		
	(0.025)				(0.011)		
$\Delta lnExport_{-1}$	0.014***				0.023**		
	(0.008)				(0.011)		
$\Delta lnExport_{-2}$	0.024***						
	(0.006)						
ΔImport	0.007					−0.032	
	(0.020)					(0.019)	
$\Delta lnImport_{-1}$	−0.006					−0.027*	
	(0.015)					(0.015)	
$\Delta lnImport_{-2}$	0.007					−0.008	
	(0.013)					(0.01)	
ΔlnTrade		0.010					
		(0.027)					
$\Delta lnTrade_{-1}$		−0.010					
		(0.018)					
ΔlnFDI			0.002**				0.009***
			(0.001)				(0.001)
$\Delta lnFDI_{-1}$			0.002**				0.001
			(0.001)				(0.001)
ΔlnM3	0.063**	0.065**				0.059*	
	(0.024)	(0.025)				(0.030)	
$\Delta lnM3_{-1}$	0.008	−0.003					
	(0.021)	(0.026)					
$\Delta lnM3_{-2}$	0.071***						
	(0.017)						
ΔlnL	0.496***	0.429**	0.468**	0.402**	0.708**	0.565	0.432**
	(0.126)	(0.200)	(0.171)	(0.195)	(0.274)	(0.332)	(0.192)
ΔlnL_{-1}	0.508***	0.541	0.370	0.494	0.846**	0.758**	
	(0.285)	(0.513)	(0.298)	(0.308)	(0.408)	(0.342)	
ΔlnL_{-2}	0.940***	0.636**	0.572*				
	(0.285)	(0.310)	(0.303)				
ΔlnK	0.605***	0.828***	0.679**	0.789*	0.525	0.246	0.776*
	(0.294)	(0.335)	(0.273)	(0.395)	(0.482)	(0.651)	(0.449)
ΔlnK_{-1}	0.797***	0.812***	0.698**		0.550**	0.866	
	(0.215)	(0.251)	(0.267)		(0.236)	(0.562)	
ΔlnK_{-2}		0.544					
		(0.349)					
Crises		−0.004			−0.968	−0.041	
		(0.012)			(1.345)	(0.435)	
Crises × lnExport					0.104		
					(0.137)		
Crises × lnImport						−0.089	
						(0.298)	

Table 5 (continued)

	Spec. 1† (0,3,3,3,3,2)	Spec. 2 (0,2,2,3,3)	Spec. 3 (3,2,0,3,2)	Spec. 4 (2,0,0,2,1)	Spec. 5 (0,2,0,2,2)	Spec. 6 (1,3,1,2,2)	Spec. 7 (1,2,0,1,1)
Crises × lnTrade				−0.054			
				(0.073)			
Crises × lnFDI							−0.021***
							(0.004)
EC_{-1}	−0.489***	−0.390**	−0.410**	−0.318**	−0.335**	−0.358**	−0.329**
	(0.109)	(0.161)	(0.174)	(0.133)	(0.128)	(0.163)	(0.139)

***$p < .01$, **$p < .05$, *$p < .1$. †Spec means specification. Standard errors are in parentheses. The number of observations in each estimated specification is 44 after adjustment. EC is the error correction term

