

Devaluation and Export Growth in Bangladesh

A Comparison with Synthetic Counterfactual

Mohammad Anamul Huq¹

Institute of South-South Cooperation and Development
Peking University, Beijing, China

Abstract:- This paper examines the relationship between currency devaluation and export performance in Bangladesh, focusing on the role of broader macroeconomic factors. While devaluation theoretically enhances export competitiveness by lowering relative prices in international markets, its actual effects in Bangladesh reveal a context-dependent relationship. This study investigates the moderating impact of variables such as interest rate, inflation, government expenditure, foreign direct investment (FDI), and trade indices, along with sector-specific dynamics in garments, pharmaceuticals, leather, and jute.

Using the Synthetic Control Method (SCM) complemented by regression analysis, this research compares Bangladesh's export trends against synthetic benchmarks and regional comparators such as India and Bhutan over the period 1991 to 2020. Regression analysis shows that devaluation has a positive but modest effect, with a coefficient of 0.0780833, while broader variables like government expenditure and export value index exhibit positive associations with export performance. Conversely, SCM analysis highlights negative gaps between Bangladesh's actual export performance and its synthetic counterpart, often indicating underperformance due to policy misalignment and economic shocks. The final government consumption expenditure, for instance, demonstrates a significant negative impact, reflecting structural challenges in trade competitiveness.

Analysis of beyond-devaluation factors underscores their crucial role in shaping export outcomes. Positive contributions from export indices and government expenditure highlight the importance of value addition and strategic public investment. However, negative trends associated with FDI and import dependency reveal persistent structural inefficiencies. Sectoral insights show that while the garments industry benefits from labor cost advantages, it faces input dependencies that limit its gains. Pharmaceuticals and leather require substantial technological and regulatory support, while jute demonstrates greater resilience due to lower import reliance.

The findings conclude that devaluation alone cannot drive sustainable export growth. Its impact is intertwined with broader structural, fiscal, and trade-specific

variables, necessitating an integrated approach. Recommendations include fostering FDI, enhancing governance, upgrading infrastructure, and promoting innovation to create a resilient and competitive export sector. By embedding devaluation within a comprehensive policy framework, Bangladesh can better address its export challenges and achieve inclusive and sustainable economic growth.

Keywords:- Currency Devaluation, Export Performance, Beyond-Devaluation Factors, Synthetic Control Method, Regression Analysis, Sectoral Insights, Macroeconomic Stability.

I. INTRODUCTION

The term "devaluation"¹ derives from the Latin "valere," meaning "to be worth," combined with the prefix "de-," signifying "down" or "away." It encapsulates the deliberate reduction of a currency's value, reflecting the concept of "worth adjustment" in a financial sense. Historically, this practice has been intertwined with notions of economic worth and strategic positioning. Its Greek counterpart, "axia" (ἀξία), denotes "value" or "worthiness," further highlighting devaluation's philosophical and practical roots in negotiating economic standing within a competitive global marketplace.

Devaluation is a strategic economic measure that adjusts a currency's value relative to others, typically to boost export competitiveness. However, its impact is inextricably linked to the broader context of global financial systems dominated by Western hegemony. The U.S. dollar (USD) serves as the cornerstone of this regime, operating as the primary reserve currency and standard for international trade and investment. Consequently, devaluation outcomes are shaped by this entrenched framework, offering both potential benefits and inherent limitations.

The dominance of the USD is a linchpin of the Western financial architecture, a system reinforced by global institutions such as the International Monetary Fund (IMF) and the World Bank. This framework dictates much of the international economic order, ensuring that trade, investment, and reserve holdings revolve around the dollar. Within this architecture, currency devaluation operates as a mechanism to achieve relative gains in export competitiveness by lowering domestic prices on the global market.

¹ Devaluation is the deliberate downward adjustment of the value of a country's money relative to another currency or

standard. It is a monetary policy tool used by countries with a fixed exchange rate or semi-fixed exchange rate.

Yet, this system also imposes significant constraints. Countries undertaking devaluation may face higher costs for servicing USD-denominated debt, heightened financial volatility, and dependencies on Western-centric economic policies. The hegemonic financial structure inherently favors established powers, limiting the scope of effective economic maneuvering for developing nations. Thus, devaluation must be understood not only as an economic adjustment but also as a negotiation within this overarching system of dependency and dominance.

The concept of "decoupling from China" provides a useful analogy to understand the strategic implications of devaluation. Decoupling involves a deliberate effort by nations to reduce reliance on China's manufacturing and supply chain dominance, often to achieve greater economic resilience and sovereignty. Similarly, devaluation is a recalibration of a nation's economic alignment, adjusting its relative standing within a USD-dominated global system.

Both strategies involve an element of distancing—whether from a powerful trading partner or a dominant currency. The prefix "de-" in both terms underscores this notion of reduction or realignment. While decoupling seeks to diversify trade and mitigate dependency risks, devaluation adjusts currency values to redefine relationships with the global financial order. Both are responses to the challenges of operating within systems dominated by concentrated power, emphasizing the pursuit of economic autonomy and strategic advantage.

Devaluation, when contextualized within the constraints of USD hegemony and Western financial dominance, transcends mere economic adjustment. It becomes a strategic tool for negotiating autonomy and resilience in a system designed to perpetuate the economic advantages of established powers. However, the effectiveness of devaluation is tempered by its potential repercussions, such as reduced investor confidence and elevated borrowing costs in global markets governed by Western institutions.

This dynamic mirrors the objectives of decoupling—both aim to navigate and mitigate the limitations imposed by dominant systems, whether financial or trade-related. Devaluation, like decoupling, represents an effort to assert greater control over economic destiny within a landscape defined by asymmetrical power relations.

Ultimately, devaluation should be seen as part of a broader strategy for achieving economic sovereignty. Its success depends on complementing currency adjustments with targeted reforms, structural changes, and diversification efforts to address vulnerabilities inherent in global economic dependencies. By framing devaluation within this strategic context, nations like Bangladesh can better navigate the complexities of a global system shaped by Western financial dominance while advancing their goals of inclusive and sustainable growth.

The term *currency* finds its roots in the Latin word *currere*, meaning "to run" or "to flow," encapsulating the idea

of movement and circulation as central to its function. This linguistic origin signifies its dual role as both a dynamic medium of exchange and a tangible asset in economic systems. Historically, *currency* evolved from representing physical commodities like gold and silver to becoming fiat money—an instrument of trust and economic utility with no intrinsic value. This transformation highlights its duality: an abstract concept that facilitates trade and a physical entity that serves as a tradable good.

Currency's primary function as a medium of exchange lies at the heart of its utility in simplifying trade and enabling economic specialization. Classical economists like Adam Smith noted that currency eliminates the inefficiencies of barter systems by resolving the "double coincidence of wants." It enables seamless transactions, fostering liquidity and economic growth by acting as a universally accepted medium. John Maynard Keynes expanded on this by emphasizing its role in sustaining economic activity, allowing for price stability and efficient resource allocation.

In this abstract sense, currency operates on collective trust in its value, sustained by the credibility of the issuing authority, typically a central bank or government. Milton Friedman further argued that the stability of currency as a medium of exchange is pivotal for maintaining economic trust. Disruptions in this trust—through devaluation, inflation, or mismanagement—can destabilize markets and erode confidence in its functionality. This underscores the abstract nature of currency as more than a physical object; it is a representation of value, backed by societal consensus and regulatory frameworks.

In contrast, currency also functions as a tradable asset within financial markets, where it takes on the characteristics of a physical good. This role is most evident in foreign exchange (Forex) markets, where currencies are traded based on supply, demand, and economic indicators. Scholars like Paul Krugman have illustrated how currencies behave as commodities, subject to price fluctuations driven by market sentiment, geopolitical stability, and macroeconomic conditions.

As a tradable good, currency becomes a tool for hedging risks, earning speculative profits, or balancing trade deficits. Its value fluctuates relative to other currencies, creating opportunities and challenges for economies dependent on imports or exports. For example, the value of a currency like the U.S. dollar or the euro influences global trade dynamics and shapes economic policy decisions. This tangible aspect of currency, tied to its physical representation in notes or coins, positions it as a commodity within the financial ecosystem.

The coexistence of currency as both an abstract concept and a tangible good reflects its multifaceted role in economics. As an abstract medium of exchange, it simplifies trade, fosters liquidity, and supports economic trust. Its tangible nature, however, highlights its role as a commodity in financial markets, where its value is influenced by competitive forces and macroeconomic factors.

The abstract role of currency relies on its societal acceptance as a unit of account, store of value, and standard of deferred payment. This conceptual framework enables it to facilitate trade efficiently, promoting economic stability and growth. The reliance on trust and systemic credibility underscores its intangible nature, which is critical for its functionality in everyday transactions and policy design.

Conversely, currency's tangible aspect is evident in its role as a tradeable asset within international markets. Here, it is treated as a commodity, influenced by supply-demand dynamics, interest rates, and geopolitical factors. This perspective emphasizes its function as an asset that can appreciate or depreciate, affecting economic competitiveness, trade balances, and financial stability.

The duality of currency reflects the inherent complexity of modern economic systems, where it must simultaneously act as a facilitator of trade and a participant within trade markets. Its abstract nature allows for the efficient functioning of economies by reducing transaction costs and supporting liquidity, while its tangible nature enables financial markets to evaluate and trade its value.

This paradox is not contradictory but complementary. The abstract function of currency provides the foundation for its trust and utility, while its tangible nature allows it to integrate into global trade dynamics as a financial asset. Together, these roles demonstrate currency's adaptability in serving as both an enabler of economic activity and a marketable entity within global finance.

Understanding currency's dual nature is critical for appreciating its role in economic systems. It bridges the theoretical framework of economics with the practical realities of global trade, reflecting its capacity to influence stability, competitiveness, and policy outcomes.

➤ *Background*

Between 1991 and 2020, Bangladesh experienced transformative economic changes through policy reforms and strategic advancements. The adoption of market-oriented policies in 1991 liberalized trade, investment, and financial sectors, aligning the economy with global markets. Milestones like the 1995 preferential trade agreements under the EU's Generalized System of Preferences (GSP) catalyzed growth in the Ready-Made Garments (RMG) sector, while events like the 1998 floods underscored the importance of resilience strategies. The 2000s saw GDP surpass \$50 billion, driven by diversification and innovations like microfinance, exemplified by Muhammad Yunus and the Grameen Bank's Nobel Peace Prize win in 2006.

By 2010, RMG exports dominated over 75% of total exports, supported by FDI and labor cost advantages. However, the 2013 Rana Plaza tragedy spurred global scrutiny, prompting labor reforms. Achieving lower-middle-income status in 2015 and a \$300 billion GDP milestone by 2018 showcased sustained growth, though the 2020 COVID-19 pandemic tested economic resilience. Globally, pivotal events like China's WTO entry in 2001 and the 2008 financial

crisis reshaped trade dynamics, while the technological boom of the 2010s revolutionized global supply chains. India's economic trajectory, with reforms starting in 1991 and initiatives like "Make in India" in 2014, mirrored some of Bangladesh's strategies, underscoring shared regional challenges and opportunities.

Currency devaluation, the deliberate downward adjustment of a country's currency relative to others, has been a recurring strategy for managing trade imbalances and fostering export competitiveness in Bangladesh. Historically, devaluation policies in the 1980s and 1990s reflected a shift from fixed exchange rates to more flexible regimes. These adjustments aimed to address trade deficits and stimulate export-driven growth, particularly in textiles and garments.

However, the dual-edged nature of devaluation is evident. While it enhances the price competitiveness of exports, it simultaneously raises import costs, contributing to inflationary pressures and increasing production costs for essential goods. The effectiveness of devaluation has varied: some periods demonstrated export gains, while others exposed vulnerabilities due to rising import dependency and inflation.

Comparative analysis with regional peers like India and Vietnam highlights diverse approaches to currency management. India has emphasized balancing inflation control with export competitiveness, while Vietnam has integrated devaluation into broader trade liberalization efforts. Using methods like the Synthetic Control Method (SCM), this study evaluates Bangladesh's devaluation strategies within a broader macroeconomic framework, revealing critical factors like labor productivity, industrial competitiveness, and global economic trends that influence outcomes.

The Bangladeshi Taka (BDT), introduced post-independence in 1971, reflects an evolving currency policy landscape aimed at managing trade balances and economic stability. Initially pegged to the British pound, the BDT transitioned to a managed float system, adapting to global and domestic economic changes. This shift facilitated the growth of export-oriented industries like RMG, which benefited from a competitive currency.

Periods of currency pressure, driven by trade deficits and inflation, prompted devaluations to maintain export competitiveness. Such adjustments were integral to structural reforms in the 1980s and 1990s, supported by international financial institutions like the IMF and World Bank. However, these policies often faced trade-offs, with devaluations leading to higher import costs and inflation, affecting production and living standards.

The performance of the BDT relative to regional currencies like the Indian Rupee (INR) and Vietnamese Dong (VND) underscores competitive dynamics. While India has prioritized inflation control alongside export strategies, Vietnam's currency policies have been embedded in its trade liberalization framework. These contrasts offer insights into

how currency management shapes trade performance in developing economies.

Bangladesh's export sector has evolved from an agricultural base to a diversified, industrial-driven economy. Initially reliant on jute and tea, shifts in global demand and competition from synthetic alternatives diminished the dominance of jute. The rise of the RMG sector in the late 20th century transformed Bangladesh into a global apparel hub, supported by competitive labor costs, trade incentives, and preferential trade agreements like the EU's GSP.

The RMG industry now accounts for over 80% of export revenues, complemented by emerging sectors like pharmaceuticals, leather goods, and jute products. Pharmaceuticals have gained international recognition for quality standards and market penetration in Asia and Africa, while the leather sector remains a traditional yet vital contributor. Export destinations include the EU, U.S., and growing Asian markets like China and Japan.

Despite its successes, the export sector faces challenges such as infrastructure constraints, energy shortages, and global competition. The currency exchange rate plays a pivotal role in shaping export competitiveness. A weaker BDT enhances price advantages but raises production costs due to import dependencies. These dynamics underscore the need for balanced currency policies that support competitiveness without exacerbating inflationary pressures.

The trajectory of Bangladesh's exports, influenced by devaluation policies and structural reforms, highlights the importance of strategic interventions tailored to sectoral needs. By aligning currency management with broader economic strategies, Bangladesh can build on its export successes to sustain growth in an increasingly competitive global market.

This dissertation explores the relationship between currency devaluation and export performance² with a particular focus on Bangladesh. The central problem addressed is whether currency devaluation is sufficient to boost export competitiveness or if it requires complementary strategies to be effective. While devaluation theoretically lowers the relative cost of exports, making them more attractive in international markets, the actual results for Bangladesh have been inconsistent. The research seeks to clarify whether devaluation alone can sustain export growth or if broader economic policies must also be considered. This inquiry is particularly pertinent given Bangladesh's heavy reliance on export-led growth and its vulnerability to external economic pressures such as fluctuating global demand and pricing.

The main objective of the study is to assess the impact of currency devaluation on export performance, both in isolation and in combination with other economic factors. It aims to identify sector-specific responses, examining key export sectors like garments, pharmaceuticals, jute, and leather goods. The rationale for selecting these sectors lies in their varying characteristics and economic significance. For instance, the garments sector, which is labor-intensive and highly competitive, might exhibit a stronger positive response to devaluation, whereas the pharmaceutical sector could face constraints due to its reliance on imported raw materials and compliance with stringent international regulations. This sectoral analysis offers a granular view of how devaluation impacts different areas of Bangladesh's economy and informs more targeted policy recommendations.

To place Bangladesh's experience within a broader regional context, this study incorporates comparative analysis with India and Bhutan. India, with its diversified export base and strategic use of policies such as FDI, provides insights into how a more complex economy can leverage devaluation effectively. Bhutan, a smaller and less diversified economy, offers a contrasting perspective, highlighting the unique challenges faced by countries with limited economic structures. These comparisons help uncover adaptable strategies and shared challenges in South and Southeast Asia, offering practical lessons for Bangladesh. For instance, India's focus on enhancing export performance through FDI and trade policy, as well as Bhutan's approach to managing trade imbalances, provide models that could inform Bangladesh's economic framework.

Methodologically, the study employs the Synthetic Control Method³ (SCM) to create a counterfactual scenario, allowing for an analysis of Bangladesh's export performance with and without the influence of devaluation. This approach, supported by OLS regression and detailed product-level data, isolates the impact of devaluation while controlling for external variables like inflation, interest rates, and government expenditure etc. The use of macroeconomic, sectoral, and product-level analyses ensures a comprehensive understanding of devaluation's role within the broader context of export performance. Data sourced from organizations like the World Bank and UN COMTRADE lend robustness to the analysis and support the empirical findings.

The research also addresses key gaps in existing literature, particularly the limited understanding of how devaluation interacts with broader macroeconomic variables to affect export outcomes. While many studies have focused on devaluation as an isolated policy, this dissertation emphasizes the importance of complementary measures such as efficient trade logistics, supportive fiscal policies, and sustained FDI. Recognizing that structural factors often have

² Export performance refers to a firm's effectiveness in enhancing its overall performance through learning and adapting strategies to meet the unique demands of international markets.

³ The synthetic control method is a statistical method used to evaluate the effect of an intervention in comparative case studies. It involves the construction of a weighted combination of group of county units used as controls, to which the treatment group is compared.

a greater influence than currency adjustments alone, this study broadens the scope of analysis to include these critical variables.

Finally, the research acknowledges the broader global economic context, where the divide between developed and developing nations impacts the effectiveness of policies like devaluation. Developing countries like Bangladesh often face barriers such as restricted market access and high tariffs, which can dilute the benefits of devaluation. This dissertation contributes to understanding how devaluation can be integrated with comprehensive policies to help mitigate trade imbalances and promote sustainable growth, emphasizing that true economic progress requires a balanced, inclusive approach that goes beyond currency adjustments alone.

➤ Motivation

Understanding devaluation's role is essential in today's shifting economic landscape, where nations strive to adapt to global dynamics marked by multipolarity and reduced reliance on the U.S. dollar. The trend toward de-dollarization signifies an effort to lessen economic dependencies, reshaping trade balances and positioning devaluation as a strategic tool in this redefined order. These moves align with the rise of economic nationalism, as countries prioritize domestic industry support, protect their markets, and pivot toward reshoring production to bolster economic resilience. Simultaneously, geopolitical and technological rivalries, especially between major powers such as the U.S. and China, drive strategies that influence currency policies and devaluation's use as a response to economic pressures.

Sustainability goals, highlighted by the global push for net-zero emissions, add further complexity to devaluation's

strategic implications. Countries are now tasked with balancing economic measures with environmental objectives, ensuring that policies do not veer into mere greenwashing but align with authentic progress. The interplay between currency policies and sustainability underscores the need for comprehensive strategies that encompass broader economic frameworks. Geoeconomic considerations also shape the context of devaluation, positioning it not as an isolated economic lever but as part of strategic maneuvering in a Western-dominated financial system.

Moreover, advancing AI governance has become crucial to support data-driven policy formulation, ensuring that devaluation and related economic strategies are resilient and adaptive. This aligns with the need for countries to harness technology and robust analytics to navigate external pressures and leverage opportunities in an interconnected global economy.

In this evolving context, devaluation serves as more than a simple economic adjustment; it is both a reaction to and a tool for negotiating within global economic structures that favor dominant powers. Effective use of devaluation must be integrated with comprehensive economic strategies that reflect technological innovation, sustainability efforts, and geopolitical positioning. Therefore, understanding devaluation requires a holistic approach that considers immediate economic impacts and its role in navigating a global landscape defined by shifting power dynamics, strategic autonomy, and structural economic challenges. Fig 1 illustrates the Brandt Line, a conceptual demarcation from the 1980s that separates the world into the affluent northern hemisphere and the less prosperous southern hemisphere, as defined by Brandt (1980).

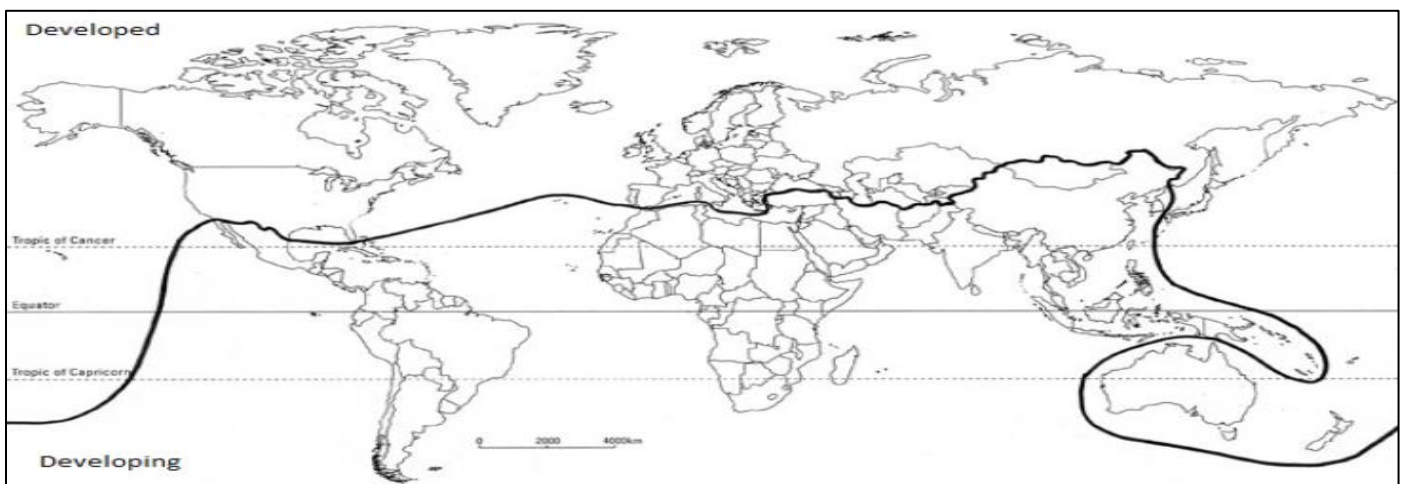


Fig 1 ⁴The Brandt line, a definition from the 1980s dividing the world into the wealthy north and the poor south. (Source: Brandt, W. (1980). North-South: A Programme for Survival. MIT Press).

⁴ The map depicts the division between developed and developing countries across the globe. This is a common illustration used to differentiate between the Global North (typically developed) and the Global South (typically developing). It is often referred to as the "Brandt Line," which was popularized in the 1980s by the Brandt Report, a document commissioned by former German Chancellor

Willy Brandt. The report analyzed global inequality and proposed strategies for addressing the economic gap between wealthy and poorer nations. The map visually highlights the economic disparity by showing countries in the northern hemisphere as generally developed, while countries in the southern hemisphere are largely considered developing.

The dissertation is structured to guide through an exploration of how currency devaluation impacts export performance in Bangladesh. Chapter 1 introduces the research objectives, the scope of the study, and the significance of examining currency devaluation in the context of Bangladesh's export sector. This chapter sets the stage by discussing two complementary ideological concepts of currency: one viewing currency as a medium of exchange rooted in economic trust and stability, and the other as a tradable asset within international markets. These perspectives provide background and motivation for understanding the multifaceted roles currency plays in global trade and national economic strategies, highlighting the dual nature of currency as both an enabler of commerce and a strategic tool subject to geopolitical and economic manipulation.

Chapter 2 reviews existing literature and theoretical frameworks, situating the study within broader economic discourses and focusing more on renowned J-Curve theory. This chapter explores historical and contemporary perspectives on currency devaluation, drawing on comparative analyses from countries such as India and Morocco. It also underscores the influence of macroeconomic variables—such as inflation, foreign direct investment (FDI), and government expenditure—on the outcomes of devaluation, supporting the need for an integrated policy approach.

Chapter 3 details the methodological approach employed in the study, emphasizing the use of Ordinary Least Squares (OLS) regression and the Synthetic Control Method (SCM) to evaluate the impact of devaluation. This chapter outlines the techniques for constructing counterfactuals⁵, conducting gap analyses, and performing placebo tests⁶ to ensure robust and reliable results. The chapter also explains the framework for macroeconomic, sectoral, and product-level analyses, which provide a comprehensive understanding of how devaluation affects different layers of the economy. This multi-tiered approach allows the study to reveal both overarching trends and sector-specific responses, enhancing the granularity of the findings.

Chapter 4 presents and interprets the empirical findings from the analyses, highlighting the varied effects of devaluation across key sectors such as ready-made garments, pharmaceuticals, leather, and jute. The chapter also discusses how the control countries used in the SCM contribute to understanding Bangladesh's position in the global and regional context, illustrating lessons that could inform strategic adjustments.

Chapter 5 concludes with policy recommendations that stress the importance of a dual approach combining macroeconomic strategies to reinforce Bangladesh's export

resilience. This chapter argues for structural reforms, investments in technology and R&D, and improvements in governance to create a balanced and inclusive economic future. The recommendations emphasize moving beyond devaluation as a singular economic tool and adopting comprehensive strategies that consider the interconnected roles of currency, export competitiveness, and economic stability to achieve sustained growth.

II. LITERATURE REVIEW

➤ *Theoretical Frameworks*

The theoretical frameworks that underpin this study focus on the multifaceted relationship between currency devaluation and export performance, incorporating insights from economic theories and empirical models. The J-Curve theory offers a valuable lens to understand the dynamic relationship between currency devaluation and trade balance, particularly in economies like Bangladesh. This theory posits that following a devaluation, the trade balance often deteriorates in the short term before improving in the longer term. The initial decline occurs because the value of imports, typically priced in foreign currency, rises more rapidly than export gains, which take time to materialize. However, as export prices become more competitive and import volumes adjust downward, the trade balance may recover if the price elasticities of export and import demand are favorable (Bahmani-Oskooee & Niroomand, 1998).

For Bangladesh, the realization of the J-Curve effect is complex and influenced by structural factors. Limited diversification in exports and dependency on imported inputs can delay or weaken the anticipated long-term benefits. Additionally, domestic production constraints and supply chain inefficiencies further complicate the adjustment process. Empirical studies, such as those by Brun, Gambetta, and Varela (2020), emphasize that the success of the J-Curve depends on a country's ability to leverage devaluation by enhancing export competitiveness and reducing import reliance.

The J-Curve theory underscores the importance of complementary policies to address structural bottlenecks. For Bangladesh, improving trade logistics, investing in value addition, and promoting sectoral innovation are critical to ensuring that the long-term benefits of devaluation outweigh the short-term trade imbalances. By aligning policy with elasticity dynamics, Bangladesh can better navigate the transitional phases of devaluation and achieve sustained trade improvements (Bahmani-Oskooee & Niroomand, 1998; Brun, Gambetta & Varela, 2020).

⁵ The synthetic control method uses a weighted combination of potential control units to act as a counterfactual (i.e., what would have happened in the treated unit without the intervention).

⁶ A placebo test is a method for probing the assumptions underlying a research design (which we call the core assumptions). In a placebo test, a researcher checks for an association that is more likely to be present if those assumptions are violated than if those assumptions hold.

The Exchange Rate Pass-Through⁷ (ERPT) theory highlights the partial nature of price adjustments following devaluation, particularly in developing economies like Bangladesh. While devaluation aims to lower export prices and enhance competitiveness, the pass-through is often incomplete due to market structures and pricing behavior (Huq, 2024). This phenomenon, discussed by Goldberg and Knetter (1997) and Devereux and Engel (2002), explains why the anticipated boost in export volumes may be muted, as prices do not adjust as fully as intended.

Complementing this is the balance of payments (BoP) theory, which posits that devaluation can improve a trade balance by making exports more affordable and imports more costly. However, for Bangladesh, mixed empirical results are common due to structural constraints and limited export diversification. The J-Curve effect⁸, noted in works by Bahmani-Oskooee and Niroomand (1998), suggests that while devaluation may initially worsen the trade balance, improvements can occur over time if export and import demand elasticities are favorable. The eventual success of devaluation, as explained by Brun, Gambetta, and Varela (2020), relies on these elasticity dynamics and a country's capacity to maintain competitive pricing.

The study also considers the interplay of broader macroeconomic factors, such as inflation and foreign direct investment (FDI), which interact with devaluation to influence export performance. High inflation, a potential byproduct of devaluation, can erode competitiveness by raising production costs (Frankel, 2004). FDI, conversely, is highlighted as a key element that supports export growth by improving productive capabilities and fostering technology transfer (Rodrik, 2008). Interest rates play an additional role, affecting investment in export-focused industries and amplifying or suppressing the benefits of devaluation, as noted by Branson (1983).

The complexity of analyzing devaluation's impact is further underscored by the need to address potential Circular reasoning⁹, where cause and effect may reinforce each other in misleading ways (Pearl, 2000). The Synthetic Control Method (SCM) offers a robust approach for overcoming this challenge by constructing counterfactual scenarios that help isolate the causal impact of devaluation from other influencing variables. Pioneering studies by Abadie and Gardeazabal (2003) and Billmeier and Nannicini (2013) have shown SCM's efficacy in policy analysis, making it a valuable tool for this study's examination of devaluation in Bangladesh.

The North-South economic divide also informs the theoretical framework, illustrating how structural inequalities, trade barriers, and protective policies favoring industrialized nations can limit the benefits of devaluation for developing countries (Brandt, 1980; Stiglitz, 2013). These inequalities often result in constrained market access and reduced competitiveness, emphasizing the need for complementary strategies that go beyond devaluation to achieve sustainable export growth.

Insights from Islamic economies such as Morocco and Pakistan provide further comparative context. These nations share economic structures and cultural commonalities with Bangladesh, influencing how they navigate global economic pressures. Morocco's diversified exports and Pakistan's textile sector, which mirrors Bangladesh's export profile, offer practical examples of how policy responses rooted in shared economic and cultural frameworks can shape outcomes. Analyzing their experiences sheds light on potential strategies for Bangladesh to strengthen its export performance while considering regional and religious economic synergies.

The theoretical foundation underscores that while devaluation can be a useful tool, its effectiveness is intertwined with broader economic variables and structural dynamics. By integrating J-Curve, ERPT and BoP theory, BoP insights, and comparative examples from similar economies, this study emphasizes the importance of a comprehensive, multi-dimensional approach to enhance export performance in developing countries like Bangladesh.

• *IMF and Financial Architecture Regime*

The IMF-led financial architecture has significantly influenced macroeconomic policymaking in developing nations, including Bangladesh. Through programs designed to instill fiscal discipline, structural adjustments, and currency management, the IMF promotes measures such as flexible exchange rates to help absorb external shocks and enhance export competitiveness. However, adopting these measures often requires balancing domestic economic priorities with the demands of international creditors and the volatility of global financial markets. The IMF serves as both a stabilizer and a reform catalyst, advocating for policies aimed at curbing fiscal deficits, controlling inflation, and fostering structural economic changes.

⁷ ERPT can be narrowly defined as the percentage change in local currency of import prices resulting from a one-percent change in the exchange rate between exporting and importing countries, or extended to refer to the impact of exchange rate changes on domestic prices in general.

⁸ A J-curve depicts a trend that starts with a sharp drop and is followed by a dramatic rise. The trendline ends in an improvement from the starting point. In economics, the J-curve shows how a currency depreciation causes a severe

worsening of a trade imbalance followed by a substantial improvement.

⁹ The circular reasoning fallacy uses circular reasoning to support an argument. More specifically, the evidence used to support a claim is just a repetition of the claim itself. For example, "The President of the United States is a good leader (claim), because they are the leader of this country (supporting evidence)".

The broader financial architecture, which includes adherence to International Financial Reporting Standards (IFRS)¹⁰, reinforces transparency and investor confidence by aligning domestic practices with global norms. For countries like Bangladesh, this alignment is essential to attract foreign direct investment (FDI) and maintain a favorable credit profile. While adopting IFRS can enhance credibility and cross-border comparability, it may also present challenges due to underdeveloped financial infrastructures that complicate implementation and strain local resources.

Navigating IMF engagements often involves complying with specific conditions attached to financial support, such as subsidy reductions, tax reforms, and currency devaluation. These measures, while intended to enhance economic efficiency and stimulate exports, can trigger complex repercussions. For example, devaluation, promoted by the IMF as a means to boost exports by making them more affordable on the global market, has shown mixed results in Bangladesh. The positive impact is sometimes offset by import dependencies that elevate production costs and inflationary pressures, limiting the intended economic benefits. This underscores the need for balanced strategies that align with both international standards and domestic growth imperatives.

The World Bank complements the IMF's influence by funding projects that strengthen infrastructure, build capacity, and alleviate poverty, supporting the broader economic framework essential for trade and export growth. These projects help Bangladesh improve its logistics and market access, reinforcing export competitiveness. However, the benefits come with the expectation of policy alignment with liberalized trade and financial practices aimed at sustaining macroeconomic stability.

For policymakers in Bangladesh, understanding and navigating this financial architecture is crucial. Integrating currency and fiscal policies that align with IMF guidelines while addressing local economic needs can help manage exchange rate fluctuations, bolster investor trust, and enhance global economic integration. This balanced approach—adhering to international financial norms while protecting domestic interests—enables Bangladesh to leverage opportunities in the global financial system while minimizing associated risks and fostering resilient export growth.

➤ *Empirical Studies*

Empirical research shows that while currency devaluation can theoretically enhance export performance, its practical impact is mixed, particularly for economies like Bangladesh, which heavily rely on imported inputs. This

dependence means that any competitive gains from devaluation may be counterbalanced by rising import costs, limiting the net positive effect on key export sectors such as ready-made garments (RMG) and leather. For example, the RMG industry, which drives a significant portion of Bangladesh's export revenue, depends on imported fabrics, dyes, and chemicals. As devaluation raises these input costs, the benefits for export competitiveness can be eroded (Amin & Rahman, 2019; Yunus & Yamagata, 2012). Similarly, the leather sector, which relies on imported tanning agents and machinery, faces similar challenges when the local currency loses value (Hossain, 2014).

This "cost paradox" highlights a critical issue: the assumption that devaluation straightforwardly enhances exports does not always hold true. The Balance of Payments (BoP) theory supports this notion, emphasizing that for devaluation to be effective, the export sectors should not be heavily reliant on imported materials. Otherwise, higher import costs can neutralize the competitive advantage (Dornbusch, 1988; Branson, 1983). Therefore, reducing import dependence becomes crucial for maximizing the positive outcomes of devaluation as an export strategy in Bangladesh.

Empirical studies also reveal sector-specific responses to devaluation, driven by factors like elasticity of demand¹¹ and production structures. The RMG sector, known for its labor intensity and high elasticity, often experiences immediate benefits post-devaluation (Rodrik, 2008; Yunus & Yamagata, 2012). In contrast, sectors such as pharmaceuticals and jute show more subdued responses due to their dependence on imported raw materials and compliance with stringent international standards (Rahman & Bari, 2016; Ahmed et al., 2017).

Conventional econometric techniques like vector autoregression (VAR)¹² have been used to study the broader relationship between devaluation and macroeconomic outcomes but often face limitations related to data requirements and endogeneity (Sims, 1980). The Synthetic Control Method (SCM), by contrast, has emerged as a valuable tool for policy evaluation, creating counterfactuals to better isolate the impact of devaluation (Abadie et al., 2010). This approach helps identify non-linear relationships and structural breaks, offering a more nuanced understanding of devaluation's influence on exports (Bouvet et al., 2022).

Empirical findings emphasize the context-dependent nature of devaluation's impact, influenced by macroeconomic variables such as inflation, FDI, interest rates, and overall BoP conditions (Edwards, 1989). In

¹⁰ International Financial Reporting Standards (IFRS) are a set of accounting rules for the financial statements of public companies that are intended to make them consistent, transparent, and easily comparable around the world.

¹¹ The price elasticity of imports is a trade-weighted average of the sectoral elasticities of substitution of the domestic consumer; the price elasticity of exports is similar, but the

average is now taken both across sectors and destination markets.

¹² Vector autoregression (VAR) is a statistical model used to capture the relationship between multiple quantities as they change over time. VAR is a type of stochastic process model. VAR models generalize the single-variable (univariate) autoregressive model by allowing for multivariate time series.

Bangladesh, while labor-driven sectors like RMG benefit, capital-intensive industries with significant import needs experience less favorable outcomes (Hossain, 2014; Yunus & Yamagata, 2012). This variability underscores the importance of a comprehensive strategy that includes supportive fiscal and trade policies to amplify devaluation's advantages (Agenor, 1992; Cooper, 1971).

In *Currency Devaluation as a Source of Growth in Africa: A Synthetic Control Approach*, Bouvet, Bower, and Jones (2022) analyze the 1994 IMF-supported CFA franc devaluation, finding limited positive impacts on GDP per capita across most CFA-franc zone countries, except for Mali, where some gains were evident. The study attributes the negative outcomes in three nations to institutional decline and external shocks that offset potential benefits of devaluation (The American Economic Review).

Empirical analysis also suggests that firm-level responses vary widely based on company size, structure, and import reliance (Berman et al., 2012). Larger firms, equipped with diversified export portfolios and stronger financial foundations, tend to manage currency fluctuations more effectively (Forbes, 2002). This highlights the potential value of incorporating firm-level data in future studies to capture differential impacts more precisely.

Empirical studies conclude that while devaluation has the potential to support export growth, it must be part of a broader policy package that addresses inflation, input cost pressures, and sectoral dependencies. For Bangladesh, effective use of devaluation involves complementary strategies aimed at reducing reliance on imported goods, bolstering industrial resilience, and modernizing production capabilities. The SCM method, with its capacity to isolate and evaluate policy impacts, provides a useful framework for guiding future economic policies and fostering sustained export performance.

- *Gap Study*

This dissertation offers contributions to the literature on currency devaluation and its impact on export performance, particularly through the lens of developing economies such as Bangladesh. Existing research often emphasizes

devaluation as a straightforward tool for promoting economic growth, largely influenced by studies conducted in or for developed countries. These analyses can be biased by the prevailing interests of developed-world financiers, who view major currencies like the Euro, Dollar, and Franc as commodities within an interest-based financial framework. This perspective frequently highlights the favorable aspects of devaluation while underrepresenting the unique challenges faced by developing nations in implementing such policies.

This study addresses these gaps by applying the Synthetic Control Method (SCM) to assess the nuanced impacts of devaluation on Bangladesh's export performance, drawing from a robust 30-year dataset. Unlike conventional approaches that may rely heavily on short-term exchange rate metrics such as the Nominal Effective Exchange Rate (NEER¹³), Real Effective Exchange Rate (REER¹⁴), and Trade-Weighted Exchange Rate (TWER¹⁵), the SCM constructs a synthetic counterfactual. This method allows for a more comprehensive, long-term analysis of devaluation's influence, revealing outcomes more aligned with the structural realities and economic intricacies of developing nations.

A further contribution of this dissertation lies in its integration of an extensive set of 14 control variables out of 30 selected macroeconomic indicators in regression models to deepen the understanding of the exchange rate environment. These control variables include essential macroeconomic indicators such as inflation, interest rates, FDI inflows, and government expenditure, among others, to capture the complexity of economic performance. The inclusion of these variables in Model 2, which explains up to 65% of the variance in export performance, underscores that devaluation alone is not sufficient to drive export growth. Instead, this analysis reveals that export success is contingent on broader economic and policy-related factors.

This comprehensive approach shifts the focus of the literature towards a more context-specific understanding of devaluation. It highlights that for developing countries like Bangladesh, structural limitations and policy frameworks must be considered to realize the potential benefits of devaluation.

¹³ NEER is a measure of the value of a currency against a weighted average of several foreign currencies. An increase in NEER indicates an appreciation of the local currency against the weighted basket of currencies of its trading partners.

¹⁴ REER is the real effective exchange rate (a measure of the value of a currency against a weighted average of several

foreign currencies) divided by a price deflator or index of costs.

¹⁵ A Trade-Weighted Exchange Rate (TWER) is a form of measuring a particular country's exchange rates. It is a more complex measure of doing so and involves measuring the currency's strength according to the weightage of trade it has with other countries.

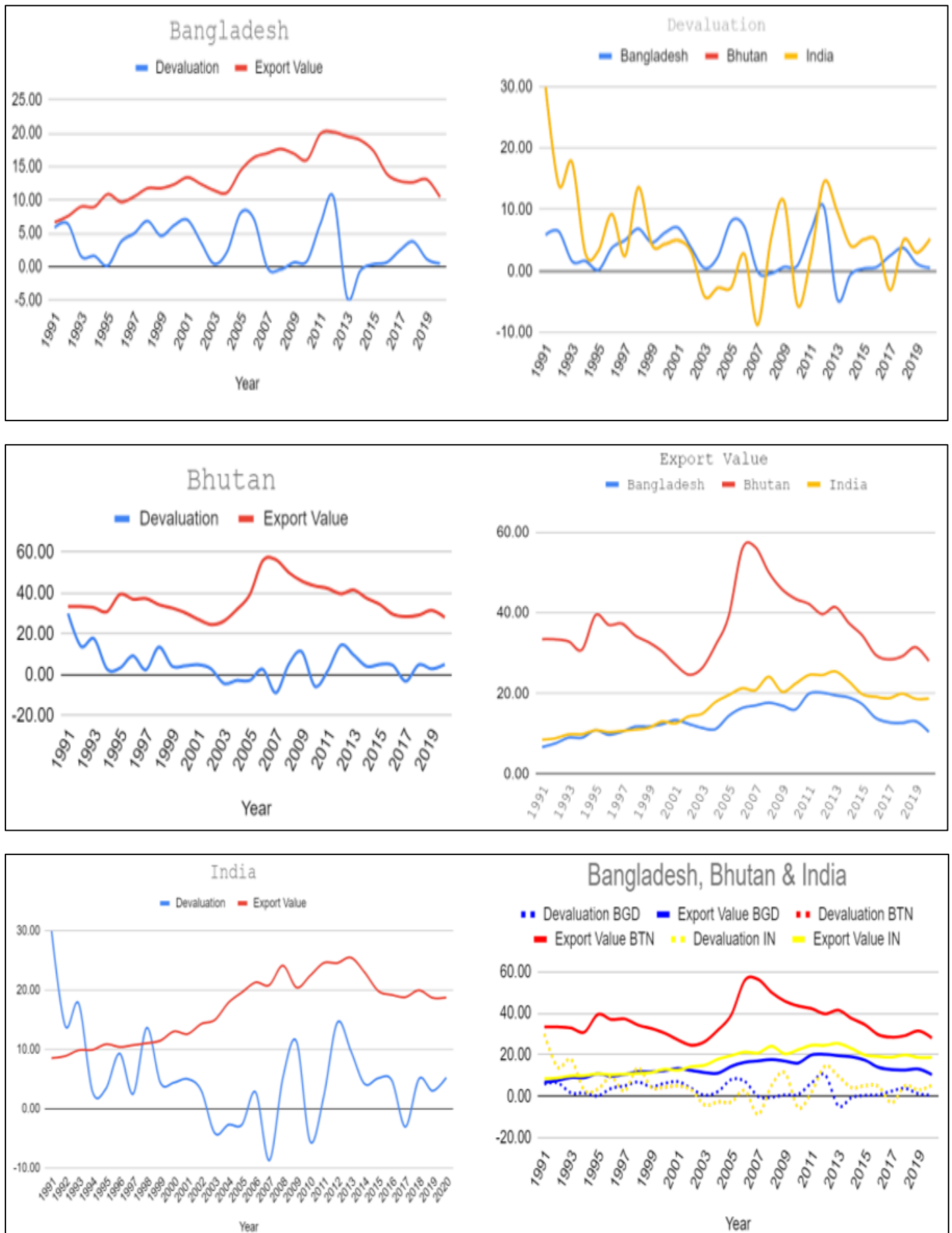


Fig 2 Devaluation and Export Value of Bangladesh, Bhutan and India

By examining how devaluation interacts with other macroeconomic and sector-specific factors, this dissertation fills a crucial gap in existing research and contributes practical insights for policymakers. The gap analysis is further illustrated in Fig 2 which depicts the trends in devaluation and export values for Bangladesh, Bhutan, and India, showcasing comparative perspectives within the region.

III. METHODOLOGY

The methodology of this study integrates two main analytical approaches—Ordinary Least Squares (OLS)¹⁶ regression and the Synthetic Control Method (SCM)—to evaluate the impact of currency devaluation on Bangladesh's export performance. This dual approach enables the exploration of both direct effects and complex interactions involving broader macroeconomic variables. The OLS regression includes simple bivariate regression, multivariate regression and fixed effect regression for better contextualization of both time and space (entity or country unit). The SCM is particularly effective in constructing a counterfactual scenario for Bangladesh by synthesizing data from control countries that did not experience similar devaluation. This method allows for a comparison between Bangladesh's actual export performance and an estimated outcome without devaluation, thereby providing a more comprehensive insight into the causal effects of currency changes. Unlike traditional difference-in-differences models, SCM offers flexibility in dealing with data constraints and reduces potential biases due to model sensitivity.