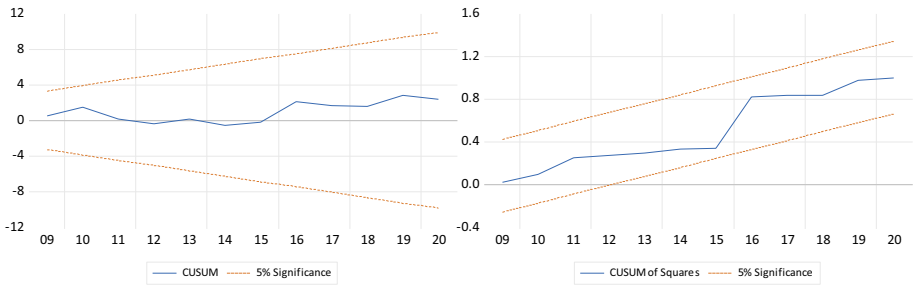

Fig. 6 Plots of CUSUM and CUSUM of squares for specification 5

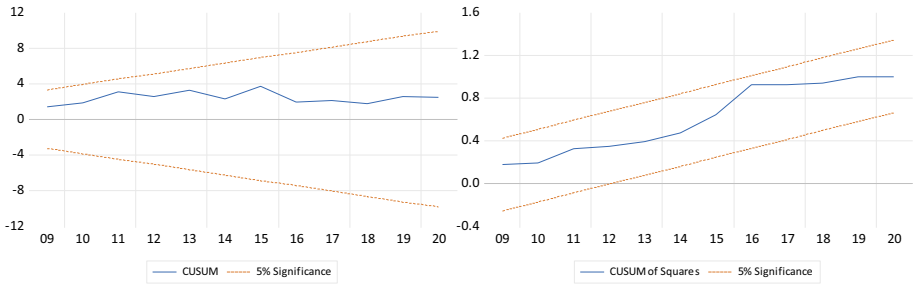

Fig. 7 Plots of CUSUM and CUSUM of squares for specification 6

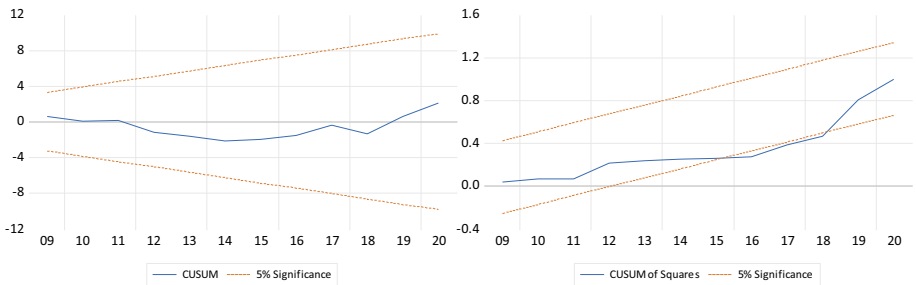

Fig. 8 Plots of CUSUM and CUSUM of squares for specification 7

recursive residuals in Figs. 2, 3, 4, 5, 6, 7, and 8 for specifications 1–7, respectively. All the plots (CUSUM and CUSUM of squares) across specifications reveal that the specified models and the estimated parameters are stable over the study period.

Table 6 Bayer and Hanck cointegration test

Specifications	EG–JOH	EG–JOH–BO–BDM	Cointegration
lnGDP = f(lnExport, lnImport, lnLabor, lnCapital, lnM3, Crises)	44.352	55.001	Yes
lnGDP = f(lnTrade, lnLabor, lnCapital, lnM3, Crises)	34.477	45.107	Yes
lnGDP = f(lnFDI, lnLabor, lnCapital, lnM3, Crises)	28.918	39.419	Yes
lnGDP = f(lnTrade, lnLabor, lnCapital, lnM3, Crises, Crises*lnTrade)	38.083	49.241	Yes
lnGDP = f(lnExport, lnLabor, lnCapital, lnM3, Crises, Crises*lnExport)	24.841	39.040	Yes
lnGDP = f(lnImport, lnLabor, lnCapital, lnM3, Crises, Crises*lnImport)	51.542	50.746	Yes
lnGDP = f(lnFDI, lnLabor, lnCapital, lnM3, Crises, Crises*lnFDI)	24.943	34.843	Yes
5% critical value	10.419	19.888	

Robustness check

First, to check the robustness of the AARDL cointegration results, Bayer and Hanck (2013) cointegration is estimated, and the results are reported in Table 6. Both statistics—EG-JOH and EG-JOH-BO-BDM—are greater than the 5% significance values in all specifications, thereby implying that there are long-run cointegrating relationships among the variables.[12]

Second, the FMOLS and DOLS methods are used to verify the robustness of the AARDL long-run results. Tables 7 and 8 report the results of FMOLS and DOLS, respectively. The results are similar to the AARDL long-run results that confirm the robustness of the long-run elasticities reported in Table 4.

Conclusion and policy recommendations

A large number of studies have tested FDI- and trade-led growth hypotheses, with most concluding that both FDI and trade have positive and significant impacts on economic growth. However, few studies have investigated the effect of crises on economic growth through FDI and trade channels. Therefore, using time-series data on Bangladesh and the AARDL bounds testing approach, this study investigates whether three major crises (the 2007–2008 economic crisis, the 2016 commodity crisis, and the 2020 COVID-19 crisis) distorted FDI- and trade-led growth.

The results reveal that exports have positive effects and imports have insignificant effects on economic growth. Total trade (the sum of exports and imports) has a significant positive impact on economic growth only in the long run, whereas FDI has a positive and significant impact in both the short and long run. The crises are not found to have any direct effect on economic growth, either in the short run or long run. However, in terms of the indirect effects, the crises are found to have distorted the positive effect of FDI on economic growth (i.e., the crises distorted FDI-led growth) in both the short run and long run, while leaving trade-led growth unaffected.

These findings suggest that the economy of Bangladesh was insulated to some extent from external shocks transmitted through international trade channels but was unable to withstand them when they were transmitted through the FDI inflow channel. Ready-made garments and textile industries, which account for a substantial part of total trade,

[12] In this sentence, EG-JOH stands for Engle and Granger (1987)-Johansen (1988) test, and BO-BDM stands for Boswijk (1994)-Banerjee et al. (1998) test.