Complementing SCM, the study employs OLS regression to establish a foundational understanding of the linear relationships between devaluation and export performance while accounting for various macroeconomic factors. This method is necessary for initial estimations and helps contextualize the findings within broader economic frameworks. By including control variables such as inflation, interest rates, government expenditure, and FDI, the OLS regression provides a baseline for identifying significant relationships that inform and support further analysis using SCM.

The analysis encompasses two primary models: one that evaluates the impact of devaluation alone and another that incorporates 14 additional macroeconomic variables to provide a nuanced understanding of the interplay between these factors and export performance. This dual-model approach ensures that both isolated and interaction effects of devaluation are captured. The study also dissects the impact through three perspectives: macroeconomic, sectoral, and product-level data, enhancing the depth of analysis. Sector-specific insights focus on critical export industries such as ready-made garments (RMG), pharmaceuticals, leather, and jute. These sectors were chosen due to their significance to Bangladesh's economy and their varying responses to

devaluation, influenced by different levels of import dependency and market dynamics.

A key aspect of this methodology is its mid to long-term perspective, with data spanning 30 years (1991-2020), allowing for a thorough examination of trends and structural shifts. The analysis incorporates a diverse set of 14 macroeconomic indicators, sourced from reputable databases like the World Bank and UN COMTRADE, to ensure comprehensive coverage. This dataset facilitates cross-regional comparisons with 30 global South countries, enabling the construction of robust synthetic control units. The choice of control countries is based on shared economic characteristics, export profiles, and historical engagement with devaluation, ensuring a well-matched synthetic model.

SCM's capability to account for exogenous shocks and structural changes is particularly relevant for studying Bangladesh, where export performance is influenced by global economic conditions, policy shifts, and sector-specific constraints. This approach isolates the effects of devaluation more effectively than simpler econometric models, thus contributing to a more accurate policy analysis. The OLS regression further supports these findings by highlighting statistically significant relationships, validating the SCM's results, and providing insights into the broader macroeconomic context in which devaluation occurs.

The combination of SCM and OLS regression, supported by datasets of macroeconomic and sectoral variables, ensures that this study not only captures the direct impact of devaluation but also examines how it interacts with other economic forces. This methodological framework aligns with the study's aim to move beyond a singular focus on currency policy, advocating for a comprehensive strategy that considers structural reforms and macroeconomic stability to enhance export growth and economic resilience in Bangladesh.

A. Data Panels

The data for this study was collected from reputable sources, primarily the World Bank and UN COMTRADE, to ensure comprehensive coverage and reliability. The analysis spans 30 years (1991-2020), encompassing macroeconomic, sectoral, and product-level perspectives. This extensive timeframe allows for a thorough investigation of long-term trends and structural changes in export performance relative to devaluation. Central to the study were two models: one examining the impact of devaluation alone and another incorporating 14 additional macroeconomic variables to capture broader economic dynamics.

Key variables included in the analysis were currency devaluation, measured as the percentage change in the nominal exchange rate, and export value as percentage of GDP, standardized to same scale with first order differentiated values for consistent cross-model and cross-

¹⁶ Ordinary Least Squares regression (OLS) is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or

more independent quantitative variables and a dependent variable (simple or multiple linear regression), often evaluated using r-squared.

country comparisons and pretreatment match for Synthetic Control Method application. The data framework also incorporated critical macroeconomic indicators such as inflation, interest rates, GDP per capita growth, foreign direct investment (FDI), and government expenditure etc. These variables were necessary for constructing a robust OLS regression model and refining the Synthetic Control Method (SCM) to provide insights into how devaluation interacts with economic conditions.

Sector-specific data focused on Bangladesh’s key export industries—ready-made garments (RMG), leather goods, pharmaceuticals, and jute—each of which has distinct dependencies on imported inputs and varying elasticities of demand. This sectoral perspective allowed for targeted insights into how devaluation impacted these industries differently. For example, while the RMG sector might benefit from lower export prices, increased costs of imported materials could offset these gains. By integrating macroeconomic, sectoral, and product-level data, the study aimed to contextualize how devaluation influenced export performance under varying economic conditions.

The methodology relied on constructing a panel that included 23 global South countries out of 30 selected countries with comparable economic structures and export profiles to serve as potential control units in the SCM. This comparative approach provided a synthetic counterfactual, enhancing the analysis of Bangladesh’s unique economic trajectory post-devaluation. The two-pronged methodology of OLS regression and SCM allowed for capturing both direct impacts and complex interactions, validating findings through cross-referenced results.

The study's exploration of currency as both a medium of exchange and an asset under speculative influence was reflected in the choice of data and analysis. By framing

currency in these dual roles, the data collection and modeling aimed to demonstrate not just how devaluation affects trade competitiveness but also how it interacts with deeper systemic economic factors. This comprehensive data-driven approach with optimization feature was necessary for crafting policy recommendations consistent with the research's anticipated findings, highlighting that devaluation should be incorporated into a holistic strategy that factors in macroeconomic stability, sector-specific adjustments, and strategic investments in infrastructure and technology.

➤ *Timeline (1991-2020)*

The timeline for this study covers the 30-year period from 1991 to 2020, strategically chosen to facilitate an in-depth analysis of the macroeconomic, sectoral, and product-level impacts of currency devaluation on Bangladesh’s export performance. The year 2012 serves as a key intervention point, marking a significant currency devaluation event that divides the period into pre- and post-devaluation phases. The pre-intervention phase (1991–2011) provides a historical baseline for understanding economic and export trends leading up to the devaluation, enabling a clearer view of the foundational factors influencing export performance. The post-intervention phase (2013–2020) allows for a focused examination of the direct and residual effects of devaluation on export growth, framed within the broader context of evolving global economic conditions.

The method helps to clarify how devaluation, both as a medium of exchange and an asset within speculative markets, interacts with these economic variables. SCM is then used to create a synthetic counterfactual, representing what Bangladesh’s export performance might have looked like in the absence of devaluation. This dual-method approach is necessary for distinguishing between immediate impacts and broader trends shaped by multiple macroeconomic influences.

Table 1 Study Period (30 Years)

Calendar / Fiscal Years									
1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2011	2012	2013	2014	2015	2016	2017	2018	2019	2020

The multi-perspective approach — macroeconomic, sectoral, and product-level data—enables a comprehensive exploration of how devaluation influenced various aspects of export performance, from overarching economic outcomes to industry-specific reactions. This study also benchmarks Bangladesh against 30 global South countries, contextualizing its economic trajectory within a broader set of developing economies with similar structural conditions.

By covering an extensive 30-year timeline and including 14 macroeconomic variables, this study seeks to provide a balanced view that captures the dual nature of currency as a tool for trade and an asset in financial markets which captures derivatives and intermediaries as well. The time frame and methodological rigor ensure that findings reflect not just short-term fluctuations but also longer-term

trends that inform policy recommendations aimed at sustaining export growth amid global economic shifts. Table 1 summarizes the 30-year study period, spanning from 1991 to 2020, which serves as the basis for the analysis.

➤ *Export Value and Devaluation (Response and Predictor Variables)*

The response variable central to this study is export value, quantified as a percentage of GDP. This measure offers a comprehensive view of the contribution exports make to Bangladesh's overall economic output, allowing for a analysis of how shifts in economic policy and global conditions impact trade performance. To evaluate the influence of currency devaluation, the study incorporates this primary response variable across different analytical levels: macroeconomic, sectoral, and product-specific data.

The principal predictor variable is currency devaluation, represented as a percentage change in the nominal exchange rate. This variable is pivotal in assessing the direct and indirect effects of currency shifts on export performance, capturing the extent of depreciation relative to major currencies or a trade-weighted basket. The dual ideologies of currency—as a medium of exchange facilitating trade and as an asset within speculative financial systems—are necessary for contextualizing the role of devaluation in economic policy.

SCM adds robustness by constructing a synthetic counterfactual that models what Bangladesh’s export trajectory might have looked like without significant currency devaluation. This approach allows for a distinction between observed export outcomes and hypothetical scenarios, strengthening the analysis by accounting for external and confounding variables.

The comprehensive dataset underpins both models—one focusing on the standalone impact of devaluation and another enriched with 14 macroeconomic indicators—facilitating a multi-angled approach that covers macroeconomic, sectoral, and product-level dynamics. By doing so, the study not only quantifies the impact of currency devaluation on exports but also reveals deeper insights into how structural and policy-related variables mediate this relationship. Table 2 outlines the key variables used in the analysis, specifying export value as the response variable and devaluation as the predictor variable, with their measurements expressed as a percentage of GDP and percentage change in nominal exchange rate in local currency unit (LCU), respectively. The first order differentiated value was used for harmonizing to the same scale.

Table 2 Response and Predictor Variable

	Response Variable	Predictor Variable
	Export Value	Devaluation
Measurement	Percentage (% of GDP)	Percentage (%)

➤ *Time and Place Contexed Panels (14 Macroeconomic Control Variables)*

The analysis incorporates a comprehensive array of 14 control variables that influence the relationship between export value (the dependent variable) and devaluation (the primary independent variable). These variables include key economic indicators such as interest rates, inflation, foreign direct investment (FDI), government expenditure, and import-export indices. By integrating this wide range of macroeconomic factors, the analysis ensures that the impact of devaluation on export performance is examined within a broader economic context, mitigating the risk of omitted variable bias.

Model 1 focuses solely on assessing the direct impact of devaluation on export performance over a 30-year period, utilizing data from Bangladesh and 23 control countries. This approach provides an initial understanding by isolating devaluation’s effects without the complexities introduced by additional economic variables. The model adopts a straightforward structure to highlight devaluation’s role as both a medium of exchange and an asset within financial systems, illustrating how currency value changes can directly influence trade outcomes.

Model 2 expands this analysis by incorporating 14 additional macroeconomic variables, drawing from data spanning 2002 to 2018 and narrowing the scope to five selected global South countries as control units. This model

captures the interactive effects of devaluation and other economic forces, such as inflation, FDI, and government spending etc. By examining how these factors collectively impact export performance, Model 2 reflects a more intricate picture of economic interdependencies. The methodological approach behind selecting these variables are usually tested by alignment with principles akin to the Akaike Information Criterion (AIC)¹⁷ and Bayesian Information Criterion (BIC)¹⁸, ensuring that the model remains effective without overfitting or excessive complexity. With some limitations, these testing of criterion are beyond the scope of this paper.

The integration of both Ordinary Least Squares (OLS) regression and the Synthetic Control Method (SCM) enriches the analysis. OLS provides a baseline for understanding linear relationships between devaluation and exports, while SCM constructs a synthetic counterpart to Bangladesh, enabling the evaluation of devaluation’s impact relative to what could have occurred without it. This dual-method approach, assessed through macroeconomic, sectoral, and product-level lenses, offers robust insights into how devaluation operates as a policy tool within a complex economic landscape.

The 14 control variables, coupled with the dual-method framework, emphasize that while currency devaluation plays a significant role, it is interwoven with broader economic factors that shape export performance. By employing these methodologies over three decades and across 23 global South countries, the study captures the multifaceted nature of

¹⁷ The Akaike information criterion (AIC) is a mathematical method for evaluating how well a model fits the data it was generated from. In statistics, AIC is used to compare different possible models and determine which one is the best fit for the data.

¹⁸ Bayesian information criterion or Schwarz information criterion is a criterion for model selection among a finite set of models; models with lower BIC are generally preferred. It is based, in part, on the likelihood function and it is closely related to the Akaike information criterion.

economic dynamics, offering a comprehensive perspective on how devaluation interacts with economic structures to influence trade and export growth.

Table 3 presents a comprehensive set of macroeconomic indicators that collectively function as a cohesive analytical unit throughout the study. These indicators include key response variables, predictors, potential confounders,

colliders, and other variables of interest that underpin the investigation into export performance and its relation to devaluation. The table outlines essential economic metrics such as devaluation, lending interest rates, inflation, and GDP per capita growth etc. It also encompasses broader fiscal and trade-related components, including government expenditure, export and import value indices, and foreign direct investment etc.

Table 3 Control Variables (30)

Response, Predictor, key, Confounder, Collider and Probable List of Concerned Variables under Assumption							
Export Value	Devaluation	Nominal Exchange Rate	Lending Interest Rate	Inflation	Balance of Payment	Foreign Direct Investment	GDP Growth
(% of GDP)	(%)	(LCU)	(%)	% (CPI)	(Net Financial Account)	(Net Inflow-% of GDP)	(% Annual)
Government Expenditure	Final Government Consumption Expenditure	Export Value Index	Export Volume Index	Import Value Index	Import Volume Index	Broad Money	GDP Per Capita Growth
(% of GDP)	(% of GDP)	(2015 = 100)	(2015 = 100)	(2015 =100)	(2015 = 100)	(% of GDP)	(% Annual)
Price Level of Capital Formation,	Price Level of Exports	Price Level of Imports	Price Level Ratio of PPP Conversion Factor (GDP) to Market Exchange Rate	Share of Labour Compensation in GDP	Share of Merchandise Exports	Share of Merchandise Imports	Subsidies and Other Transfers
(Price Level of USA GDPo in 2017=17)	(Price Level of USA GDPo in 2017=29)	(Price Level of USA GDPo in 2017=17)		(Current National Prices)	(Current PPPs)	(Current PPPs)	(% of GDP)
Tech Value Added	Barter Terms of Trade Index	Personal Remittance	Interest Rate Spread	Real Effective Exchange Rate	Ease of Doing Business Rank		
(% Manufacturing Value Added)	(2015 =100)	(% of GDP)	(%)				

To capture a broader economic landscape, variables like the tech value addition, barter terms of trade etc. are included. Further, it reflects aspects like the broad money, technological value added, etc. This integrated approach allows for a comprehensive analysis, ensuring that most of the macroeconomic indicators are considered as a unified system influencing export values, thereby enhancing the robustness and reliability of the findings.

➤ *Units Used for Construction of SCM Unit (23 Global South Countries)*

This study focuses on 23 Global South countries out of 30 selected from three key regions: Asia, Africa, and South and Latin America, to construct the synthetic control unit. In Asia, the countries included are Bangladesh, Bhutan,

Cambodia, India, Indonesia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand, Turkiye, and Viet Nam. The African cohort comprises Egypt, Ethiopia, Ghana, Kenya, Mauritania, Morocco, Nigeria, South Africa, Tanzania, Tunisia, and Uganda. From South and Latin America, the selected countries are Argentina, Brazil, Colombia, El Salvador, Mexico, and Peru. These countries were strategically chosen due to their economic characteristics that resemble or complement Bangladesh’s trade environment, aiding in the creation of a robust synthetic control model. Table 4 lists the 30 Global South countries categorized by region (Asia, Africa, and South and Latin America) that were selected for constructing the synthetic control unit in the study.

Table 4 Countries for Construction of Synthetic Control Unit (30 Global South Countries)

Asia	Africa	South and Latin America
Bangladesh	Egypt	Argentina
Bhutan	Ethiopia	Brazil
Cambodia	Ghana	Colombia
India	Kenya	El Salvador
Indonesia	Mauritania	Mexico
Myanmar	Morocco	Peru
Nepal	Nigeria	
Pakistan	South Africa	
Philippines	Tanzania	
Sri Lanka	Tunisia	
Thailand	Uganda	
Turkiye		
Viet Nam		

➤ *Introduction to Datasets*

This study utilizes a comprehensive dataset spanning macroeconomic, sectoral, and product-level variables to investigate the complex relationship between currency devaluation and export performance. The dataset is structured into three key levels of analysis, each offering unique insights into the factors influencing Bangladesh’s export dynamics.

• *Macroeconomic Dataset*

The macroeconomic dataset underpins the broader analysis, encompassing two models to evaluate the influence of devaluation on export values. Model 1 includes export values and devaluation data from 1991 to 2020 in 23 countries, focusing on the direct relationship between currency adjustments and trade performance. Model 2

incorporates a more detailed framework, adding 14 control variables such as inflation, foreign direct investment (FDI), and government expenditure for the period 2002–2018. This enhanced model covers data from five countries, providing a comparative perspective on the structural and external economic factors that shape export outcomes. These datasets are instrumental in identifying the macroeconomic conditions that amplify or mitigate the effects of devaluation. Table 5 presents the dataset used for analyzing export value and devaluation from 1991 to 2020 across 23 countries, including Bangladesh, Egypt, Brazil, and others and Table 6 outlines the dataset for analyzing devaluation along with 14 added indicators impacting export value from 2002 to 2018 in five countries: Bangladesh, India, Peru, Philippines, and South Africa.

Table 5 Dataset for Devaluation in 23 Countries

Time: 1991 to 2020	
Response Variable: Export Value	Predictor Variable: Devaluation
Bangladesh, Egypt, Brazil, Bhutan, Ghana, Colombia, India, Kenya, Mexico, Indonesia, Morocco, Peru, Nepal, Mauritania, Pakistan, South Africa, Philippines, Tanzania, Thailand, Tunisia, Turkiye, Uganda, Viet Nam	
Total = 23 Countries	

Table 6 Dataset for Devaluation plus 14 added indicators in 05 Countries

Time: 1991 to 2020	
Response Variable: Export Value	Predictor Variable: Devaluation
Control Units: Bangladesh, India, Peru, Philippines, and South Africa = 05 Countries	
Added Control Variables:	
Lending Interest Rate, Inflation, Foreign Direct Investment, Government Expenditure, Final Government Consumption Expenditure, Export Value Index, Export Volume Index, Import Value Index, Import Volume Index, Broad Money, GDP Per Capita Growth, Subsidies and Other Transfers, Tech Value Added, Barter Terms of Trade Index.	
Total = 14 Indicators	

• *Sectoral Dataset*

The sectoral dataset focuses on export performance across four pivotal industries—ready-made garments (RMG), pharmaceuticals, leather, and jute—using data from 1991 to 2020 from two comparing countries Bangladesh, and India. By comparing Bangladesh with Bhutan and India, the dataset

highlights sectoral variations in responsiveness to devaluation. For instance, the garments sector, with its cost-competitive labor, may benefit differently from devaluation than the pharmaceutical sector, which depends heavily on imported active pharmaceutical ingredients (APIs). Similarly, the leather and jute sectors display unique

dynamics influenced by global demand patterns and input costs. This sectoral focus enables a detailed examination of industry-specific dependencies and challenges, fostering more precise policy recommendations. Table 7 outlines description of the sectoral data for export value based on the

FOB (Free on Board) value, categorizing export commodities under the Harmonized System (HS) codes upto Chapter Level defined by the World Customs Organization (WCO) for sectors such as readymade garments, pharmaceutical products, leather goods, and jute and jute products.

Table 7 Sectoral Data - Export Value - (FOB Value)

Log of Export Value		
Sector	Chapter	Harmonized System of Commodity Description (WCO Defined)
Readymade Garments	61	Articles of apparel and clothing accessories, knitted or crocheted
	62	Articles of apparel and clothing accessories, not knitted or crocheted.
Pharmaceutical Products	30	Pharmaceutical products.
Leather Goods	41	Raw hides and skins (other than furskins) and leather
	42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)
Jute and Jute Products	53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn

• *Product-Level Dataset*

To further refine the analysis, the study employs a product-level dataset covering the years 2004 to 2015 from comparing countries Bangladesh, India and Bhutan. This dataset disaggregates export values for RMG, pharmaceuticals, leather, and jute products, allowing for granular insights into how specific product categories respond to currency devaluation. For example, variations in export performance within the pharmaceutical products may reveal the differential impact of regulatory standards or technological capabilities. Similarly, jute products, often less

dependent on imported inputs, may exhibit distinct trends compared to the leather sector, which relies on high-cost processing materials. The product-level data offers a fine-grained view of export dynamics, uncovering subtle patterns that macroeconomic and sectoral datasets might overlook. Table 8 provides a description of detailed breakdown of selected export values at the product level, categorized by products and specific HS codes Headings as defined by the World Customs Organization (WCO). It includes FOB values for readymade garments, pharmaceutical products, leather goods, and jute and jute products, showcasing distinct commodities within each Heading.

Table 8 Selected Export Value of Product Level Data (FOB Value)

Log of Export Value		
Sector	HS Code	Commodity Description (WCO Defined)
Readymade Garments	6111	Babies' garments and clothing accessories, knitted or crocheted.
	6113	Garments, made up of knitted or crocheted fabrics of heading 59.03, 59.06 or 59.07.
Pharmaceutical Products	510	HS Codes of Ambergris, castoreum, civet and musk; cantharides; bile, whether or not dried; glands and other animal products used in the preparation of pharmaceutical products, fresh, chilled, frozen or otherwise provisionally preserved.
	1905	Bread, pastry, cakes, biscuits and other bakers' wares, whether or not containing cocoa; communion wafers, empty cachets of a kind suitable for pharmaceutical use, sealing wafers, rice paper and similar products.
Leather Goods	3210	Paints and varnishes, incl. enamels, lacquers and distempers (excl. those based on synthetic polymers or chemically modified natural polymers); prepared water pigments of a kind used for finishing leather
	4107	Leather further prepared after tanning or crusting, including parchment-dressed leather, of bovine (including buffalo) or equine animals, without hair on, whether or not split, other than leather of heading 4114
Jute and Jute Products	5303	Jute and other textile bast fibres (excluding flax, true hemp and ramie), raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock)
	5307	Yarn of jute or of other textile bast fibres of heading 5303. Harmonized System Codes of Chapter Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn. : Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn.

- *Strategic Insights from the Dataset*

The combined datasets provide a robust foundation for understanding the multifaceted impact of devaluation on Bangladesh's export sectors. They reveal that the effectiveness of devaluation is contingent upon a combination of macroeconomic conditions, sector-specific structures, and product-level dependencies. For instance, while the RMG sector might gain from price competitiveness, the pharmaceutical sector's response is shaped by non-price factors like regulatory compliance and global quality standards. The leather and jute sectors, with their unique input and market dynamics, further underscore the importance of tailored strategies.

This multi-tiered analytical approach underscores the need for nuanced, sector-specific policies to enhance export performance. By addressing dependencies, such as input cost management for pharmaceuticals and technological upgrades for leather processing, policymakers can create a more resilient export ecosystem. Ultimately, the datasets used in this study highlight the interplay between devaluation and broader economic variables, advocating for integrated macroeconomic and microeconomic strategies to bolster Bangladesh's export competitiveness.

- *Data Arrangement for Cross-Model and Cross-Country Comparisons*

The first order differentiated values have been used for scaling the data to the same level. The systematic pairing of data across multiple models facilitates cross-model and cross-country comparisons, focusing on the unique economic behaviors and export performance in response to devaluation with a potential of higher possibility of evolving new comparison unit. By incorporating countries like South Africa, Peru, Pakistan and Morocco with significant weightage in the analysis, the study broadens the perspective to include nations with varied economic scales and global trade influences. This ensures a comprehensive understanding of how different economies respond to currency devaluation, enhancing the relevance of findings for policy formulation.

- *Validation and Robustness Checks*

To ensure the reliability of the Synthetic Control Method (SCM) and regression results, several robustness checks were employed. Placebo tests validated the SCM findings by creating synthetic controls for non-treated countries, confirming the robustness of Bangladesh's post-devaluation results. Bootstrapping further assessed the stability of regression outcomes, reinforcing that observed relationships were consistent across different samples. Sensitivity analyses adjusted control unit weights in the SCM model to verify that the results were not significantly altered by changes in model parameters. These validation techniques enhance confidence in the findings, demonstrating that the observed effects represent genuine economic relationships rather than artifacts of model design. This thorough approach provides a sound foundation for policy recommendations aimed at bolstering Bangladesh's export competitiveness amid global economic challenges.

- B. *Models (Two Models: Time, Place and Variables)*

The analysis utilizes two models to comprehensively assess the impact of currency devaluation on export performance in Bangladesh, applying these models across macroeconomic, sectoral, and product-level analyses with some adjustment of time period, country units and variables based on paired data availability and methodological requirements:

- *Model 1: Devaluation Alone*

The first model isolates the direct impact of currency devaluation on export performance, focusing on how changes in currency value as a standalone factor affect the macroeconomic landscape. This model is critical for establishing a baseline understanding of devaluation's immediate and unmediated effects on total export activity. At the sectoral level with two comparing countries (Bangladesh, and India), this model helps identify how key industries such as the ready-made garments (RMG) sector, pharmaceuticals, and leather are influenced directly by shifts in currency valuation. Similarly, at the product level, this approach allows for the analysis of specific export products and their responsiveness to devaluation. (Table 5)

- *Model 2: Devaluation Plus 14 Macroeconomic Variables*

The second model incorporates 14 additional macroeconomic variables in five countries to provide a more comprehensive understanding of the dynamics at play. This expanded model evaluates how devaluation interacts with other economic factors such as inflation, interest rates, foreign direct investment (FDI), and government expenditure, offering a multidimensional view of its impact. By considering these macroeconomic variables, the model examines the complex web of influences that shape export performance beyond devaluation alone.

Applying this model across macroeconomic, sectoral, and product-level analyses enables a more nuanced perspective. At the macroeconomic level, it helps illustrate how variables collectively influence export outcomes and mitigate or amplify the effects of devaluation. Sectorally, the inclusion of these variables allows for an in-depth analysis of how industries reliant on imported inputs, like the RMG and leather sectors, are affected by macroeconomic shifts. At the product level, this model enables a detailed investigation into specific goods, helping identify which export products benefit most from devaluation when other economic conditions are accounted for.

By employing both models, the analysis not only isolates the fundamental impact of devaluation but also contextualizes it within a broader economic framework, enhancing the depth and applicability of the findings across different levels of economic activity. (Table 5)

Table 9 summarizes the Synthetic Control Method (SCM) and regression models, comparing macroeconomic variables across different countries for the analysis of currency devaluation and export performance. Model 1 spans 1991 to 2020, while Model 2 focuses on 2002 to 2018, each involving various control units such as Bangladesh, Bhutan,

India, South Africa, Peru etc. Key indicators include export value, devaluation, foreign direct investment, and broader

economic measures like government expenditure and export indices.

Table 9 Models for SCM and Regression

	Model 1		Model 2		
Time (Year)	(1991-2020)		(2002-2018)		
Control Unit	Country	Variable	Country	Variable	Variables
Bangladesh	✓	✓	✓	✓	Export Value
Bhutan	✓	✓		✓	Devaluation
Brazil	✓				Nominal Exchange Rate
Colombia	✓			✓	Lending Interest Rate
Egypt	✓			✓	Inflation
Ghana	✓			✓	Foreign Direct Investment
India	✓		✓		GDP Growth
Indonesia	✓			✓	Government Expenditure
Kenya	✓			✓	Final Government Consumption Expenditure
Mauritania	✓			✓	Export Value Index
Mexico	✓			✓	Export Volume Index
Morocco	✓			✓	Import Value Index
Nepal	✓			✓	Import Volume Index
Pakistan	✓			✓	Broad Money
Peru	✓		✓	✓	GDP Per Capita Growth
Philippines	✓		✓		Price Level of Capital Formation,
South Africa	✓		✓		Price Level of Exports
Tanzania	✓				Price Level of Imports
Thailand	✓				Price Level Ratio of PPP Conversion Factor (GDP) to Market Exchange Rate
Tunisia	✓				Share of Labour Compensation in GDP
Turkiye	✓				Share of Merchandise Exports
Uganda	✓				Share of Merchandise Imports
Viet Nam	✓			✓	Subsidies and Other Transfers
Argentina				✓	Tech Value Added
Cambodia				✓	Barter Terms of Trade Index
El Salvador					Personal Remittance
Ethiopia					Balance of Payment
Myanmar					Interest Rate Spread
Nigeria					Real Effective Exchange Rate
Sri Lanka					Ease of Doing Business Rank

Model 2 also integrates additional factors like subsidies, tech value added, etc. creating a comprehensive framework for assessing how these economic variables interact across nations.

C. Methods

➤ Regression

• *Demonstrative Findings for Bangladesh*

In Model 1, regression analysis shows a statistically significant positive relationship between devaluation and Bangladesh's export performance, with the devaluation coefficient observed at 0.0052623 (p-value = 00.002). This

suggests that a 1% change in devaluation corresponds to a 0.0052623% change in export value, underlining the direct beneficial effect of currency devaluation on exports. Table 10 presents the regression coefficients for the relationship between export value and devaluation, highlighting a statistically significant positive effect of devaluation on export value, indicating that devaluation correlates with an increase in export value. The constant term shows a positive value of 0.2046455, suggesting the baseline export level when other variables are held constant.

Table 10 Export Value and Devaluation . (Model 1 Coefficient)

Exportvalue	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
devaluation	0.0052623	0.0016613	3.17	0.002	0.0020003	0.0085242
_cons	0.2046455	0.1278404	1.6	0.11	-0.046374	0.4556649

Despite the positive correlation, the overall explanatory power of the model is relatively low, as indicated by the R-squared value of 0.0149. This implies that devaluation alone explains only a small portion of the variation in export value. The low adjusted R-squared value, along with the model's Root Mean Square Error (3.3007), suggests that there are likely other economic variables influencing export performance that are not accounted for in this simplified

model. Table 11 displays the results for ANOVA table of Model 1, where devaluation is the sole predictor variable. The model explains a small portion of the variance in export value, as indicated by an R-squared value of 0.0149 and an adjusted R-squared of 0.0134. The F-statistic of 10.03 (p = 0.0016) shows that the model is statistically significant, albeit with a modest explanatory power.

Table 11 Devaluation only (Model 1)

Source	SS	df	MS	Number of obs	667
				F(1, 688)	10.03
Model	109.317945	1	109.317945	Prob > F	0.0016
Residual	7245.10406	665	10.8948933	R-squared	0.0149
				Adj R-squared	0.0134
Total	7354.422	666	11.0426757	Root MSE	3.3007

In contrast, Model 2, which includes 14 macroeconomic more control variables, presents a more nuanced picture of devaluation's impact on export performance across multiple countries, including Bangladesh. This model significantly improves explanatory power, as evidenced by an R-squared of 0.7232 and an adjusted R-squared of 0.658, indicating that the included variables together explain a substantial portion of the variability in export value. The inclusion of these variables helps mitigate multicollinearity¹⁹ issues and

clarifies the extent to which devaluation directly influences export performance. Table 12 presents the results of ANOVA table for Model 2, which incorporates devaluation alongside 14 additional macroeconomic variables. The model shows a higher explanatory power, with an R-squared value of 0.723 and an adjusted R-squared of 0.6583. The F-statistic of 11.15 (p < 0.000) indicates strong overall significance, suggesting that the combined variables effectively account for variations in export value.

Table 12 Devaluation Plus 14 Variables (Model 2)

Source	SS	df	MS	Number of obs	80
				F(15, 64)	11.15
Model	298.684272	15	19.9122848	Prob > F	0
Residual	114.316599	64	1.78619687	R-squared	0.7232
				Adj R-squared	0.6583
Total	413.000872	79	5.22785913	Root MSE	1.3365

¹⁹ Multicollinearity is a statistical concept where several independent variables in a model are correlated. Two variables are considered perfectly collinear if their correlation

coefficient is +/- 1.0. Multicollinearity among independent variables results in less reliable statistical inferences.

The coefficient for devaluation in Model 2 is 0.078083, also suggesting a positive relationship when broader macroeconomic factors are considered. However, this finding is higher than Model 1, revealing that devaluation's direct effect diminishes when accounting for other influential economic variables.

Several key variables demonstrate significant relationships with export growth, while others show weaker or statistically insignificant effects.

Lending interest rates show a positive relationship with export value, with a coefficient of 0.6441, suggesting that favorable financial conditions, driven by lower interest rates, may encourage investment, which, in turn, could boost export performance. This relationship is statistically significant (p -value = 0), indicating that lending rates play a role in shaping the economic environment and enhancing export potential.

Similarly, government expenditure exhibits a positive relationship with export performance, with a coefficient of 0.6362 and a significant p -value of 0.003. This suggests that increased government spending, particularly in areas like infrastructure, trade facilitation, and policy support, can enhance export capacity. However, this effect may depend on how efficiently the government allocates its spending, with potential diminishing returns if mismanaged.

In contrast, final government consumption expenditure shows a negative relationship with export growth. The coefficient of -0.3937 (p -value = 0.005) indicates that excessive public consumption, particularly on non-productive sectors, can crowd out private sector investment and hinder export growth. This finding underscores the importance of optimizing public spending to ensure it complements, rather than competes with, export-driven initiatives.

The export value index shows a strong and statistically significant positive relationship with exports (coefficient = 0.1304, p -value = 0.006), highlighting that increasing the value-added component of exports is crucial for improving export outcomes. Expanding higher-value exports can lead to substantial improvements in overall export performance, emphasizing the importance of diversifying and upgrading the export base.

On the other hand, the export volume index (coefficient = 0.0349) and import volume index (coefficient = 0.0570) show weak, non-significant relationships with exports, suggesting that changes in export and import volumes alone may not significantly affect export performance in this model. Similarly, the import value index shows a negative coefficient of -0.0375, but with a p -value of 0.403, indicating that import dependency does not have a significant impact on export outcomes in this analysis, even though theoretically, higher imports could reduce export competitiveness.

The analysis also includes tech value added, which shows a positive relationship with exports (coefficient = 0.0629), but its statistical insignificance (p -value = 0.221) implies that while technological advancements may enhance export capacity, this effect is not strongly supported in the current data.

The regression results suggest that factors such as government expenditure, lending interest rates, and export value index play significant roles in determining export performance. Conversely, variables such as tech value added, import volumes etc. demonstrate weaker or non-significant impacts. These findings emphasize the need for a comprehensive and balanced export strategy that integrates financial policies, value-added export development, and efficient government spending, while minimizing over-reliance on imports. The effectiveness of devaluation, while positive in certain cases, is clearly dependent on the broader economic context and the interplay of these macroeconomic variables.

➤ *Synthetic Control Method*

The synthetic control method (SCM), along with regression and related estimation and inference techniques, was utilized to examine the effects of currency devaluation on Bangladesh's export performance. In this study, devaluation is analyzed as a significant policy shock within the export business ecosystem, impacting various economic dimensions, particularly within the FX market²⁰, where currency value is influenced by supply and demand dynamics. The intervention year of 2012 was identified due to a marked devaluation rate of 10.40%, serving as a pivotal point for evaluating the subsequent effects on export outcomes. By constructing a synthetic counterfactual, SCM estimates how Bangladesh's export performance might have evolved in the absence of this devaluation event.

To ensure the robustness of the response, the analysis make attempts to be accounted for economic shocks from serial correlation, interacting, instrumental, confounding and colliding variables to minimize the effect of circular reasoning at macro and micro levels with maximized optimization, such as inflation, foreign direct investment (FDI), and interest rates. This inclusion along with both non-parametric and parametric estimation techniques helped manage the interactive effects and potential bias from observed and unobserved variables, allowing for an in-depth exploration of the relationship between devaluation and export performance over time. The SCM approach facilitated an examination of both pre- and post-intervention periods, enabling the isolation of devaluation's causal impact while considering other influential economic factors.

Addressing the endogeneity challenge — where devaluation and exports could mutually influence each other—was a key methodological focus. The study's comprehensive approach integrated significant

²⁰ The foreign exchange market, commonly referred to as the forex or FX, is the global marketplace for the trading of one nation's currency for another. The forex market is the largest,

most liquid market in the world, with trillions of dollars changing hands every day.

macroeconomic variables (e.g. inflation, interest rates, and FDI) and employed placebo tests, bootstrapping, and confidence intervals to validate the robustness of the findings. By balancing the predictor variables with relevant controls and assessing SCM gaps, the study provided insights into whether devaluation acts as an independent driver of export performance or whether a broader array of economic factors, including global market conditions, contribute to the observed outcomes.

The SCM framework allowed for a structured analysis of the complex relationship between currency devaluation and export outcomes in Bangladesh. This method extended beyond a singular focus on devaluation to include the interplay of various economic elements, highlighting that export performance in an open market economy is subject to multifaceted influences. The analysis revealed that understanding the full scope of export dynamics requires looking at devaluation within the broader economic context, where multiple factors interact to shape overall performance.

• *SCM Specification with Demonstrative Findings for Bangladesh*

The Synthetic Control Method (SCM) is employed as a structured technique for assessing causal impacts in observational studies by constructing a synthetic counterfactual—a weighted combination of control units that closely matches the pre-intervention characteristics of the treated unit. This enables an estimation of what the treated unit's outcomes might have been without the intervention. The main components of SCM include selecting appropriate control units, determining their optimal weights, creating a synthetic path, estimating the treatment effect as the observed

versus synthetic outcome difference, and conducting diagnostic checks for model reliability. This comprehensive process allows for a nuanced examination of policy impacts, as seen in evaluating how currency devaluation affected Bangladesh's export performance.

• *Step-by-Step SCM (Seven Steps)*

✓ *Step 1: Selection of Control Units*

To create a robust synthetic counterpart to Bangladesh, the selection of appropriate control units is required. Countries with economic similarities to Bangladesh, such as trade structure, sectoral composition, and regional characteristics, were chosen, excluding those that underwent significant currency devaluation during the study period. This ensures a credible comparison between Bangladesh and its synthetic control, reinforcing causal interpretations.

✓ *Step 2: Assigning Weights to Control Units*

SCM allocates weights to control units based on their alignment with Bangladesh's pre-intervention characteristics. Control units that somewhat matched Bangladesh's economic profile received higher weights. For example, countries like India and South Africa were significant contributors due to their comparable economic traits. The weighted average of these units forms the synthetic Bangladesh, reflecting pre-devaluation conditions with high accuracy. Table 13 illustrates the assigned weights of control units used in the construction of the synthetic control model, highlighting that South Africa carries the highest weight (0.64), indicating its significant contribution to the synthetic unit, while countries like Indonesia, Pakistan, Ghana, Morocco, and Thailand have minimal weights of 0.02 each.

Table 13 Weight of control units

Country name	South Africa	Indonesia	Pakistan	Ghana	Morocco	Thailand
w.weight	0.64	0.02	0.02	0.02	0.02	0.02

✓ *Step 3: Constructing the Synthetic Path*

The synthetic path aggregates weighted data from selected control units to create a counterfactual trajectory for Bangladesh's export performance without devaluation.

Table 14 Treated Unit (Bangladesh) and Synthetic Control Unit

Variable	Treated	Synthetic	Sample Mean
d_devaluation	-0.18	-0.18	-1.88

This path, represented in Fig 3, allows for comparison between actual export outcomes and the synthetic estimate, highlighting deviations that can be attributed to the devaluation intervention and Table 14 compares the treated unit (Bangladesh) with the synthetic control unit, showing

that both have the same devaluation value of -0.18, while the sample mean for devaluation is -1.18 where first order differentiated value of both export value and devaluation were used, indicating the alignment between the treated and synthetic units in the analysis.

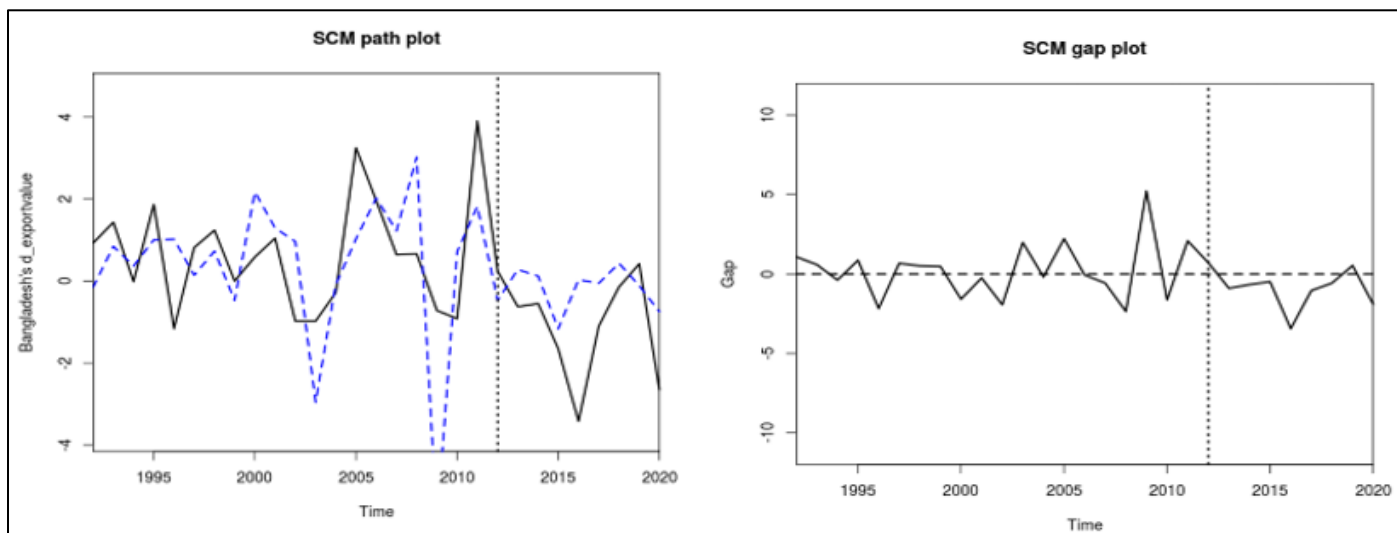


Fig 3 Synthetic Control Path and Gap Plot of Bangladesh

✓ *Step 4: Estimating Treatment Effects (Path and Gap Analysis)*

The treatment effect is measured as the gap analysis²¹ of difference between actual and synthetic export performance post-devaluation. A widening or narrowing of the gap provides insights into whether devaluation positively or negatively impacted exports. This step confirms whether observed changes are due to devaluation or other external influences, providing a detailed analysis of both immediate and long-term impacts.

✓ *Step 5: Conducting Placebo Tests and Bootstrapping*

Placebo tests were applied to control units to verify the specificity of the treatment effect observed in Bangladesh. These tests ensure that the gap is unique and not a random

occurrence. Bootstrapping added statistical rigor by generating confidence intervals that account for variability, reinforcing the reliability of the SCM results. Table 14 presents the model output along with bootstrap intervals, detailing variable gaps and their statistical significance, where p-values and confidence intervals indicate the reliability of the pre- and post-intervention differences in export performance. The combination of these methods strengthens causal claims by demonstrating consistency in treatment effects. Figure 3.2: displays the results of the synthetic control placebo test and bootstrapping for Bangladesh, showcasing the comparative gaps in export value to validate the robustness of the treatment effect of devaluation against random variations in control units.

Table 14 Model Output and Bootstrap Interval Model Output

Variable	Value	P_value	Bootstrap_interval
gap_pre_3	1.89	0.13	[-0.055 , 2.07]
gap_pre_1	2.08	0.17	[-0.072 , 2.566]
gap_post_1	-0.9	0.48	[-1.275 , 1.418]
gap_post_3	-0.69	0.57	[-1.339 , -0.225]
gap_last_1	-1.9	0.74	[-2.312 , 4.007]
gap_pre_all	0.23	0.3	[-0.739 , 0.289]
gap_post_all	-1.06	0.87	[-1.731 , 0.608]

✓ *Step 6: Diagnostic and Robustness Tests (MSPE and Ratio-MSPE)*

Diagnostic tools such as mean squared prediction error²² (MSPE) were used to evaluate the fit of the synthetic model before devaluation. A low MSPE indicates an effective match

between Bangladesh and the synthetic counterpart. The ratio of post- to pre-intervention MSPEs (ratio MSPE²³) helps identify outliers, ensuring robustness in the analysis and validating the model's credibility.

²¹ A gap analysis can help to evaluate the effectiveness and efficiency of SCM processes and identify areas for improvement and innovation. A gap analysis is a systematic method of comparing a current state with a desired state and identifying the differences or gaps between them.

²² Mean squared error (MSE) is a measure of the error in prediction algorithms. This statistic quantifies the average

squared variance between observed and predicted values. When there are no errors in a model, the MSE equals 0. A model's worth increases in proportion to the degree of error it contains.

²³ Post/pre-treatment mean square prediction error ratio is the difference between the observed outcome of a unit and its synthetic control before and after treatment.