Table 7 FMOLS estimation results

	Spec. 1†	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6	Spec. 7
lnExport	0.121***				0.028**		
	(0.032)				(0.012)		
lnImport	−0.020					−0.020	
	(0.030)					(0.013)	
lnTrade		0.057***		0.052**			
		(0.021)		(0.023)			
lnFDI			0.021***				0.012***
			(0.001)				(0.001)
lnM3	0.085**	0.079**	0.073**	0.094***	0.100***	0.088**	0.076**
	(0.034)	(0.032)	(0.036)	(0.034)	(0.034)	(0.033)	(0.036)
lnLabor	−0.701	−0.776	−0.854	−0.803	−0.750	−0.724	−0.891
	(0.595)	(0.581)	(0.696)	(0.592)	(0.549)	(0.611)	(0.688)
lnCapital	0.187***	0.218***	0.205***	0.222***	0.194v	0.207***	0.251***
	(0.046)	(0.041)	(0.045)	(0.052)	(0.052)	(0.058)	(0.05)
Crises	−0.010	−0.006	−0.006	0.677	0.465	0.563	0.857
	(0.014)	(0.014)	(0.015)	(0.718)	(0.664)	(0.864)	(0.56)
Crises × lnExport					−0.048		
					(0.067)		
Crises × lnImport						−0.056	
						(0.084)	
Crises × lnTrade				−0.063			
				(0.066)			
Crises × lnFDI							−0.094***
							(0.031)
Constant	13.607***	14.492***	15.061***	14.98***	14.436***	13.869***	15.769***
	(1.28)	(1.008)	(1.205)	(1.178)	(1.233)	(1.423)	(1.263)
R-squared	0.988	0.989	0.981	0.994	0.983	0.987	0.981

***$p < .01$, **$p < .05$, *$p < .1$. †Spec means specification. Standard errors are in parentheses. The number of observations in each estimated specification is 44 after adjustment

contributed significantly to insulating the economy, at least partly, from global crises as these crises could not dampen the amount of Bangladesh's export earnings remarkably. Although the COVID-19 crisis was both an internal and external shock and took a great toll on public health and subsequently on economic activities, major industries such as garments, textiles, and knitwear were not shut down for long in Bangladesh. Other industries, including those operating in the export processing zones, also continued production with little disruption, ensuring continuous exports and thus contributing to GDP. Overall, the structure of the economy (i.e., the share of agriculture, industry, and service sectors in GDP) and all the factors discussed in this study prevented any sharp decline in economic growth of Bangladesh during the crises. FDI inflows in Bangladesh, on the other hand, significantly declined following the major crises, including COVID-19, thus distorting the positive growth effect of FDI. The underlying reason is that global crises create uncertainty among foreign investors, thereby affecting global FDI flows particularly in emerging economies like Bangladesh.

Therefore, policymakers and business consultants should further emphasize the exploration of new international markets for garments and textile products to limit the effect of future crises on exports. This will significantly insulate the domestic economy from

Table 8 DOLS estimation results

	Spec. 1†	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6	Spec. 7
lnExport	0.107**				0.078***		
	(0.051)				(0.024)		
lnImport	−0.077					0.004	
	(0.052)					(0.039)	
lnTrade		0.088***		0.120***			
		(0.026)		(0.021)			
lnFDI			0.012***				0.022***
			(0.002)				(0.002)
lnM3	0.087**	0.084**	0.077*	0.079**	0.084*	0.095**	0.118***
	(0.041)	(0.040)	(0.043)	(0.033)	(0.045)	(0.037)	(0.039)
lnLabor	−0.765	−0.698	−0.778	−0.521	−0.364	−0.519	−0.381
	(0.606)	(0.667)	(0.604)	(0.572)	(0.519)	(0.512)	(0.584)
lnCapital	0.185***	0.208***	0.196***	0.217***	0.221***	0.234***	0.210***
	(0.054)	(0.057)	(0.051)	(0.048)	(0.057)	(0.069)	(0.062)
Crises	0.025	0.033	0.029	−0.549	−0.309	−0.121	−0.579
	(0.020)	(0.020)	(0.025)	(0.495)	(0.376)	(0.663)	(0.492)
Crises × lnExport					−0.034		
					(0.042)		
Crises × lnImport						−0.093	
						(0.059)	
Crises × lnTrade				−0.032			
				(0.086)			
Crises × lnFDI							−0.176**
							(0.070)
Constant	14.817***	13.244***	14.188***	10.479***	7.953***	11.543***	10.064
	(1.636)	(0.961)	(1.27)	(0.929)	(1.742)	(3.251)	(2.029)
R-squared	0.983	0.983	0.984	0.984	0.995	0.986	0.989

***$p < .01$, **$p < .05$, *$p < .1$. †Spec means specification. Standard errors are in parentheses. The number of observations in each estimated specification is 44 after adjustment

any external shocks. Additionally, the creation of a congenial investment climate and business atmosphere must also be prioritized to ensure continuous FDI inflows. Since the crises significantly reduced FDI inflows, specific fiscal measures, such as additional tax breaks and duty-free import and export, can be implemented in future. These measures can act as additional incentives for foreign investors on the one hand and reduce the extent of uncertainty ensuing from crises on the other. Specifically, measures should be positioned to escalate stimulus for economic growth and further liberalize the financial sector, if required. Attention should also be directed to developing human capital and formulating policies for a sound macroeconomic position to encourage foreign investment. Since this study dealt with a single developing country context, which is a limitation, the results cannot be generalized. Therefore, the research topic requires further investigation. Future studies should use data from several developing, developed, or mixed countries.