Table 15 Model Diagnosis for the Treated Unit

Reliability of SCM	Should re-Cluster	Should be excluded following unit(s) due to pre-MSPE	Should be excluded following unit(s) due to ratio -MSPE
Yes	No	Indonesia	India

Table 15 provides the model diagnosis for the treated unit, assessing the reliability of the Synthetic Control Method (SCM), with notes on re-clustering needs and exclusions based on pre- and ratio-MSPE criteria, identifying Indonesia and India as units to be excluded. This table suggests adjustments for optimization. The table highlights that re-clustering is not required, but it does recommend excluding Indonesia and India based on the pre-MSPE and ratio-MSPE criteria. While these exclusions do not inherently undermine the reliability of the model, they offer an opportunity for

improved model optimization by refining the selection of comparator units. This approach helps enhance the precision of the SCM analysis, ensuring more accurate and robust results.

✓ *Step 7: Non-Parametric and Parametric Estimation Techniques*

To supplement SCM findings, non-parametric and parametric estimation techniques were used.

Table 16 Non-Parametric and Parametric Estimation

	Non parametric			Parametric		
	2.50%	mean	97.50%	2.50%	mean	97.50%
2013	-1.2977	0.1812	4.6164	-1.2925	0.0452	3.5125
2014	-1.976	-0.7982	0.0072	-1.3925	-0.7858	0
2015	-4.4854	-1.463	-0.1612	-2.2875	-1.2565	0
2016	-5.0266	-3.6481	-1.8773	-2.2875	-1.3377	0
2017	-2.4741	-1.3779	-0.8606	-2.2875	-1.3274	0.1925
2018	-1.525	-0.6216	1.3156	-2.2875	-1.1852	1.745
2019	-0.9779	0.7998	4.7629	-2.2875	-0.9919	3.94
2020	-2.4304	-1.2334	4.4638	-2.2875	-0.8842	5.08

Non-parametric methods offer flexibility by not assuming a specific functional form, capturing more nuanced changes over time. Parametric techniques, assuming linear relationships, provided additional verification. Table 16 compares non-parametric and parametric estimation results for years 2013 to 2020, presenting the 2.5%, mean, and 97.5% percentiles for each method, showing consistent ranges and highlighting variations in estimation accuracy over time. This approach allowed for a comprehensive assessment across

macroeconomic, sectoral, and product-level angles, revealing broader economic interactions that influenced export performance beyond devaluation alone. Fig 4 presents the non-parametric and parametric estimation results for Bangladesh's synthetic control model, illustrating the treatment effect of devaluation on export performance and highlighting deviations between actual and synthetic outcomes over the analyzed period.

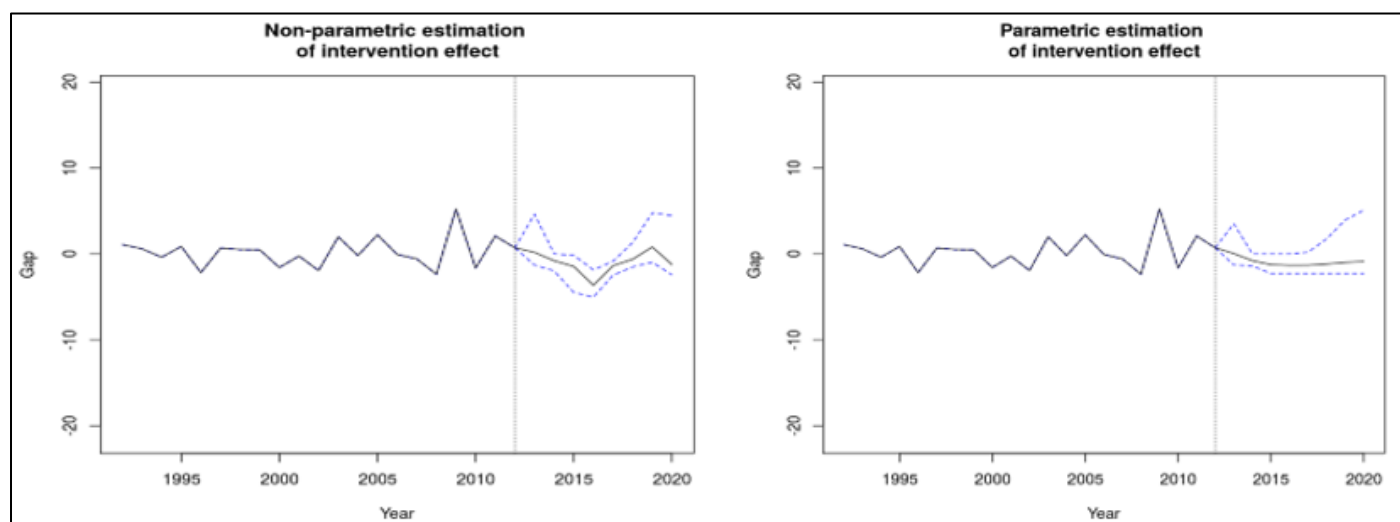


Fig 3 Non-parametric and parametric Estimation of Bangladesh

These steps, spanning 30 years of data and incorporating comparisons with 23 global South countries, provide an exhaustive examination of devaluation's impact on Bangladesh. The SCM framework, supported by OLS regression and contextualized by two theoretical ideologies of currency—as a medium of exchange and as an asset—enables a nuanced understanding of how devaluation intersects with 14 macroeconomic variables to shape export outcomes.

• *Basic Equations for Calculations*

The Synthetic Control Method (SCM) employs a structured approach that uses mathematical formulations to construct a synthetic control group that serves as a counterfactual for a treated unit experiencing an intervention. For analyzing Bangladesh's currency devaluation, SCM creates a synthetic Bangladesh by combining control units that did not face similar devaluation, thereby estimating what its export performance would have been without the devaluation event. The synthetic outcome at time t, denoted as Y_{1t}^{SC} , is formed by weighted outcomes from control units Y_{jt} , with weights w_j being non-negative and summing to 1:

$$\hat{Y}_{1t}^{SC} = \sum_{j=2}^{J+1} w_j Y_{jt}$$

Where:

- \hat{Y}_{1t}^{SC} is the synthetic control's outcome at time t,
- Y_{jt} is the outcome of control unit j at time t,
- w_j are non-negative weights such that $\sum_{j=2}^{J+1} w_j = 1$.

The causal impact of devaluation is determined by comparing the actual observed outcome Y_{1t} for Bangladesh to \hat{Y}_{1t}^{SC} . The treatment effect at time t (α_t) is calculated as:

$$\alpha_t = Y_{1t} - \hat{Y}_{1t}^{SC}$$

The weights $w = (w_1, w_2, \dots, w_j)$ are selected through optimization to minimize the difference between pre-devaluation characteristics of Bangladesh (X_1) and those of the synthetic control (X_0W^*). This ensures that the pre-treatment conditions are accurately mirrored, making the synthetic control a valid comparison. The optimization satisfies:

$$X_1 = X_0W^*$$

The pre- and post-intervention gaps help assess the intervention's impact. The pre-intervention gap (Gap^{Pre}) reflects differences before devaluation, establishing a baseline. The post-intervention gap (Gap^{Post}) shows the divergence in export performance due to devaluation. Mean Squared Prediction Error (MSPE) quantifies how closely the synthetic control matches the treated unit before intervention. A low MSPE signals a good fit, while a high ratio-MSPE between post- and pre-intervention errors flags potential outliers in the donor pool.

To further validate SCM results, bootstrap replications²⁴ are conducted by resampling the control pool to estimate variability and confidence intervals. Non-parametric estimation techniques²⁵ provides an additional analysis that does not rely on predefined assumptions, capturing the post-2012 widening of the gap and revealing devaluation's sustained negative impact on export performance. Bias correction techniques refine the gap estimates, reducing potential inaccuracies.

Sector-specific analysis adapts this approach for individual export sectors like Ready-Made Garments (RMG) and pharmaceuticals, shedding light on unique responses to devaluation. By applying bias corrections, the analysis ensures more reliable treatment effects across sectors, offering nuanced insights into how devaluation influences each segment within Bangladesh's export landscape.

IV. EMPIRICAL ANALYSIS

A. Regression Analysis

The regression analysis presented in Table 22 and Table 17 illustrates the relationship between currency devaluation and export performance in Bangladesh, influenced by various macroeconomic and trade-related factors. In Model 1, devaluation's coefficient is 0.0053 and statistically significant, indicating a small but meaningful impact on exports when considered independently. In Model 2, which incorporates 14 additional variables, the coefficient for devaluation increases to 0.0781, maintaining a statistically significant relationship ($p < 0.01$), suggesting that devaluation continues to play a notable role even when broader economic conditions are accounted for.

Table 17 Export Value and Devaluation plus 14 variables (Coefficients)

exportvalueofgdp	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
devaluation	0.0780833	0.0175727	4.44	0	0.0429779	0.1131887
lendinginterestrate	0.644087	0.138258	4.66	0	0.3678849	0.9202892
inflationcpi	0.1005943	0.0849973	1.18	0.241	-0.0692074	0.270396
foreigndirectinvestmentnetinflow	-0.0505943	0.1905719	-0.27	0.791	-0.4313055	0.3301169
governmentexpenditureofgdp	0.6362186	0.2059308	3.09	0.003	0.2248245	1.047613

²⁴ Bootstrap Replications involve resampling the gaps to generate variability estimates.

²⁵ Parametric statistics are based on assumptions about the distribution of the population from which the sample was

taken. Nonparametric statistics are not based on assumptions; that is, the data can be collected from a sample that does not follow a specific distribution.

finalgovernmentconsumptionexpend	-0.3937499	0.1350328	-2.92	0.005	-0.6635088	-0.1239909
exportvalueindex2015100	0.1303643	0.0456905	2.85	0.006	0.0390871	0.2216415
exportvolumeindex2015100	0.0349247	0.045153	0.77	0.442	-0.0552788	0.1251283
importvalueindex2015100	-0.0374624	0.0444581	-0.84	0.403	-0.1262778	0.0513529
importvolumeindex2015100	0.0569874	0.0554067	1.03	0.308	-0.0537003	0.1676751
broadmoneyofgdp	0.0126171	0.0635923	0.2	0.843	-0.1144232	0.1396574
gdppercapitagrowthannual	0.0431052	0.0927668	0.46	0.644	-0.1422178	0.2284282
subsidiesandothertransfersofgdp	-0.0523765	0.0592177	-0.88	0.38	-0.1706774	0.0659245
techvalueaddedmanufacturingvalue	0.0629497	0.0508956	1.24	0.221	-0.038726	0.1646254
bartertermsoftradeindex2015100	-0.0045633	0.0284819	-0.16	0.873	-0.0614624	0.0523358
_cons	-0.8191629	0.2183663	-3.75	0	-1.2554	-0.3829262

Lending interest rates (coefficient: 0.6441, $p < 0.01$) emerge as a significant positive contributor, reflecting the importance of favorable financial conditions in supporting export growth. Similarly, government expenditure (0.6362, $p < 0.01$) demonstrates a strong positive effect, emphasizing the critical role of targeted public spending. The export value index (0.1304, $p < 0.01$) also contributes positively, highlighting the significance of value-added growth in export performance.

Conversely, final government consumption expenditure (-0.3937, $p < 0.01$) exerts a significant negative impact, underscoring inefficiencies in public spending that may hinder export performance. Foreign direct investment (-0.0506, $p > 0.05$) shows a weak negative relationship, indicating limited effectiveness in stimulating exports under current conditions. The import value index (-0.0375, $p > 0.05$) and subsidies (-0.0524, $p > 0.05$) also demonstrate negative but statistically insignificant effects, reflecting persistent structural challenges.

Broad money (0.0126, $p > 0.05$) and GDP per capita growth (0.0431, $p > 0.05$) show modest positive coefficients, but their lack of statistical significance suggests limited direct influence on export outcomes. Similarly, variables such as tech value added (0.0629, $p > 0.05$) and the barter terms of trade index (-0.0046, $p > 0.05$) exhibit weak contributions, highlighting the need for enhanced technological integration and trade negotiations.

These findings underscore that while devaluation has a meaningful role, its impact is significantly shaped by broader macroeconomic and structural variables. Effective export strategies must focus on reducing inefficiencies in public spending, enhancing financial conditions, and fostering value-added production. Integrating devaluation within a broader framework of fiscal, trade, and investment policies is crucial for achieving sustainable export growth in Bangladesh.

➤ *Macroeconomic Comparison of Devaluation Impact Across Models*

The comparative analysis of Model 1 and Model 2 demonstrates significant differences in the influence of currency devaluation on export performance, shaped by

model complexity and the inclusion of additional macroeconomic variables. In Model 1, where devaluation is analyzed as the sole explanatory variable, the coefficient is 0.00526 and statistically significant, indicating a small but positive effect on export value. This suggests that, in isolation, currency devaluation may contribute to enhancing exports.

In Model 2, which integrates 14 additional economic and trade-related variables, the coefficient for devaluation rises to 0.07808 and remains statistically significant ($p < 0.01$). This indicates that devaluation retains its positive association with export performance even in the presence of broader macroeconomic variables. Factors like lending interest rates (0.6441, $p < 0.01$) and government expenditure (0.6362, $p < 0.01$) emerge as strong positive contributors to export growth, underscoring the importance of financial stability and targeted public investment. The export value index (0.1304, $p < 0.01$) further highlights the role of value-added production in driving export outcomes.

Conversely, variables such as final government consumption expenditure (-0.3937, $p < 0.01$) exhibit a significant negative impact, suggesting inefficiencies in public spending that may offset the benefits of devaluation. Inflation (0.1006, $p > 0.05$) and foreign direct investment (-0.0506, $p > 0.05$) show limited statistical significance, indicating that their effects on exports may be context-dependent. The import value index (-0.0375, $p > 0.05$) and subsidies (-0.0524, $p > 0.05$) reflect ongoing structural challenges, highlighting the need for policy adjustments to mitigate their adverse effects.

These findings reveal that while devaluation plays a notable role in export performance, its impact is mediated by a range of macroeconomic variables. The transition from a simple model to a more comprehensive one underscores the complexity of the relationship between devaluation and exports. Factors such as trade balance, public spending, and financial conditions interact with devaluation in ways that shape export outcomes.

The analysis reinforces the necessity of a multifaceted policy approach. Relying solely on devaluation as a policy tool is insufficient to achieve sustained export growth.

Instead, integrating devaluation with structural reforms, efficient public expenditure, and measures to enhance trade competitiveness is crucial. These results underscore the importance of aligning fiscal, monetary, and trade policies to optimize the benefits of currency devaluation within the broader economic context.

Using Model 1, The Fig 4 collectively illustrate the analysis of trends and model predictions across countries and over time. The top-left figure (Entity Demean Fixed Effect Regression) predicted export values by country remain

largely consistent, indicating stability in model predictions regardless (The top-right figure (n-1 Binary Regression)) of country-specific characteristics. The bottom-left figure (T-1 Binary Regression) suggests, over time, the model reveals fluctuations in predicted export values, highlighting variability due to macroeconomic factors. The bottom-right figure presents, the combined regression results demonstrating a close alignment between observed and fitted export values, suggesting the model's reliability in capturing export trends with minimal discrepancies.



Fig 4 "Regression Results with First Order Difference: Entity Demean, n-1 Binary, T-1 Binary and Combined (n-1) Country and (T-1) Year Dummies Indicating Relative Influence on Export Values"

The Fig 5 displays the estimated coefficients from the regression model incorporating both country-specific and year-specific dummy variables.

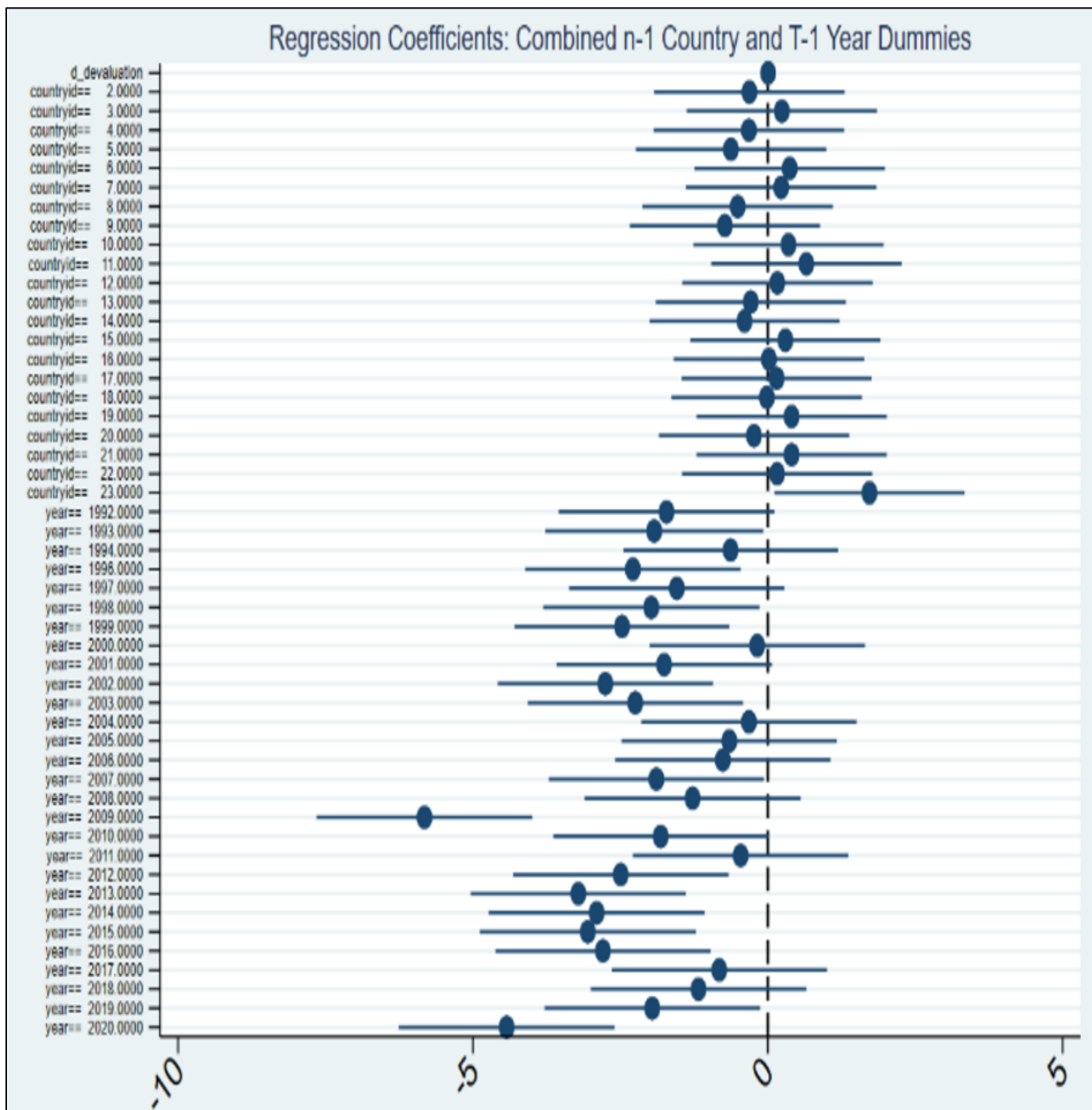


Fig 5 "Regression Coefficients Overview: Combined (n-1) Country and (T-1) Year Dummies with 95% Confidence Intervals Indicating Relative Influence on Export Values"

The points represent the estimated coefficients for each country and year, while the horizontal lines illustrate the 95% confidence intervals for these estimates. The dashed vertical line at zero helps to distinguish positive and negative coefficients, indicating the relative influence of each country and year on the dependent variable (export value). Coefficients to the right of this line suggest a positive association, while those to the left imply a negative association.

The plot in Fig 6 illustrates the residuals from a regression model over time, spanning from 1991 to 2020.

Each point represents the residual for 1991 to 2020, showing how the model's predictions compare to actual observations. Residuals are scattered around the zero line, indicating the difference between observed and predicted values. The spread of residuals appears fairly consistent across the years, without major trends of increasing or decreasing variance, which suggests homoscedasticity and no clear pattern of autocorrelation over time. The plot's concentration of points around zero implies that the model's predictions are generally accurate, though some variability exists.

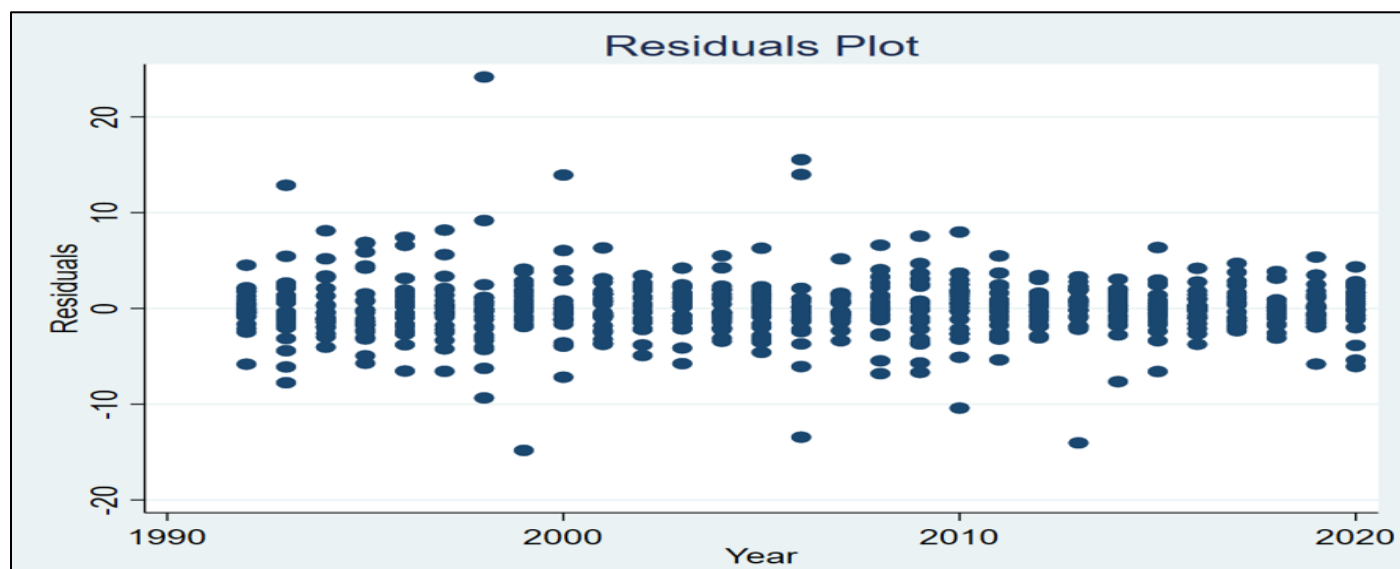


Fig 6 "Residuals Plot (1990–2020): Assessing Model Prediction Accuracy Over Time"

➤ Sectoral Analysis

The regression analysis presented in Model 1 and Model 2 provides insights into the relationship between currency devaluation and export performance across four major sectors in Bangladesh: Ready-Made-Garments (RMG), Pharmaceuticals, Leather, and Jute. In Model 1, which analyzes devaluation without considering broader macroeconomic factors, the coefficients reveal varying sector-specific impacts.

In Model 1, the coefficient for Garments is 0.0008503, indicating a small but positive effect of devaluation on the export value of this sector. This suggests that devaluation may have a modest beneficial effect on garment exports, although the magnitude of this effect is limited. On the other hand, Pharmaceuticals shows a slight negative coefficient of -0.0000958, indicating a negligible negative impact, which could be attributed to the sector's challenges related to import dependency and high regulatory standards. Leather also exhibits a negative coefficient of -0.0008272, suggesting that the sector faces difficulties that hinder its ability to benefit from devaluation. Similarly, Jute shows a larger negative coefficient of -0.0037853, indicating a significant decline in export performance, possibly due to the sector's limited value addition and competition in global markets.

In Model 2, which includes 14 additional macroeconomic variables, the picture becomes more complex. For Garments, the coefficient increases to 0.0033479, indicating a moderate positive effect of devaluation when other economic conditions are taken into account. However, this effect is still relatively modest, suggesting that while devaluation may help in favorable conditions, other factors like domestic policies and trade conditions play a significant role. Pharmaceuticals shows a positive coefficient of 0.0015487, suggesting that with the right economic environment, this sector may experience slight improvements in exports despite earlier challenges in Model 1. Leather also shows a small positive coefficient of 0.0017597, indicating a marginal improvement in export performance when broader macroeconomic factors are

considered. Jute, however, still exhibits a negative coefficient of -0.0004215, showing that the sector continues to struggle in a devaluation context, likely due to its challenges in value addition and competition on the global stage.

These results highlight the complexity of the relationship between currency devaluation and export performance. In Model 1, where devaluation is considered in isolation, Garments exhibit a small positive response, while Pharmaceuticals, Leather, and Jute face negative impacts. In Model 2, with the inclusion of broader macroeconomic variables, the effects of devaluation become more nuanced. While Garments, Pharmaceuticals, and Leather show slight positive coefficients, Jute continues to face significant challenges.

While devaluation may have some positive effects on Bangladesh's export sectors, the results emphasize the need for a more integrated approach. Devaluation alone is not sufficient to drive sustained export growth. Policies addressing the underlying structural issues, such as enhancing value addition, reducing import reliance, and improving sectoral competitiveness, will be crucial to fully harness the potential benefits of currency devaluation.

The sectoral analysis of standard decomposed regression models—including First Order Difference, Entity Demean Fixed Effect, n-1 Binary, T-1 Binary, and combined n-1 and T-1 Binary Regression—provides a detailed evaluation of how devaluation impacts Bangladesh's primary export sectors: garments, pharmaceuticals, leather, and jute. Across these analyses, it becomes evident that currency devaluation alone does not substantially drive export growth. The garments sector shows minor sensitivity to devaluation, with increased input costs offsetting any competitive gains. The pharmaceuticals and leather sectors reflect minimal or insignificant responses, indicating that non-price factors such as regulatory compliance, supply chain stability, and production efficiency play more significant roles. The jute sector, despite showing some vulnerability to devaluation, demonstrates a limited negative impact overall, underscoring

that sector-specific challenges outweigh currency effects. The consistent significance of year dummy variables in most models points to overarching structural and market-driven growth factors rather than devaluation as key drivers of export performance. These results underscore the finding that while devaluation might offer short-term relief, achieving sustained export growth demands targeted, sector-specific strategies focused on quality improvement, market diversification, and managing input costs.

• *Analysis of First Order Difference Regression*

The analysis of the first-order difference regression using a sectoral dataset evaluates the impact of currency devaluation on export values across Bangladesh’s four key export sectors: garments, pharmaceuticals, leather, and jute. The findings highlight varied sectoral responses, emphasizing the need for tailored strategies to maximize export performance.

In the garments sector, the coefficient for the first-order difference in devaluation ($d_Devaluation$) is positive but statistically insignificant. This indicates that while there may be a minor positive relationship between devaluation and export value changes, the effect is neither consistent nor robust. The garments sector’s limited sensitivity to devaluation may result from its well-established global markets and competitive cost structure, which help cushion against exchange rate volatility. However, the reliance on imported raw materials, such as fabric and accessories, likely offsets any competitive advantage gained from devaluation, diluting its overall impact.

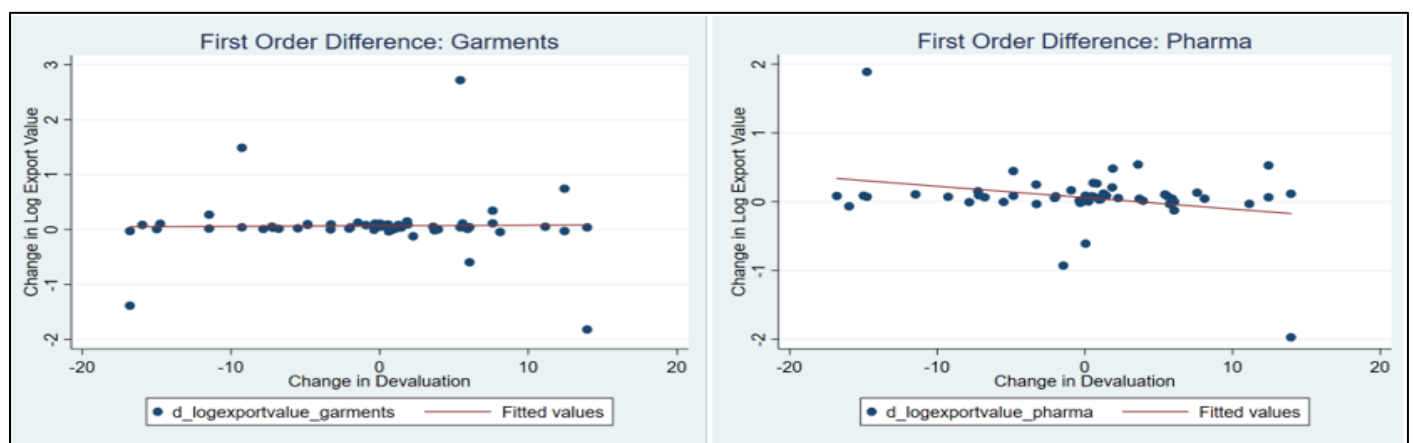
The pharmaceuticals sector demonstrates a negative, though statistically insignificant, coefficient for $d_Devaluation$. This suggests that devaluation does not meaningfully influence export value changes in this sector. Pharmaceuticals exports are heavily reliant on stable supply chains, adherence to stringent regulatory requirements, and international quality standards, which are less influenced by price fluctuations driven by currency devaluation. As such, this sector would benefit more from strategies focusing on market diversification, innovation, and regulatory compliance than from relying on devaluation as a competitiveness tool.

The leather sector also shows a negative and statistically insignificant coefficient for $d_Devaluation$, indicating negligible sensitivity to currency devaluation. The limited response can be attributed to the sector’s reliance on imported chemicals and processing materials, as well as intense competition from other global exporters. These factors suggest that improvements in supply chain efficiency, branding, and value addition are more effective for driving growth in leather exports than devaluation alone.

The jute sector stands out with a negative and statistically significant coefficient for $d_Devaluation$, highlighting a clear adverse impact of currency devaluation on export values. The sector’s vulnerability may stem from its reliance on imported inputs and limited global demand, which amplify the challenges posed by devaluation. This suggests that jute exports would benefit from policies focused on stabilizing currency, reducing input costs, and enhancing value addition to improve competitiveness in international markets.

The findings underscore significant variations in how different sectors respond to currency devaluation. While the jute sector appears adversely affected, the garments, pharmaceuticals, and leather sectors exhibit minimal or negligible sensitivity to devaluation. Import dependencies in garments, leather, and pharmaceuticals reduce the net benefits of devaluation, emphasizing the need for supply chain improvements and cost management. For sectors like garments and pharmaceuticals, strategies aimed at enhancing product quality, diversifying export markets, and fostering trade agreements are likely to yield more substantial results. In contrast, the jute sector requires targeted support to stabilize production costs and increase its value-added output.

These findings suggests that devaluation alone is insufficient to address the multifaceted challenges of Bangladesh’s export sectors. A nuanced, sector-specific approach that combines macroeconomic stability with structural reforms is essential to achieve sustained and inclusive export growth. Fig 7 presents a scatter plot illustrating the first-order difference regression trends of currency devaluation on export performance. The plot highlights a stable trend for the garments sector, a slight negative trend for pharmaceuticals and jute, and minimal variation observed in the leather sector.



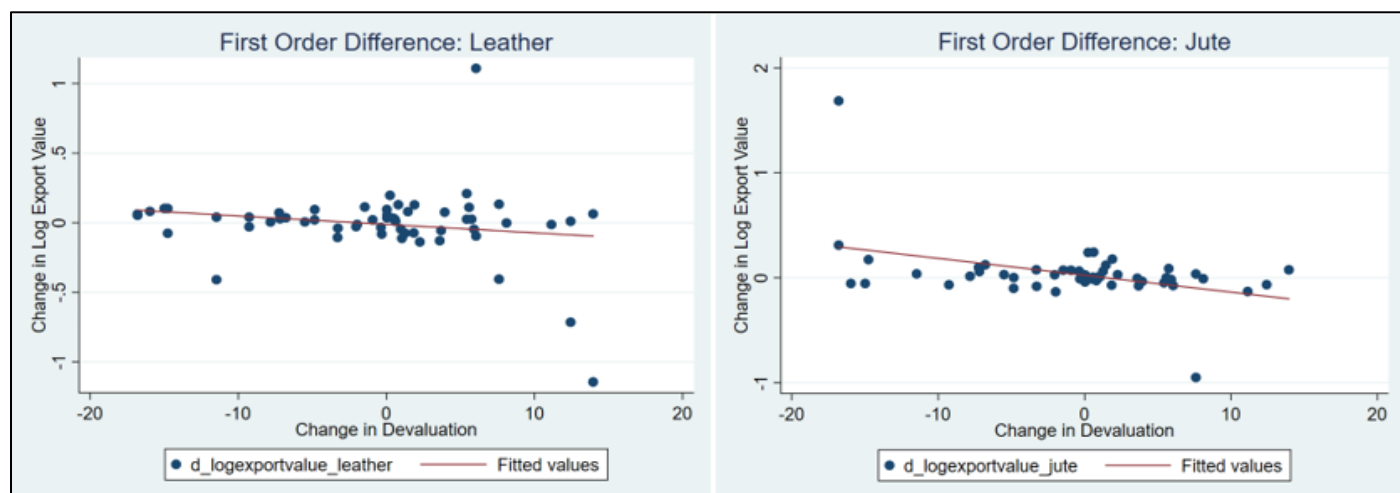


Fig 7 Scatter Plot for First-Order Difference Regression Trends of Currency Devaluation on Export Performance – Stable Trend in Garments, Slight Negative Trend in Pharma and Jute, and Minimal Variation in Leather

- *Analysis of Entity Demeaned Fixed Effect Regression*

The Entity Demeaned Fixed Effect Regression provides a nuanced analysis of the impact of devaluation on export performance across Bangladesh's key export sectors: garments, pharmaceuticals, leather, and jute. The results demonstrate significant variations in sectoral sensitivity, emphasizing the importance of targeted policy interventions rather than a one-size-fits-all approach to leveraging devaluation for export growth.

In the garments sector, the coefficient for devaluation is -0.0207 with a marginal p-value of 0.078 , indicating a slight negative effect that is not statistically significant at conventional levels. This outcome suggests that while devaluation may offer competitive pricing advantages, these gains are often offset by increased costs of imported raw materials such as fabrics and accessories. As such, the garments sector appears less likely to benefit directly from devaluation without supplementary measures, such as cost management incentives or subsidies, to mitigate the adverse effects of higher input costs.

The pharmaceuticals sector exhibits a coefficient of -0.0242 with a p-value of 0.134 , reflecting a small, negative, and statistically insignificant relationship between devaluation and export performance. This limited sensitivity underscores the sector's reliance on factors beyond currency fluctuations, including regulatory compliance, quality standards, and established supply chains. Given this, strategies to enhance pharmaceutical exports should focus on innovation, adherence to international standards, and diversification into new markets rather than currency devaluation as a core policy tool.

In the leather sector, the coefficient is -0.0080 with a p-value of 0.194 , indicating a minimal and statistically insignificant negative effect of devaluation on exports. This weak response may result from the sector's mixed cost structures, which include significant import dependencies for processing materials, and competitive pressures in international markets. To bolster leather exports, policymakers should prioritize improving value chain

efficiencies, branding, and market access over relying solely on devaluation.

The jute sector presents a notable exception, with a coefficient of -0.0156 and a statistically significant p-value of 0.029 . This indicates that devaluation has a measurable adverse impact on jute exports, likely due to increased production costs or diminished price competitiveness in global markets. For this sector, policies emphasizing currency stability, reducing reliance on imported inputs, and improving productivity through technological upgrades and skill development could help mitigate the negative effects of devaluation.

When year fixed effects are introduced, the analysis reveals that broader global factors also influence export performance, particularly in the pharmaceuticals and jute sectors. These findings suggest that international market dynamics, beyond domestic currency policy, play a critical role in shaping export outcomes.

The sectoral analysis highlights the varied and often limited effectiveness of devaluation as a standalone tool for enhancing export performance. While the jute sector demonstrates clear vulnerability to devaluation, the garments, pharmaceuticals, and leather sectors show minimal sensitivity, reflecting the interplay of cost structures, external dependencies, and market conditions. These insights reinforce the point that tailored, sector-specific strategies—focused on addressing structural challenges, enhancing competitiveness, and stabilizing production costs—are necessary for fostering sustainable export growth in Bangladesh amidst currency fluctuations. Figure 4.5 illustrates the impact of devaluation on predicted export values across various sectors, revealing a consistent decline in the garments sector, the steepest drop in pharmaceuticals, and moderate declines in both leather and jute.

- *Analysis of n-1 Binary Regression*

The n-1 Binary Regression provides a detailed analysis of how devaluation impacts export performance across Bangladesh's garments, pharmaceuticals, leather, and jute

sectors, incorporating country-specific fixed effects to account for variations in national economic conditions. The findings highlight the diverse and nuanced ways in which currency devaluation interacts with sectoral dynamics, underscoring the need for targeted strategies tailored to the characteristics of each industry.

In the garments sector, the coefficient for devaluation is -0.0207 with a p-value of 0.078, indicating a negative but marginally insignificant effect on export values. This suggests that devaluation may have a limited adverse impact on garments exports, likely due to increased costs of imported inputs such as fabrics and accessories that negate any competitive pricing advantage. The significant country dummy variables, particularly for country_dummy3 (Bhutan), indicate notable cross-country variations in export performance, reflecting differences in economic structures and industry capabilities. These findings imply that garments exports may not benefit substantially from devaluation alone. Policymakers should consider measures to lower input costs and promote domestic production of raw materials to enhance export competitiveness.

In the pharmaceuticals sector, the coefficient for devaluation is -0.0242 with a p-value of 0.134, indicating a small and statistically insignificant negative effect. This outcome reflects the sector's reliance on non-price factors such as regulatory compliance, quality standards, and supply chain stability, which devaluation does not directly influence. Significant country dummy variables for country_dummy2 (India) and country_dummy3 (Bhutan) further emphasize the importance of country-specific factors in shaping pharmaceutical export outcomes. Strategies for this sector should prioritize improving quality, enhancing regulatory frameworks, and diversifying markets over relying on devaluation as a competitiveness tool.

The leather sector shows a statistically insignificant relationship between devaluation and export values, with a coefficient of -0.0080 and a p-value of 0.194. This weak and negative association suggests that devaluation has a minimal impact on leather exports, pointing to the importance of factors such as value chain efficiency, quality standards, and market dynamics. The significance of country dummy variables indicates substantial cross-country differences in leather export performance, potentially driven by variations in production practices and infrastructure. Policies for leather exports should focus on technological advancements, branding, and market access rather than currency adjustments.

The jute sector stands out with a statistically significant negative coefficient of -0.0156 and a p-value of 0.029, indicating that devaluation adversely affects export values. This finding suggests that higher input costs and competitive pressures outweigh any benefits derived from a weaker currency in the jute industry. The influence of significant country-specific fixed effects underscores the role of national economic contexts, with some countries experiencing more pronounced challenges due to import dependencies or market competition. For the jute sector, currency stability, reduction

in input costs, and diversification of export markets could mitigate the adverse effects of devaluation and sustain growth.

The n-1 Binary Regression underscores that the impact of devaluation on export performance varies significantly across sectors. While garments, pharmaceuticals, and leather show limited responsiveness to currency fluctuations, the jute sector exhibits a clear negative response. These results emphasize that a uniform devaluation policy is insufficient to address the diverse needs of Bangladesh's export sectors. Instead, targeted approaches that address sector-specific challenges, such as input cost management, quality enhancement, and market diversification, are necessary to optimize the benefits of devaluation and strengthen overall export performance.

• Analysis of T-1 Binary Regression

The T-1 Binary Regression analysis examines the relationship between currency devaluation and export values across the garments, pharmaceuticals, leather, and jute sectors, incorporating year-specific effects to account for temporal changes in export performance. In the garments sector, the devaluation coefficient is positive (0.0055) but statistically insignificant ($p = 0.288$), indicating that currency devaluation does not have a substantial direct impact on export performance. However, the significant positive coefficients for later year dummies suggest that garments exports have grown over time, likely due to structural improvements or increased global demand rather than the effects of devaluation alone.

In the pharmaceuticals sector, the coefficient for devaluation is also positive (0.0152) but statistically insignificant ($p = 0.184$), further emphasizing the limited role of currency fluctuations in driving export growth. The significant positive year effects suggest a steady upward trend in pharmaceutical export values, likely driven by factors such as advancements in production quality, regulatory compliance, and expanded market access, which are not directly tied to currency devaluation. This highlights the importance of non-price factors in shaping the performance of the pharmaceuticals sector.

The leather sector similarly shows a positive but statistically insignificant devaluation coefficient (0.0028, $p = 0.632$), indicating a minimal impact of currency devaluation on export performance. Significant positive year dummy coefficients point to an overall growth trend in leather exports over time, likely resulting from structural and market-related improvements rather than currency adjustments. This underscores the potential effectiveness of policies aimed at improving product quality, branding, and technological advancements in driving export growth for leather products.

In the jute sector, the devaluation coefficient is negative (-0.0047) but statistically insignificant ($p = 0.426$), suggesting that currency devaluation has a weak and unreliable relationship with export performance. Similar to the other sectors, the positive year effects highlight a consistent upward trend in export values over time, driven by

factors such as improved production techniques and favorable global market conditions. The findings indicate that currency stability, combined with sector-specific strategies, may be more effective in sustaining jute export growth.

The T-1 Binary Regression analysis reveals that devaluation has no significant direct impact on export performance across any of the four sectors. Instead, the significant positive year dummies point to broader structural and market-based factors driving export growth. These results suggest that policies focused on enhancing competitiveness, improving quality standards, and expanding market access are likely to yield greater benefits than reliance on devaluation as a tool for boosting exports. By addressing the unique challenges and opportunities within each sector, policymakers can better support long-term, sustainable export growth across Bangladesh's key industries.

- *Analysis of Combined n-1 Binary . T-1 Binary Regression*

The combined n-1 and T-1 Binary Regression analysis, accounting for both country-specific and year-specific effects, offers nuanced insights into the effects of devaluation on export performance across four key sectors: garments, pharmaceuticals, leather, and jute. In the garments sector, the coefficient for devaluation is positive (0.0055) but statistically insignificant ($p = 0.790$), indicating that currency devaluation does not have a meaningful impact on garments exports. However, several year dummy coefficients for later years are positive and statistically significant, suggesting a consistent upward trend in export values over time. This growth is likely attributable to factors such as increased global demand or sectoral improvements, rather than currency fluctuations.

In the pharmaceuticals sector, the devaluation coefficient is positive (0.0152) but also statistically insignificant ($p = 0.520$), reflecting a negligible direct effect of currency devaluation on export performance. As with garments, positive and significant year dummy coefficients for recent years suggest steady growth in pharmaceutical exports, likely driven by advancements in production capabilities, compliance with international standards, and improved access to global markets. These findings highlight the sector's reliance on factors other than devaluation for sustained growth.

The leather sector exhibits a positive but statistically insignificant devaluation coefficient (0.0028; $p = 0.814$), indicating minimal direct impact of devaluation on export performance. Positive and significant year dummy coefficients for certain years point to an increase in export values over time, likely due to structural improvements in production processes, adoption of advanced technologies, and stronger trade relationships. This underscores the need for policies focusing on enhancing production efficiency and product quality, rather than relying solely on currency adjustments to drive export growth.

The jute sector displays a negative devaluation coefficient (-0.0047) with a p-value of 0.588, suggesting that devaluation does not significantly influence export values in

this sector. However, positive and statistically significant year dummy coefficients indicate a general upward trend in jute exports, likely due to sustained global demand and improved production techniques. This trend underscores the sector's resilience and highlights the limited effectiveness of devaluation as a strategy for boosting jute exports.

The combined regression results reveal that devaluation does not significantly impact export values in any of the four sectors studied. Instead, the consistent and significant positive year dummy coefficients across sectors suggest that export growth is more strongly associated with sector-specific advancements, such as production efficiency, technological innovation, and market expansion, as well as external market factors. These findings emphasize the importance of tailored sectoral policies that focus on enhancing competitiveness, quality, and market access, rather than relying on devaluation as a one-size-fits-all solution for export promotion.

- *Product Level Analysis*

The regression results from Models 1 and 2 offer a comprehensive understanding of how currency devaluation impacts Bangladesh's primary export products—ready-made-garments (RMG), pharmaceuticals, leather, and jute.