Appendix

See Table 9.

Table 9 Definition of variables

Variables	Definition
Exports	Total amount of goods and services exported in a year in constant 2010 million US$.
Imports	Total amount of goods and services imported in a year in constant 2010 million US$.
Capital stock	Amount of physical capital stock in a particular year in constant 2010 million US$.
Gross fixed capital formation (GFCF)	The total expenditure for the acquisitions of new or existing fixed assets less the disposal of fixed assets in an economy in a year. Acquisitions can be done by the business sector, governments, and households. It is used as a constant 2010 million US$.
Labor	Number of people aged 14–65 in a year.
Total trade	The sum of exports and imports in a year in constant 2010 million US$.
FDI	The amount of foreign direct investment inflow in a year in constant 2010 million US$.
Broad Money (M3)	The total money supply in an economy that includes M2 as well as large time deposits, institutional money market funds, short-term repurchase agreements, and other larger liquid assets, which is measured in constant 2010 million US$.
Crises	A dummy variable having a value of 1 for the years 2007, 2008, 2009, 2016, 2017, and 2020 and a value of 0 in other years.
Real GDP	The gross domestic product in a year in constant 2010 million US$.

Abbreviations

AARDL	Augmented autoregressive distributed lag
ADF	Augmented Dickey Fuller
AIC	Akaike info criterion
ARDL	Autoregressive distributed lag
BEPZA	Bangladesh export processing zone authority
BIDA	Bangladesh investment development authority
COVID	Coronavirus disease
CUSUM	Cumulative sum
DF-GLS	Dicky Fuller generalized least squares
DOLS	Dynamic ordinary least squares
EC	Error correction
EG–JOH	Engle and Granger–Johansen
EG–JOH–BO–BDM	Engle and Granger–Johansen–Boswijk–Banerjee Dolado and Mestre
EU	European Union
FDI	Foreign direct investment
FMOLS	Fully modified ordinary least squares
GDP	Gross domestic product
GFCF	Gross fixed capital formation
IMF	International Monetary Fund
KPSS	Kwiatkowski–Phillips–Schmidt–Shin
KSS	Kapetanios, Shin and Shell
LM	Lagrange multiplier
R&D	Research and Development
RESET	Regression equation specification error test
UNCTAD	United Nations Conference on Trade and Development
US$	United State dollar
WDI	World development indicators

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Availability of data and materials
FDI inflow data are taken from the UNCTAD database. The depreciation rate is sourced from the Penn World Table version 10.0. Data on other variables are drawn from the World Bank's World Development Indicators (WDI) database.

Declarations

Competing interests
The author declares that he has no competing interests.