In Model 1, which examines the effect of devaluation without accounting for other macroeconomic variables, the aggregated GPLJ (Garments, Pharmaceuticals, Leather, Jute) category shows a small negative coefficient of -0.0048441, indicating a slight decline in export value following devaluation. For sector-specific results, garments show a coefficient of -0.0001058, reflecting a minimal negative response, while leather demonstrates a coefficient of 0.0021722, suggesting a slight positive response. On the other hand, pharmaceuticals and jute both show negative coefficients, with pharmaceuticals at -0.0155751 and jute at -0.0187158, indicating negative responsiveness to devaluation, potentially due to challenges such as high import dependence and limited value addition.

Model 2, which incorporates 14 additional macroeconomic variables, paints a more complex picture. In this model, garments show a slightly positive coefficient of 0.0009287, suggesting that devaluation may have a modest positive impact when favorable economic conditions are considered. However, the coefficient is small, indicating that the benefits of devaluation for the garments sector may be limited. Pharmaceuticals continue to experience a negative impact with a coefficient of -0.0023397, pointing to structural issues like regulatory challenges and reliance on imports. Leather shows a very small positive coefficient of -0.0032815, indicating that the sector's response to devaluation is marginal, possibly due to offsetting effects between lower costs and other market pressures. Jute, however, shows a significant negative coefficient of -0.029992, reflecting the considerable hurdles the sector faces, including difficulties in value addition and global competition.

These results suggest that the impact of devaluation on export growth is sector-dependent and influenced by broader economic factors. While garments exhibit a modest positive response under favorable conditions, pharmaceuticals and jute experience negative effects, highlighting the need for targeted strategies to address sector-specific challenges. For leather, the impact of devaluation is marginal, indicating that growth requires more than just currency adjustments. These findings underline the importance of developing comprehensive, product-specific policies to reduce import reliance, enhance value addition, and strengthen supply chain efficiencies in order to sustain long-term export growth.

The regression analyses, including first-order difference, entity demean fixed-effects, n-1 binary, T-1 binary, and combined n-1 and T-1 models, reveal that currency devaluation alone does not significantly drive changes in export performance across Bangladesh's main products—garments, pharmaceuticals, leather, and jute. While Model 1 shows varied responsiveness, Model 2 incorporates 14 macroeconomic variables, highlighting the complexity of export determinants. Across all models, the low R-squared values and insignificant coefficients for devaluation underscore that broader macroeconomic and sector-specific factors, such as inflation, FDI, government policies, and external market dynamics, play more decisive roles. These findings are consistent with the broader analysis, indicating that while devaluation may have some positive effects, it is not sufficient by itself. Instead, comprehensive policies involving structural reforms, technological investment, and targeted sectoral support are essential for achieving sustained export growth in Bangladesh.

• *Analysis of First Order Difference Regression*

The first-order difference regression analysis explores the relationship between changes in currency devaluation and

corresponding changes in export performance, focusing on the short-term impacts. This approach seeks to determine if immediate variations in devaluation significantly affect export outcomes over time.

The analysis results indicate a positive but statistically insignificant relationship between the first-order difference in devaluation (d_Devaluation) and changes in export value. The non-significant findings suggest that short-term fluctuations in devaluation do not substantially drive changes in export performance within the dataset. This is consistent with the broader economic perspective that currency devaluation alone is inadequate to tackle the multifaceted challenges associated with exports.

The low R-squared value further implies limited explanatory power, highlighting that other economic variables likely play a more influential role in shaping export outcomes. The coefficient for d_Devaluation, paired with its high p-value, corroborates that short-term devaluation changes are not significant predictors of export value shifts.

These outcomes reinforce that while currency devaluation may have implications for long-term export competitiveness, short-term shifts do not exhibit a strong or immediate effect. This finding underscores the need for comprehensive strategies beyond devaluation, involving structural reforms, investment in technology, and supportive trade policies to promote sustained export growth.

Fig 8 offers a visual representation of the first-order differences in export values across different countries, illustrating variations and aiding in identifying patterns or anomalies. (Supporting data and STATA code for this analysis are available at huq.researchbri.com for further examination or replication.)

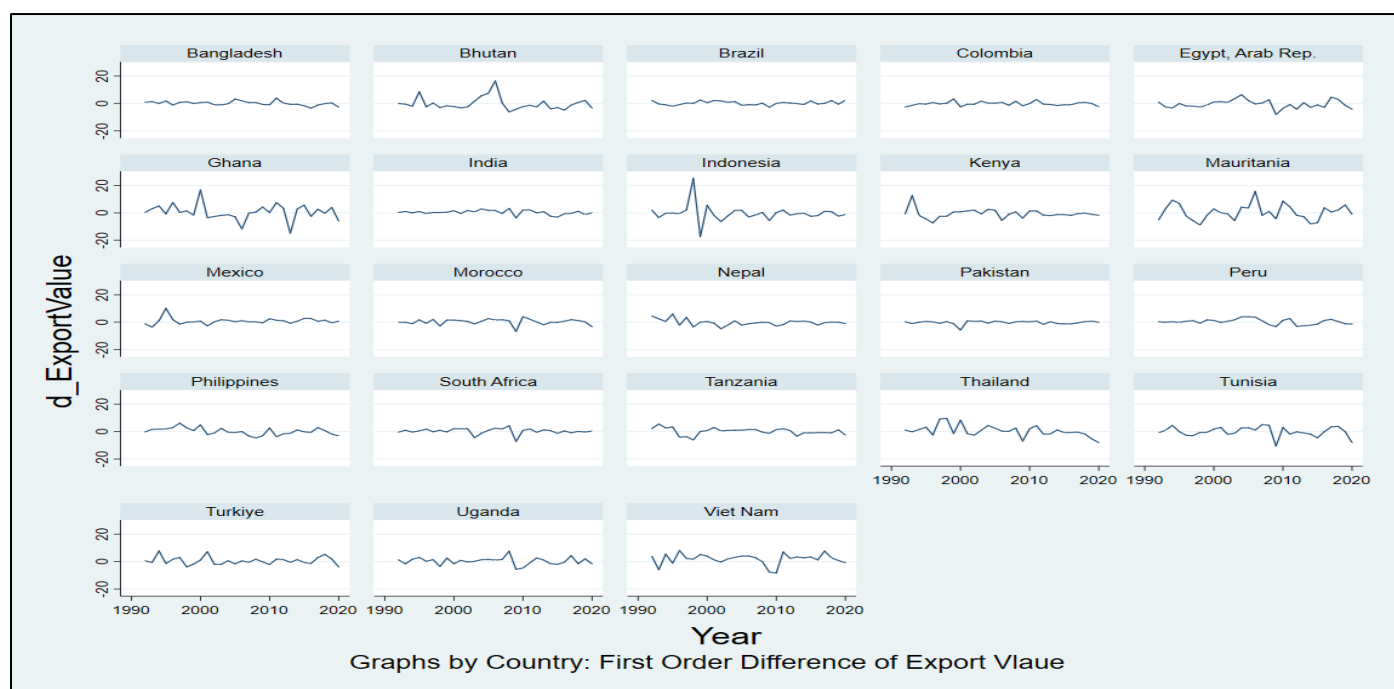


Fig 8 First Order Difference of Export Value

While theoretical models often posit a link between devaluation and export performance, this analysis suggests that short-term impacts are minimal. Policymakers should, therefore, pursue a multi-faceted approach that incorporates broader economic factors to foster resilient and sustained export growth.

- *Analysis of Entity Demean Fixed Effect Regression*

The entity demean fixed-effects regression aims to capture the impact of currency devaluation on export performance by controlling for unobserved, country-specific characteristics that remain constant over time. This approach provides an in-depth look at the within-country variation, offering insights into how export performance responds to devaluation when country-specific traits are held constant.

The results reveal that, within individual countries, the relationship between devaluation and export value changes is not statistically significant. This suggests that when analyzed over time within a single country's context, devaluation alone does not emerge as a substantial driver of export fluctuations. The low R-squared values further indicate that the model explains only a small portion of the variability in export outcomes, implying that other, unaccounted factors may play a more decisive role in influencing export performance.

P-values from the regression analysis reinforce the absence of a significant relationship, underscoring that currency devaluation's direct impact on export value changes may be limited without complementary economic factors. These findings align with the notion that devaluation, as an isolated strategy, is insufficient to drive export growth. Instead, it points to the necessity of integrating macroeconomic policies and addressing broader factors, such as supply chain dependencies, technological capabilities, and international trade agreements.

The entity demean fixed-effects regression analysis underscores that currency devaluation alone is not a significant determinant of export performance within countries. To achieve meaningful improvements in exports, policymakers should pursue comprehensive strategies that incorporate structural economic reforms, technological investments, and sector-specific support, as emphasized throughout the study.

- *Analysis of n-1 Binary Regression*

The n-1 binary regression analysis using fixed-effects models reveals that the influence of devaluation on export value changes within Bangladesh lacks statistical significance. This outcome suggests that, even when accounting for within-country time variations, devaluation alone is not a robust determinant of export performance fluctuations. The low R-squared values highlight that the model accounts for only a small fraction of the variation in export outcomes, underscoring the finding that other factors play a more significant role.

The insignificant p-values for the devaluation coefficients are consistent with the study's wider findings: currency devaluation, although an element of economic

policy, cannot independently lead to significant export growth. This indicates that an isolated focus on currency devaluation overlooks critical macroeconomic and sector-specific variables that shape export trends. The findings underscore the necessity for a comprehensive analytical approach incorporating additional economic factors such as inflation, FDI inflows, and government expenditure, which are shown to significantly affect export outcomes.

This analysis advocates for policies that extend beyond devaluation to encompass structural reforms, technological investment, and supportive fiscal measures. (Further data details and the STATA commands used in this analysis are available at huq.researchbri.com for replication and deeper exploration.)

- *Analysis of T-1 Binary Regression*

The T-1 binary regression analysis underscores the complexity of determining the direct influence of currency devaluation on export performance. The model findings indicate that the first-order difference in devaluation ($d_Devaluation$) lacks statistical significance in predicting changes in export value ($d_ExportValue$). This suggests that shifts in currency value alone do not consistently explain variations in export performance, reinforcing the stance that devaluation is not a singularly effective tool for fostering export growth.

The low R-squared value observed in the regression model confirms that the included variables only explain a limited fraction of the changes in export value, pointing to the presence of other influential factors not captured in the analysis. This aligns with the view that macroeconomic variables such as inflation, FDI, government expenditure, and product-specific characteristics play significant roles in shaping export outcomes.

These findings underscore that devaluation, while part of the economic strategy, needs to be integrated with comprehensive macroeconomic and product-specific policies to achieve meaningful improvements in export performance. The lack of substantial results from the T-1 binary model illustrates that focusing solely on currency value adjustments is insufficient. Instead, a holistic policy approach that incorporates structural reforms, investment in technological capabilities, and strengthened governance is essential for sustainable export growth in Bangladesh.

- *Analysis of n-1 Binary.T-1 Binary Regression*

The combined analysis of the n-1 and T-1 binary regression models offers a deeper look into the complex dynamics between currency devaluation and export performance. While the models provide insights into the association, results indicate variability across different countries and time periods. The presence of significant negative year dummies underscores specific years where export performance faced notable declines, likely influenced by global economic factors or regional disturbances. This suggests that export outcomes are often shaped by broader temporal influences beyond currency policies alone.

Conversely, the analysis reveals that significant country dummies are sparse, indicating that inherent country-specific characteristics may have less direct influence or may be obscured by other variables not accounted for in the models. This finding points to the challenges of isolating devaluation's direct impact from other economic factors and highlights the intricate interplay between macroeconomic variables and sectoral conditions. Such results reinforce the importance of a multifaceted policy approach that goes beyond devaluation to incorporate economic reforms, technological investments, and supportive sector-specific strategies. These findings emphasize that while currency devaluation can impact export performance, its effectiveness is contingent on a comprehensive policy framework that considers various external and domestic economic forces. The analysis supports the broader research findings, emphasizing the need for a comprehensive and balanced approach to enhance Bangladesh's export sector.

Both Sectoral and Product-level responses to devaluation reflect varied levels of sensitivity. The garments, while benefitting from labor cost advantages, struggles with increased production costs due to imported inputs. Similarly, the leather industry shows initial positive responses but is constrained by high costs of imported processing materials. Pharmaceuticals, with a significant reliance on imported active ingredients, demonstrate minimal gains from devaluation. The jute, less reliant on imports, shows moderate sensitivity but is limited by global demand fluctuations and lower value addition.

A comparison with regional peers underscores the importance of broader economic strategies. India's diversified economy and robust trade infrastructure enable it to maintain stable export performance despite devaluation, suggesting that Bangladesh could benefit from diversifying its export base and enhancing local sourcing. In contrast, Bhutan's smaller economy exhibits mixed outcomes, reflecting its import dependencies and limited export range. These observations highlight that while Bangladesh shares certain characteristics with regional economies, targeted economic reforms and investments are essential for leveraging devaluation effectively.

Macroeconomic variables such as high interest rates, limited FDI, and government expenditure also play crucial roles. High borrowing costs impact SMEs disproportionately, limiting their ability to manage expenses associated with devaluation. Insufficient FDI restricts technological upgrades and productivity enhancements necessary for export growth. Government spending, when not directed toward supportive infrastructure, can stifle private investment.

These findings suggest that currency devaluation alone is insufficient for sustainable export growth in Bangladesh.

Addressing import dependencies, enhancing local production, and implementing targeted sectoral support are necessary steps. A comprehensive policy approach that integrates these strategies will enable Bangladesh to optimize the benefits of devaluation and achieve resilient export performance.

B. SCM Analysis

➤ *Demonstrative Analysis for Bangladesh with Model 1*

The evaluation of Bangladesh's export performance under Model 1 utilized a synthetic control composed of weighted units, with South Africa emerging as the dominant contributor (weight: 0.64). This weighting indicates that South Africa's economic structure, particularly in relation to export performance and currency dynamics, closely mirrored that of Bangladesh prior to devaluation. Other countries, such as Indonesia, Pakistan, Ghana, Morocco, and Thailand, contributed minimally (each with a weight of 0.02), highlighting a lower degree of comparability. Table 3.11 presents the weights assigned to control units in the analysis, with South Africa contributing the highest weight at 0.64, followed by smaller contributions from Indonesia, Pakistan, Ghana, Morocco, and Thailand.

The gap analysis using the Synthetic Control Method (SCM) revealed the trend, as depicted in Figure 3.1. The gap plot (Right) demonstrates that Bangladesh's export performance initially showed alignment with the synthetic control immediately post-devaluation but began to exhibit a negative trend in subsequent years, signaling a decline in competitiveness. The synthetic control path plot (Left) illustrates the comparative trajectory of Bangladesh's exports (solid line) against the synthetic control (dashed line). After 2012, the divergence between the two paths becomes evident, with Bangladesh underperforming. The gap remains relatively stable over time but hovers below zero, indicating persistent export underperformance compared to the synthetic control. These findings highlight the limited and diminishing impact of devaluation on Bangladesh's export performance over the observed period.

Further examination using non-parametric and parametric estimation techniques, including the Mann-Whitney U test²⁶ and kernel density estimation²⁷, showed significant differences in export trajectories between Bangladesh and its synthetic counterpart. The analysis (Figure 3.3) revealed a fluctuating trend in the export performance gap between 2013 and 2020. Initially, the gap widened significantly from 2013 to 2016, indicating a persistent negative impact post-devaluation. While there were brief periods of partial recovery in subsequent years, these improvements were not sustained, and the trend remained inconsistent. By 2020, the gap indicated a renewed downturn, reflecting the continued challenges in achieving export

²⁶ Mann-Whitney U test is the non-parametric alternative test to the independent sample t-test. It is a non-parametric test that is used to compare two sample means that come from the same population and used to test whether two sample means are equal or not.

²⁷ Kernel density estimation is a nonparametric density estimator that smooths the contribution of each observed data point over a local neighborhood of that individual data point. It is a procedure that provides an alternative to the use of histograms as a means of generating frequency distributions.

competitiveness after devaluation. The findings highlight a pattern of persistent underperformance with occasional but short-lived recoveries.

Rank significance tests²⁸ provided additional insight into macroeconomic variables influencing these export gaps, while diagnostic measures such as mean squared prediction error (MSPE) and ratio-MSPE were used to validate model robustness. The low pre-intervention MSPE highlighted a strong fit between Bangladesh and the synthetic control. Conversely, the higher post-intervention ratio-MSPE

suggested that the model effectively captured the devaluation's impact, demonstrating how the economic divergence following devaluation became pronounced over time.

➤ *Placebo Test Output for Bangladesh under 2 Models*
 With Model 2, Table 18 presents the weights assigned to control units in the analysis, with India contributing the highest weight at 0.72, followed by smaller contributions from Peru (0.20), and Philippine (0.08).

Table 18 Weight of Control Units

India	Peru	Philippine
0.72	0.2	0.08

The evaluation of Bangladesh's export performance using two models highlights significant differences in pre- and post-devaluation gaps, offering insights into the effects of currency devaluation under varying analytical frameworks. In Model 1, which evaluates baseline conditions without additional controls, the pre-intervention gap is generally positive, as indicated by variables such as gap_pre_3 and gap_pre_1, suggesting that Bangladesh's export performance was slightly ahead of the synthetic control before devaluation. However, the post-intervention results, including gap_post_1 and gap_post_3, reveal a shift to negative values, indicating that Bangladesh's actual exports began to lag behind the synthetic control following devaluation. This trend highlights a transition from relative alignment to underperformance in export outcomes post-intervention.

Post-devaluation, the trends observed in the two models reveal notable differences. Model 1 consistently demonstrates a negative trajectory, indicating underperformance in export growth following devaluation. The gaps in this model remain substantial over time, highlighting the persistent challenges in achieving recovery. In contrast, Model 2 shows a more stable trend, with smaller fluctuations and indications of moderation in the adverse effects. While Model 1 reflects continued economic divergence, Model 2 suggests a more balanced performance, pointing to the potential influence of broader macroeconomic factors in supporting recovery. These contrasting trends underscore the importance of adopting a more comprehensive approach to economic management post-devaluation.

Table 19 Model Output Comparison of Bangladesh for 2 Models

Model 1		Model 2
Variable	Value	Value
gap_pre_3	1.89	0.71
gap_pre_1	2.08	2.11
gap_post_1	-0.9	-0.63
gap_post_3	-0.69	0.61
gap_last_1	-1.9	-1.11
gap_pre_all	0.23	-0.19
gap_post_all	-1.06	-0.66

Table 19 illustrates the annual trends across both models, indicating more pronounced adverse effects in Model 1 compared to Model 2. Long-term evaluations reveal contrasting trends between the two models. Model 1 indicates a persistent decline in export performance, reflecting

substantial negative gaps in the post-devaluation period. In contrast, Model 2 exhibits a more stable trajectory, with gaps remaining relatively modest and consistent, suggesting that the inclusion of additional economic variables helps mitigate adverse impacts.

²⁸ The ranking test is used when the objective is to determine if a difference exists between three or more samples regarding

a specified attribute, e.g., bitterness, hardness, aroma intensity, freshness, an overall impression, or preference.

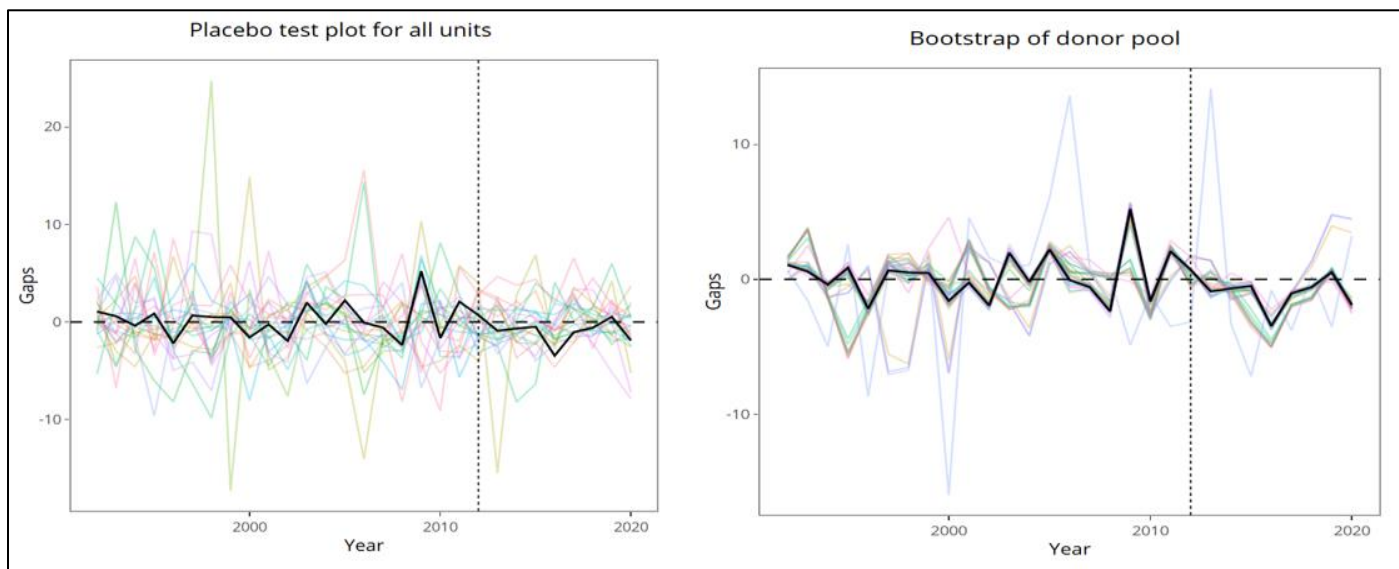


Fig 9 Synthetic Control Placebo Test and Bootstrapping of Bangladesh

As illustrated in Fig 9, the placebo test and bootstrap analysis further highlight the significance of incorporating comprehensive macroeconomic controls. These findings emphasize that while devaluation can play a role in shaping export performance, its outcomes are strongly influenced by the presence or absence of broader economic strategies and structural factors.

➤ *Non-parametric and Parametric Estimation for Bangladesh Under 2 Models*

The trends observed from Table 20, both the non-parametric and parametric estimations reveal distinct patterns for Models 1 and 2.