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References

Adams S (2009) Foreign Direct investment, domestic investment, and economic growth in Sub-Saharan Africa. J Policy Model 31(6):939–949. https://doi.org/10.1016/j.jpolmod.2009.03.003
Adeleye BN, Adedoyin F, Nathaniel S (2021) The criticality of ICT-trade nexus on economic and inclusive growth. Inf Technol Dev 27(2):293–313. https://doi.org/10.1080/02681102.2020.1840323
Adhikary BK (2011) FDI, trade openness, capital formation, and economic growth in Bangladesh: a linkage analysis. Int J Bus Manag 6(1):16–28
Adusei M, Adeleye N (2020) Credit information sharing and non-performing loans: the moderating role of creditor rights protection. Int J Finance Econ. https://doi.org/10.1002/ijfe.2398
Ahamed MG, Tanin F (2010) Determinants of, and the relationship between FDI and economic growth in Bangladesh.
Aitken BJ, Harrison AE (1999) Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. Am Econ Rev 89(3):605–618. https://doi.org/10.1257/aer.89.3.605
Akinlo AE (2004) Foreign direct investment and growth in Nigeria. J Policy Model 26(5):627–639. https://doi.org/10.1016/j.jpolmod.2004.04.011
Akram V, Rath BN (2018) Exchange rate misalignment and total factor productivity growth in case of emerging market economies. IEEP 15(3):547–564. https://doi.org/10.1007/s10368-017-0374-6
Alegre J, Sard M (2015) When demand drops and prices rise. Tourist packages in the Balearic Islands during the economic crisis. Tour Manag 46:375–385. https://doi.org/10.1016/j.tourman.2014.07.016
Alfaro L, Chen MX (2010) Surviving the global financial crisis: foreign direct investment and establishment performance. SSRN Electron J. https://doi.org/10.2139/ssrn.1623831
Alfaro L, Chanda A, Kalemli-Ozcan S, Sayek S (2004) FDI and economic growth: the role of local financial markets. J Int Econ 64(1):89–112. https://doi.org/10.1016/S0022-1996(03)00081-3
Aluko OA, Adeyeye PO (2020) Imports and economic growth in Africa: testing for granger causality in the frequency domain. J Int Trade Econ Dev 29(7):850–864. https://doi.org/10.1080/09638199.2020.1751870
Alvarado R, Iñiguez M, Ponce P (2017) Foreign direct investment and economic growth in Latin America. Econ Anal Policy 56:176–187. https://doi.org/10.1016/j.eap.2017.09.006
Anwar S, Nguyen LP (2010) Foreign direct investment and economic growth in Vietnam. Asia Pac Bus Rev 16(1–2):183–202. https://doi.org/10.1080/10438590802511031
Asteriou D, Spanos K (2019) The relationship between financial development and economic growth during the recent crisis: Evidence from the EU. Finance Res Lett 28:238–245. https://doi.org/10.1016/j.frl.2018.05.011
Athukorala P, Menon J (1996) Foreign investment and industrialization in Malaysia: exports employment and spillovers. Asian Econ J 10(1):29–44. https://doi.org/10.1111/j.1467-8381.1996.tb00156.x
Auboin M, Engemann M (2014) Testing the trade credit and trade link: evidence from data on export credit insurance. Rev World Econ 150(4):715–743. https://doi.org/10.1007/s10290-014-0195-4
Awokuse TO (2007) Causality between exports, imports, and economic growth: evidence from transition economies. Econ Lett 94(3):389–395. https://doi.org/10.1016/j.econlet.2006.08.025
Balassa B (1985) Exports, policy choices, and economic growth in developing countries after the 1973 oil shock. J Dev Econ 18(1):23–35. https://doi.org/10.1016/0304-3878(85)90004-5
Bandara A (2014) How effective are countercyclical policy tools in mitigating the impact of financial and economic crises in Africa? J Policy Model 36(5):840–854. https://doi.org/10.1016/j.jpolmod.2014.08.003
Banerjee A, Dolado J, Mestre R (1998) Error-correction mechanism tests for cointegration in a single-equation framework. J Time Ser Anal 19(3):267–283. https://doi.org/10.1111/1467-9892.00091
Bayer C, Hanck C (2013) Combining non-cointegration tests. J Time Ser Anal 34(1):83–95. https://doi.org/10.1111/j.1467-9892.2012.00814.x
Bekun FV, Alola AA, Sarkodie SA (2019) Toward a sustainable environment: Nexus between CO_2 emissions, resource rent, renewable and nonrenewable energy in 16-EU countries. Sci Total Environ 657:1023–1029. https://doi.org/10.1016/j.scitotenv.2018.12.104
Bevan A, Estrin S, Meyer K (2004) Foreign investment location and institutional development in transition economies. Int Bus Rev 13(1):43–64. https://doi.org/10.1016/j.ibusrev.2003.05.005
BGMEA (2022) Export performance. https://www.bgmea.com.bd/page/Export_Performance
Bhagwati JN (1988) Protectionism. MIT Press, Cambridge
Bilbao-Ubillos J, Fernández-Sainz A (2022) The results of internal devaluation policy as a crisis exit strategy: the case of Spain. Glob Policy 13(5):767–781. https://doi.org/10.1111/1758-5899.13120
Blome C, Schoenherr T (2011) Supply chain risk management in financial crises: a multiple case-study approach. Int J Prod Econ 134(1):43–57. https://doi.org/10.1016/j.ijpe.2011.01.002
Borensztein E, De Gregorio J, Lee J-W (1998) How does foreign direct investment affect economic growth? J Int Econ 45(1):115–135. https://doi.org/10.1016/S0022-1996(97)00033-0
Boswijk HP (1995) Efficient inference on cointegration parameters in structural error correction models. J Econom 69(1):133–158. https://doi.org/10.1016/0304-4076(94)01665-M

Breitenlechner M, Gächter M, Sindermann F (2015) The finance–growth nexus in crisis. Econ Lett 132:31–33. https://doi.org/10.1016/j.econlet.2015.04.014
Calderón C, Liu L (2003) The direction of causality between financial development and economic growth. J Dev Econ 72(1):321–334. https://doi.org/10.1016/S0304-3878(03)00079-8
Chao X, Kou G, Peng Y, Viedma EH (2021) Large-scale group decision-making with non-cooperative behaviors and heterogeneous preferences: an application in financial inclusion. Eur J Oper Res 288(1):271–293. https://doi.org/10.1016/j.ejor.2020.05.047
Chongvilaivan A (2012) Thailand's 2011 flooding: its impact on direct exports and global supply chains (Issue 113). Asia-Pacific Research and Training Network on Trade (ARTNeT). http://hdl.handle.net/10419/64271
Chor D, Manova K (2012) Off the cliff and back? Credit conditions and international trade during the global financial crisis. J Int Econ 87(1):117–133. https://doi.org/10.1016/j.jinteco.2011.04.001
Chowdhury DAR (1998) The Asian currency crisis: lessons for Bangladesh. The Daily Star. https://www.thedailystar.net/news/the-asian-currency-crisis-lessons-for-bangladesh
Coe DT, Helpman E (1995) International R&D spillovers. Eur Econ Rev 39(5):859–887. https://doi.org/10.1016/0014-2921(94)00100-E
Curran L, Escaith H, Hallaert J-J, Barfield C, Evenett SJ, Koopmann G (2009) The impact of the financial and economic crisis on world trade and trade policy. Intereconomics 44(5):264–293. https://doi.org/10.1007/s10272-009-0305-z
Dawson PJ (2006) The export–income relationship and trade liberalisation in Bangladesh. J Policy Model 28(8):889–896. https://doi.org/10.1016/j.jpolmod.2006.04.005
Deme M (2002) An examination of the trade-led growth hypothesis in Nigeria: a co-integration, causality, and impulse response analysis. J Dev Areas 36(1):1–15
Dornean A, Işan V, Oanea D-C (2012) The impact of the recent global crisis on foreign direct investment. Evidence from central and Eastern European countries. Procedia Econ Finance 3:1012–1017. https://doi.org/10.1016/S2212-5671(12)00266-3
Dritsaki C, Stamatiou P (2018) Cobb–Douglas production function: the case of Poland's economy. In: Tsounis N, Vlachvei A (eds) Advances in time series data methods in applied economic research. Springer, Cham, pp 465–483. https://doi.org/10.1007/978-3-030-02194-8_31
Dunning JH (1970) Studies in direct investment, 1st edn. Routledge, London
Dutta CB, Haider MZ, Das DK (2017) Dynamics of economic growth, investment and trade openness: evidence from Bangladesh. South Asian J Macroecon Public Finance 6(1):82–104. https://doi.org/10.1177/2277978717695150
Edwards S (1998) Openness, productivity and growth: what do we really know? Econ J 108(447):383–398. https://doi.org/10.1111/1468-0297.00293
Elliott G, Rothenberg TJ, Stock JH (1996) Efficient tests for an autoregressive unit root. Econometrica 64(4):813. https://doi.org/10.2307/2171846
Engle RF, Granger CWJ (1987) Co-integration and error correction: representation, estimation, and testing. Econometrica 55(2):251. https://doi.org/10.2307/1913236
Export Promotion Bureau (2022) Exporter's database: exporter list (goods). http://www.epb.gov.bd/site/files/aca7df47-0d5b-4ebb-84eb-42790727acb0/Exporter-List-(Goods)
Feder G (1983) On exports and economic growth. J Dev Econ 12(1–2):59–73. https://doi.org/10.1016/0304-3878(83)90031-7
Forte R, Moura R (2013) The effects of foreign direct investment on the host country's economic growth: theory and empirical evidence. Singapore Econ Rev 58(03):1350017. https://doi.org/10.1142/S0217590813500173
Gaies B, Goutte S, Guesmi K (2019) FDI, banking crises and growth: direct and spill over effects. Appl Econ Lett 26(20):1655–1658. https://doi.org/10.1080/13504851.2019.1591587
Giles JA, Williams CL (2000) Export-led growth: a survey of the empirical literature and some non-causality results. Part 1. J Int Trade Econ Dev 9(3):261–337. https://doi.org/10.1080/09638190050086177
Goh SK, McNown R (2015) Examining the exchange rate regime–monetary policy autonomy nexus: evidence from Malaysia. Int Rev Econ Finance 35:292–303. https://doi.org/10.1016/j.iref.2014.10.006
Gómez DM, Álvarez-Ude GF, Gálvez IM (2011) Trade-led growth hypothesis in Cuban commercial regimes since 1960[1,2]. Econ Transit 19(2):287–304. https://doi.org/10.1111/j.1468-0351.2010.00401.x
Gorg H, Strobl E (2003) "Footloose" multinationals? Manch Sch 71(1):1–19. https://doi.org/10.1111/1467-9957.00331
Grossman G, Helpman E (1991) Innovation and growth in the global economy. MIT Press, Cambridge
Haug AA (2002) Temporal aggregation and the power of cointegration tests: a Monte Carlo study*. Oxf Bull Econ Stat 64(4):399–412. https://doi.org/10.1111/1468-0084.00025
Helpman E, Krugman P (1985) Market structure and trade. MIT Press, Cambridge
Hosseini H (2005) An economic theory of FDI: a behavioral economics and historical approach. J Socio-Econ 34(4):528–541. https://doi.org/10.1016/j.socec.2005.07.001
Jawaid ST (2014) Trade openness and economic growth. Foreign Trade Rev 49(2):193–212. https://doi.org/10.1177/0015732514525223
Jimborean R, Kelber A (2017) Foreign direct investment drivers and growth in central and Eastern Europe in the aftermath of the 2007 global financial crisis. Comp Econ Stud 59(1):23–54. https://doi.org/10.1057/s41294-016-0018-9
Johansen S (1988) Statistical analysis of cointegration vectors. J Econ Dyn Control 12(2–3):231–254. https://doi.org/10.1016/0165-1889(88)90041-3
Johansen S (1991) Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica 59(6):1551–1580. https://doi.org/10.2307/2938278
Johansen S (1995) A stastistical analysis of cointegration for I(2) variables. Econom Theor 11(1):25–59. https://doi.org/10.1017/S0266466600009026
Johansen S, Juselius K (1990) Maximum likelihood estimation and inference on cointegration: with applications to the demand for money. Oxf Bull Econ Stat 52(2):169–210. https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x
Joshua U, Rotimi ME, Sarkodie SA (2020) Global FDI inflow and its implication across economic income groups. J Risk Financ Manag 13(11):291. https://doi.org/10.3390/jrfm13110291

Jung WS, Marshall PJ (1985) Exports, growth and causality in developing countries. J Dev Econ 18(1):1–12. https://doi.org/10.1016/0304-3878(85)90002-1
Kapetanios G, Shin Y, Snell A (2003) Testing for a unit root in the nonlinear STAR framework. J Econom 112(2):359–379. https://doi.org/10.1016/S0304-4076(02)00202-6
Kavoussi RM (1984) Export expansion and economic growth. J Dev Econ 14(1):241–250. https://doi.org/10.1016/0304-3878(84)90052-X
Khatun F, Ahamad M (2015) Foreign direct investment in the energy and power sector in Bangladesh: Implications for economic growth. Renew Sustain Energy Rev 52:1369–1377. https://doi.org/10.1016/j.rser.2015.08.017
Klapper L, Love I (2011) The impact of the financial crisis on new firm registration. Econ Lett 113(1):1–4. https://doi.org/10.1016/j.econlet.2011.05.048
Kotrajaras P, Tubtimtong B, Wiboonchutikula P (2011) Does FDI enhance economic growth? New evidence from East Asia. ASEAN Econ Bull 28(2):183–202
Kou G, Olgu Akdeniz Ö, Dinçer H, Yüksel S (2021) Fintech investments in European banks: a hybrid IT2 fuzzy multidimensional decision-making approach. Financ Innov 7(1):39. https://doi.org/10.1186/s40854-021-00256-y
Krueger AO (1987) Debt, capital flows, and LDC growth. Am Econ Rev 77(2):159–164
Krugman PR (1987) Is free trade Passé? J Econ Perspect 1(2):131–144. https://doi.org/10.1257/jep.1.2.131
Kumar K, Paramanik RN (2020) Nexus between Indian economic growth and financial development: a non-linear ARDL approach. J Asian Finance Econ Bus 7(6):109–116. https://doi.org/10.13106/jafeb.2020.vol7.no6.109
Kwiatkowski D, Phillips PCB, Schmidt P, Shin Y (1992) Testing the null hypothesis of stationarity against the alternative of a unit root. J Econom 54(1–3):159–178. https://doi.org/10.1016/0304-4076(92)90104-Y
Lawrence R, Weinstein D (1999) Trade and growth: import-led or export-led? Evidence from Japan and Korea. https://doi.org/10.3386/w7264
Liu M-H, Margaritis D, Zhang Y (2019) The global financial crisis and the export-led economic growth in China. Chin Econ 52(3):232–248. https://doi.org/10.1080/10971475.2018.1548144
Lucas RE (1988) On the mechanics of economic development. J Monet Econ 22(1):3–42. https://doi.org/10.1016/0304-3932(88)90168-7
Macias JB, Massa I, Salois MJ (2010) The impact of financial crises on trade flows: a developing country perspective. https://doi.org/10.22004/ag.econ.91831
Mahadevan R (2007) New evidence on the export-led growth nexus: a case study of Malaysia. World Econ 30(7):1069–1083. https://doi.org/10.1111/j.1467-9701.2007.01030.x
Mahmoud AA (2011) Financial crises and bilateral foreign direct investment flows. In: MPRA
Mazumdar J (2001) Imported machinery and growth in LDCs. J Dev Econ 65(1):209–224. https://doi.org/10.1016/S0304-3878(01)00134-1
McCombie JSL, Thirlwall AP (1994) Economic growth and the balance-of-payments constraint. Palgrave Macmillan, London. https://doi.org/10.1007/978-1-349-23121-8
McNab RM, Moore RE (1998) Trade policy, export expansion, human capital and growth. J Int Trade Econ Dev 7(2):237–256. https://doi.org/10.1080/09638199800000013
McNown R, Sam CY, Goh SK (2018) Bootstrapping the autoregressive distributed lag test for cointegration. Appl Econ 50(13):1509–1521. https://doi.org/10.1080/00036846.2017.1366643
Ogunmuyiwa MS, Ekone AF (2010) Money supply: economic growth nexus in Nigeria. J Soc Sci 22(3):199–204. https://doi.org/10.1080/09718923.2010.11892802
Okere KI, Muoneke OB, Onuoha FC, Omoke PC (2022) Tripartite relationship between FDI, trade openness and economic growth amidst global economic crisis in Nigeria: application of combined cointegration and augmented ARDL analysis. Future Bus J 8(1):5. https://doi.org/10.1186/s43093-022-00116-w
Park-Poaps H, Bari MS, Sarker ZW (2021) Bangladeshi clothing manufacturers' technology adoption in the global free trade environment. J Fash Mark Manag Int J 25(2):354–370. https://doi.org/10.1108/JFMM-06-2020-0119
Pesaran MH, Shin Y, Smith RJ (2001) Bounds testing approaches to the analysis of level relationships. J Appl Econom 16(3):289–326. https://doi.org/10.1002/jae.616
Popescu G (2014) FDI and economic growth in central and Eastern Europe. Sustainability 6(11):8149–8163. https://doi.org/10.3390/su6118149
Poulsen L, Hufbauer G (2011) Foreign direct investment in times of crisis. Transnatl Corp 20(1):19–38
Rajab B, Zouheir A (2023) Complementarity relationship between foreign direct investment, human capital threshold and economic growth: state of the 15 least developed African countries. J Knowl Econ. https://doi.org/10.1007/s13132-023-01314-9
Ramirez MD (2006) Does foreign direct investment enhance labor productivity growth in Chile? A cointegration analysis. East Econ J 32(2):205–220
Rayhan MA (2014) Contribution of foreign direct investment to economic growth in Bangladesh [Eastern Illinois University]. https://thekeep.eiu.edu/theses/1339
Ricardo D (1817) The works and correspondence of David Ricardo. Principles of political economy and taxation, vol 1. Online Library of Liberty, Carmel
Romer PM (1986) Increasing returns and long-run growth. J Political Econ 94(5):1002–1037. https://doi.org/10.1086/261420
Saleh EA (2023) The effects of economic and financial crises on FDI: a literature review. J Bus Res 161:113830. https://doi.org/10.1016/j.jbusres.2023.113830
Sam CY, McNown R, Goh SK (2019) An augmented autoregressive distributed lag bounds test for cointegration. Econ Model 80:130–141. https://doi.org/10.1016/j.econmod.2018.11.001
Sarker B (2023) Foreign firms in the industry frontier and productivity convergence: importance of proximity and firm attributes. Manag Decis Econ 44(2):906–925. https://doi.org/10.1002/mde.3721
Sarker B, Khan F (2020) Nexus between foreign direct investment and economic growth in Bangladesh: an augmented autoregressive distributed lag bounds testing approach. Financ Innov 6(1):10. https://doi.org/10.1186/s40854-019-0164-y

Sarker B, Serieux J (2022) Foreign-invested and domestic firm attributes and spillover effects: evidence from Brazil. J Multinatl Financ Manag 63(March):100719. https://doi.org/10.1016/j.mulfin.2021.100719
Sarker B, Serieux J (2023) Multilevel determinants of FDI: a regional comparative analysis. Econ Syst. https://doi.org/10.1016/j.ecosys.2023.101095
Shan J (2002) A VAR approach to the economics of FDI in China. Appl Econ 34(7):885–893. https://doi.org/10.1080/00036840110058941
Todaro M (1982) Economics for a developing world, 2nd edn. Longman, London
Ucal M, Bilgin MH, Özcan KM, Mungo J (2010) Relationship between financial crisis and foreign direct investment in developing countries using semiparametric regression approach. J Bus Econ Manag 11(1):20–33. https://doi.org/10.3846/jbem.2010.02
UNCTAD (2017) Global investment trends monitor. https://unctad.org/system/files/official-document/webdiaeia2017d1_en.pdf
UNCTAD (2021a) Global foreign direct investment fell by 42% in 2020, outlook remains weak. Prosperity for All. https://unctad.org/news/global-foreign-direct-investment-fell-42-2020-outlook-remains-weak
UNCTAD (2021b) World investment report 2021. https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=96740
Urata S, Kawai H (2000) The determinants of the location of foreign direct investment by Japanese small and medium-sized enterprises. Small Bus Econ 15(2):79–103. https://doi.org/10.1023/A:1008173912813
Vadlamannati KC, Tamazian A (2009) Growth effects of FDI in 80 developing economies: the role of policy reforms and institutional constraints. J Econ Policy Reform 12(4):299–322. https://doi.org/10.1080/17487870903314583
Voivodas CS (1973) Exports, foreign capital inflow and economic growth. J Int Econ 3(4):337–349. https://doi.org/10.1016/0022-1996(73)90026-3
Williams C, Martinez CA (2012) Government effectiveness, the global financial crisis, and multinational enterprise internationalization. J Int Mark 20(3):65–78. https://doi.org/10.1509/jim.12.0078
Williamson RB (1978) The role of exports and foreign capital in Latin American economic growth. South Econ J 45(2):410. https://doi.org/10.2307/1057671
World Bank (2021) World development indicators. World Bank, Washington, DC
Yuan C, Liu S, Xie N (2010) The impact on Chinese economic growth and energy consumption of the Global Financial Crisis: an input–output analysis. Energy 35(4):1805–1812. https://doi.org/10.1016/j.energy.2009.12.035
Yunus M, Yamagata T (2014) Bangladesh: market force supersedes control. In: Fukunishi T, Yamagata T (eds) The garment industry in low-income countries. Palgrave Macmillan, London, pp 77–104
Zahonogo P (2017) Trade and economic growth in developing countries: evidence from sub-Saharan Africa. J Afr Trade 3(1–2):41. https://doi.org/10.1016/j.joat.2017.02.001

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