Table 20 Non-Parametric and Parametric Estimation of Effect

	Non parametric		Parametric	
	Model 1	Model 2	Model 1	Model 2
2013	0.1812	-0.7019	0.0452	-0.0316
2014	-0.7982	1.1123	-0.7858	-0.0439
2015	-1.463	0.6168	-1.2565	-0.2152
2016	-3.6481	-3.3542	-1.3377	-1.79
2017	-1.3779	-1.3896	-1.3274	-1.8787
2018	-0.6216	-0.9519	-1.1852	-1.88
2019	0.7998		-0.9919	
2020	-1.2334		-0.8842	

In Model 1, there is a noticeable decline in export performance over time, with the impact becoming most pronounced during the mid-to-late evaluation period. Although there are signs of partial recovery in later years, the overall trend remains negative. In contrast, Model 2 demonstrates less severe negative effects, with a sharp drop during the mid-period followed by a more stabilized performance toward the end of the analysis. These trends suggest that the inclusion of additional macroeconomic variables in Model 2 helps to moderate the adverse impacts of devaluation, leading to relatively smaller deviations compared to Model 1.

The parametric results reflect similar patterns. Model 1 highlights a consistent downward trend in export performance throughout the analysis period, indicating that devaluation alone was insufficient to counteract negative

pressures on exports. Model 2, although also showing negative effects, exhibits a more moderated trajectory with signs of stabilization in the later years. These comparative trends emphasize that the effectiveness of devaluation in enhancing export performance is contingent on integrating supportive macroeconomic policies and strategic adjustments.

The SCM analysis provides further insights, revealing a widening gap between Bangladesh’s actual export trajectory and its synthetic counterpart following the 2012 devaluation. This persistent gap highlights the shortcomings of relying solely on currency devaluation, particularly in sectors such as garments and leather, which face high import dependencies. The limited response in export growth suggests that underlying issues, such as reliance on imported raw materials, need to be addressed for devaluation to be effective.

➤ *Cross Model and Cross Country Pathway Trajectory Comparison*

• *Comparing Countries*

The comparative analysis of Bangladesh’s export performance under currency devaluation, using Synthetic Control Models (SCM), highlights notable differences in the

construction of synthetic Bangladesh across the two models. Table 21 illustrates the weights assigned to control units. In Model 1, South Africa carries the highest weight, followed by smaller contributions from Indonesia, Pakistan, Ghana, Morocco, and Thailand. In contrast, Model 2 places heavy weight exclusively on India, reflecting a concentrated approach in forming the synthetic control.

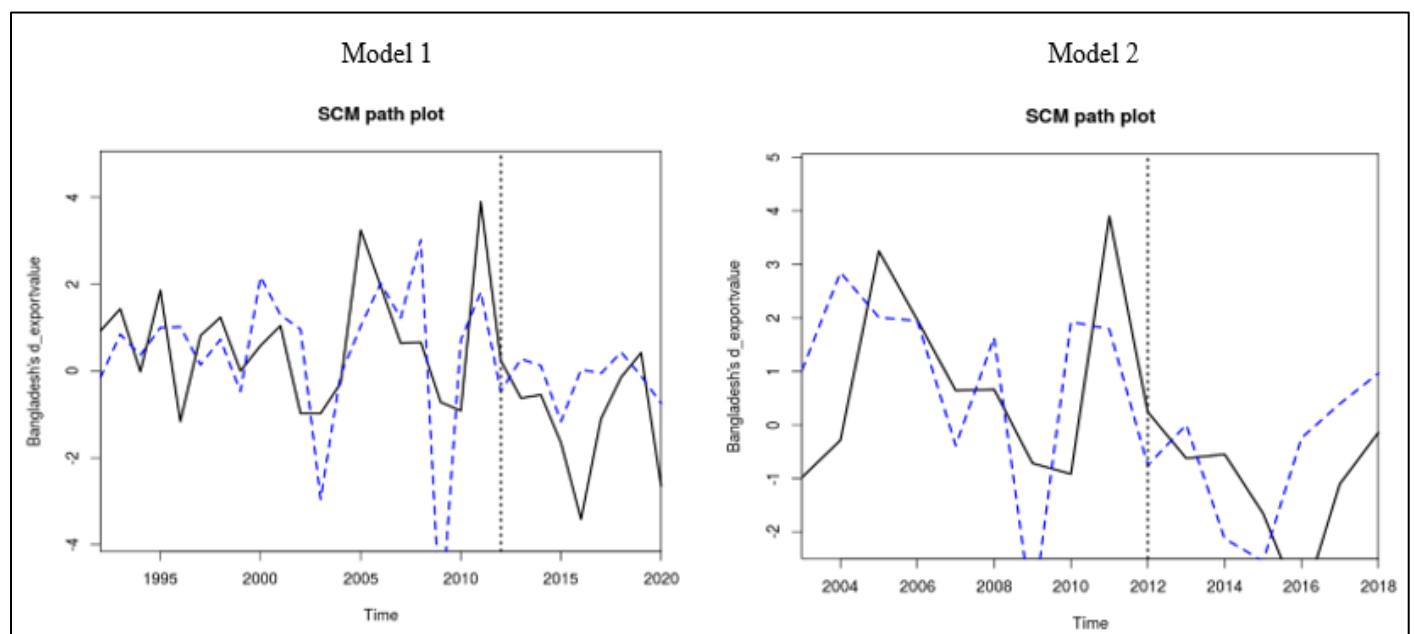
Table 21 Weight of Control Units Under 2 Models (Bangladesh)

	Model 1	Model 2
India		0.72
South Africa	0.64	
Indonesia	0.02	
Pakistan	0.02	
Ghana	0.02	
Morocco	0.02	
Thailand	0.02	
Peru		0.2
Philippines		0.08
Total	0.74	1

Model 2 assigns its heavy weight to India, signaling that India’s economic trajectory aligns most closely with Bangladesh’s when additional macroeconomic factors are considered. This transition from a diversified control group in Model 1 to a singular focus in Model 2 underscores the adaptability of the Synthetic Control Method. The shift emphasizes the importance of India’s structural and economic similarities to Bangladesh in capturing the effects of devaluation within a broader macroeconomic context.

Fig 10 A presents a comparison of the export performance of Bangladesh and India under both models, illustrating actual export trajectories (solid black lines)

alongside their synthetic controls (dashed blue lines). In Model 1, both Bangladesh and India experience export performance below their synthetic benchmarks post-devaluation, suggesting that devaluation did not deliver the expected improvements in price competitiveness. In Model 2, while Bangladesh's actual export path still lags behind its synthetic control, the gap is narrower, indicating that the inclusion of additional macroeconomic variables may have mitigated some of the negative effects. Meanwhile, India's export trajectory remains relatively stable and closely tracks its synthetic control, highlighting the advantages of India’s more diversified economic structure and greater resilience in the face of external shocks.



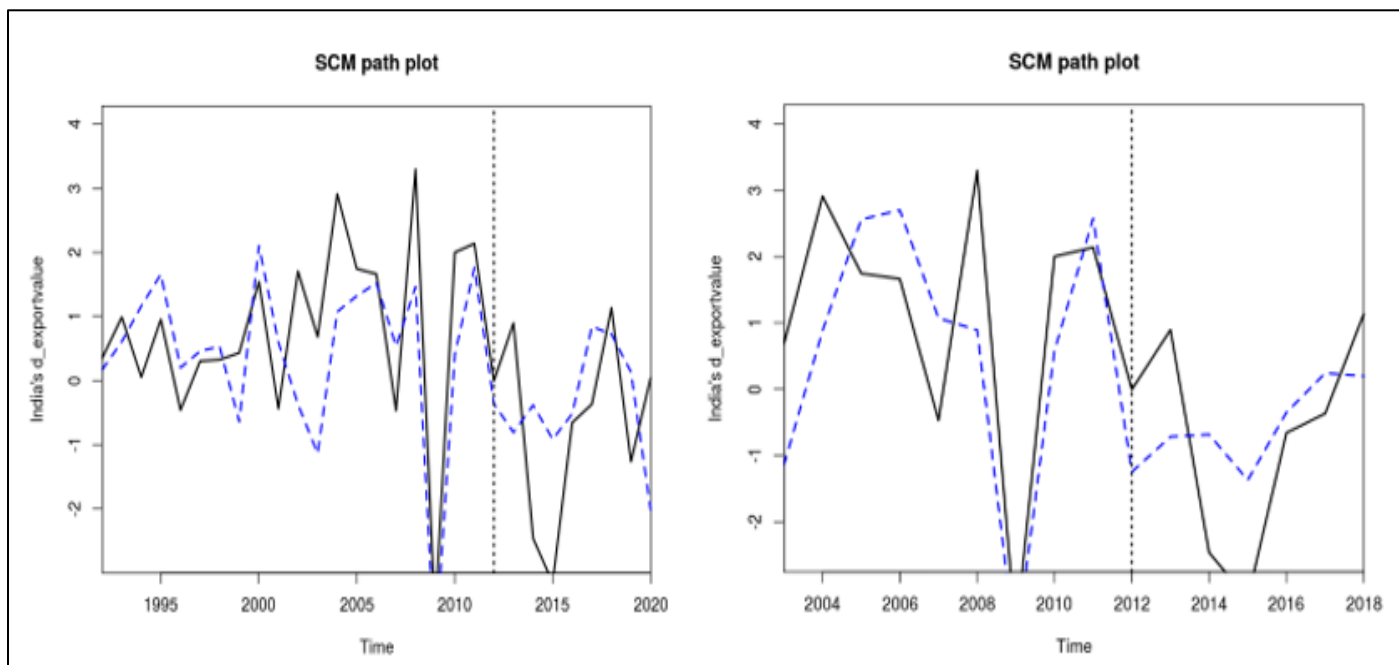
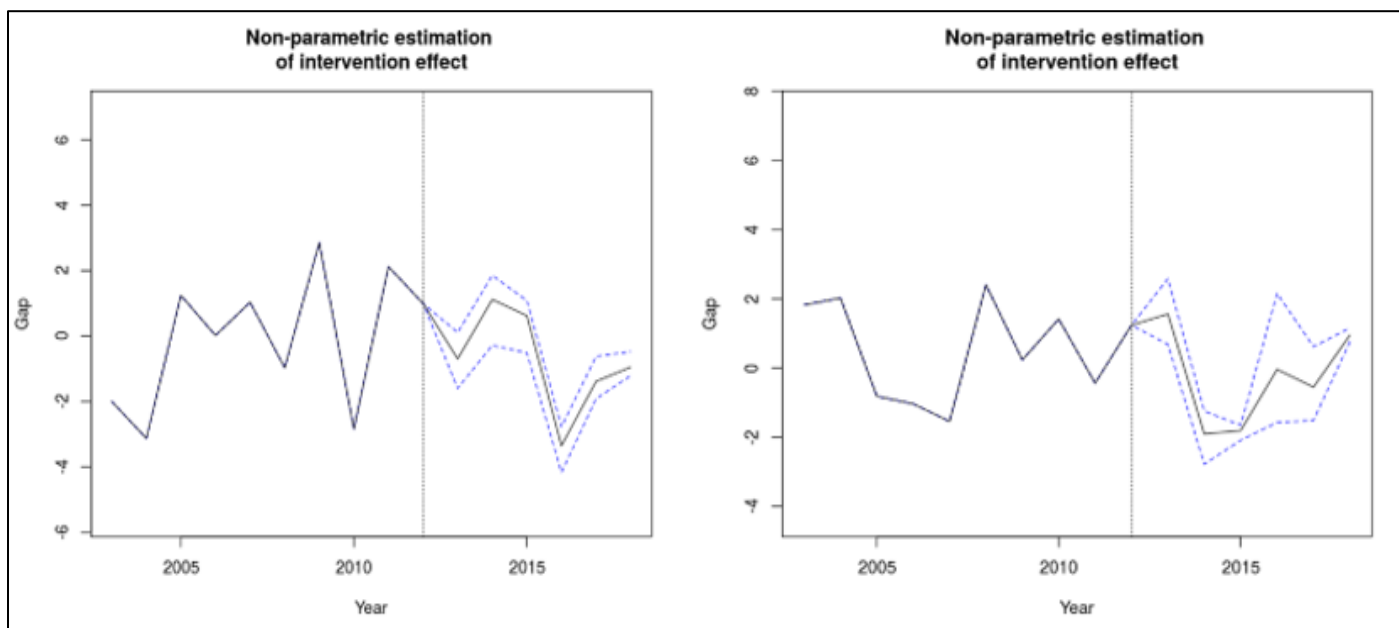


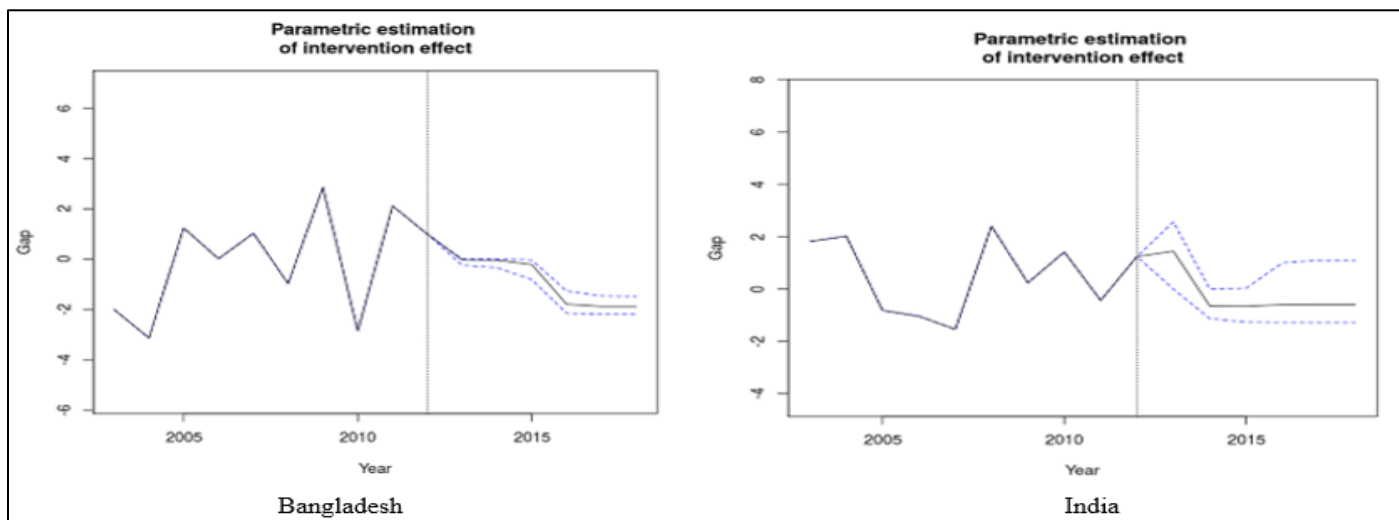
Fig 10 A SCM Path of Comparing Countries under 2 Models

These comparative findings highlight the multifaceted nature of devaluation as a policy instrument. The SCM results indicate that devaluation, on its own, does not provide a guaranteed boost to export competitiveness in developing economies like Bangladesh and India. The observed performance gaps reinforce the importance of adopting holistic strategies that include macroeconomic stability, structural reforms, and economic diversification. For Bangladesh, these insights suggest that relying solely on devaluation is insufficient. Instead, a comprehensive policy approach that integrates broader economic factors is crucial for improving export performance and ensuring long-term, sustainable growth.

Furthermore, using model 1, Fig 11 illustrates non-parametric and parametric estimations of intervention effects for Bangladesh and India, comparing real trends with synthetic control predictions. The non-parametric estimations show that Bangladesh and India experienced significant post-intervention deviations from their synthetic counterparts, suggesting notable impacts of devaluation. The parametric estimations reinforce these observations, showing consistent gaps for Bangladesh and marked deviations for India. These results suggest that currency devaluation influenced export performance in Bangladesh and India significantly, highlighting the varied effectiveness of devaluation policies across these countries.



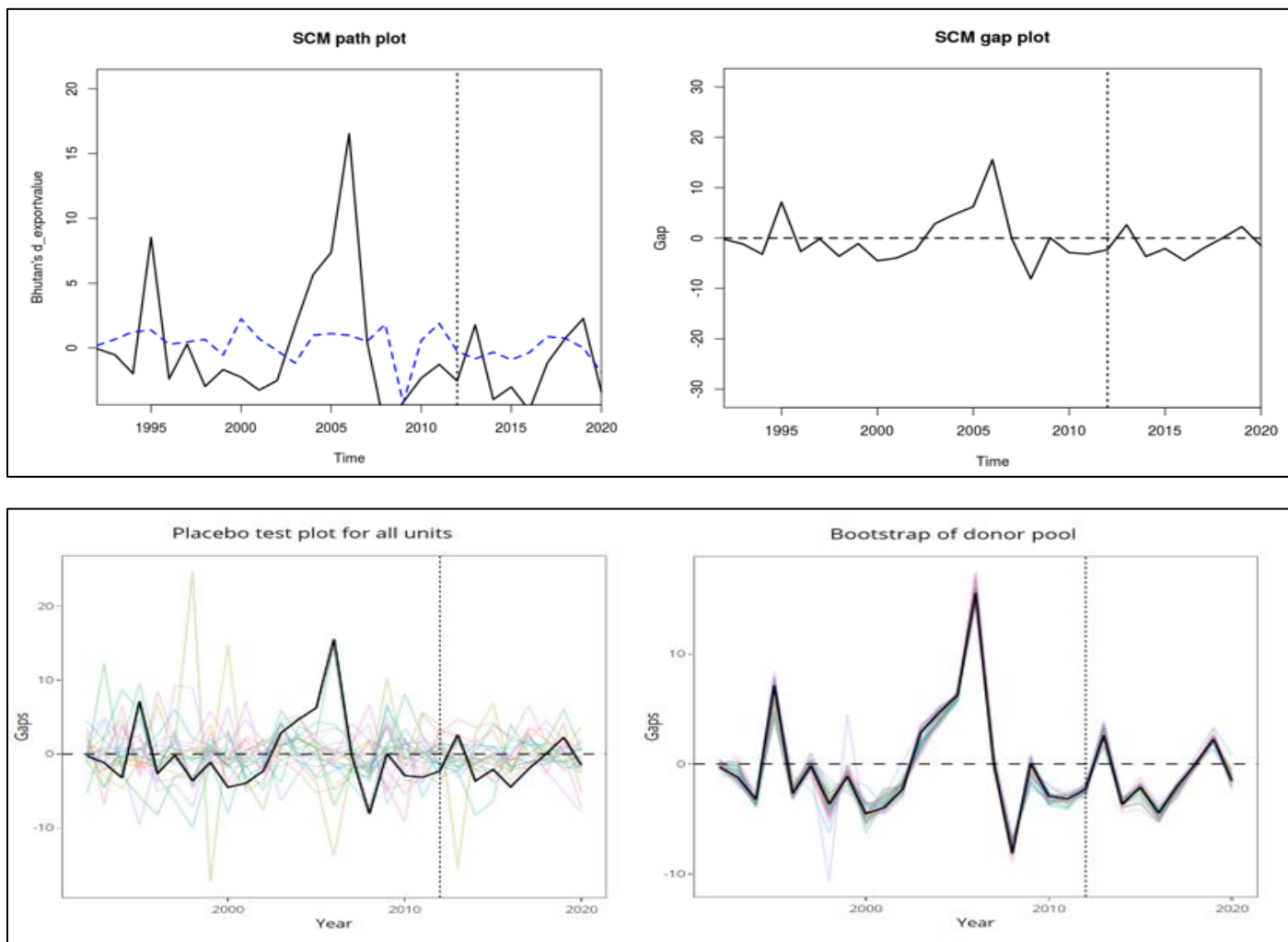
Non-Parametric Estimation



Parametric Estimation
 Fig 11 Non-Parametric and Parametric Estimation for Bangladesh and India

The analysis of Bhutan in Fig 12 underscores the distinctiveness of Bhutan’s economic response to devaluation compared to Bangladesh and India. The SCM path plot and subsequent tests reveal a divergence that can be attributed to Bhutan's unique economic structure and smaller scale. Unlike its larger neighbors, Bhutan's economy is more susceptible to pronounced effects from minor shifts, given its limited

market size and distinctive dynamics. These results highlight the challenges of making direct comparisons between Bhutan and larger economies like Bangladesh and India. The findings emphasize the necessity of tailoring economic interventions such as devaluation to the specific conditions and structural characteristics of each country.



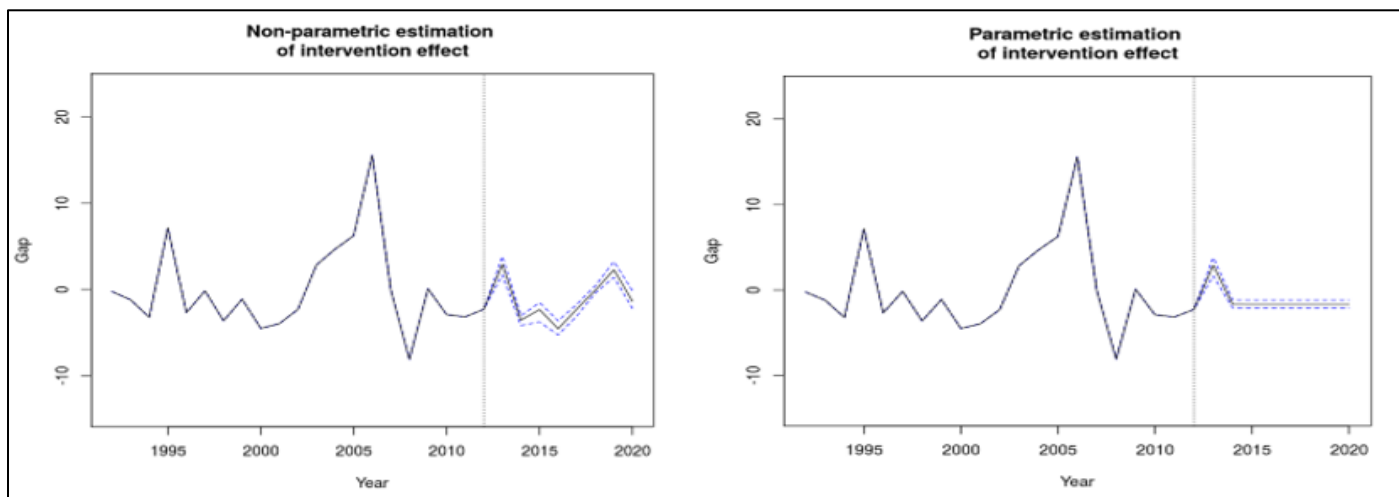
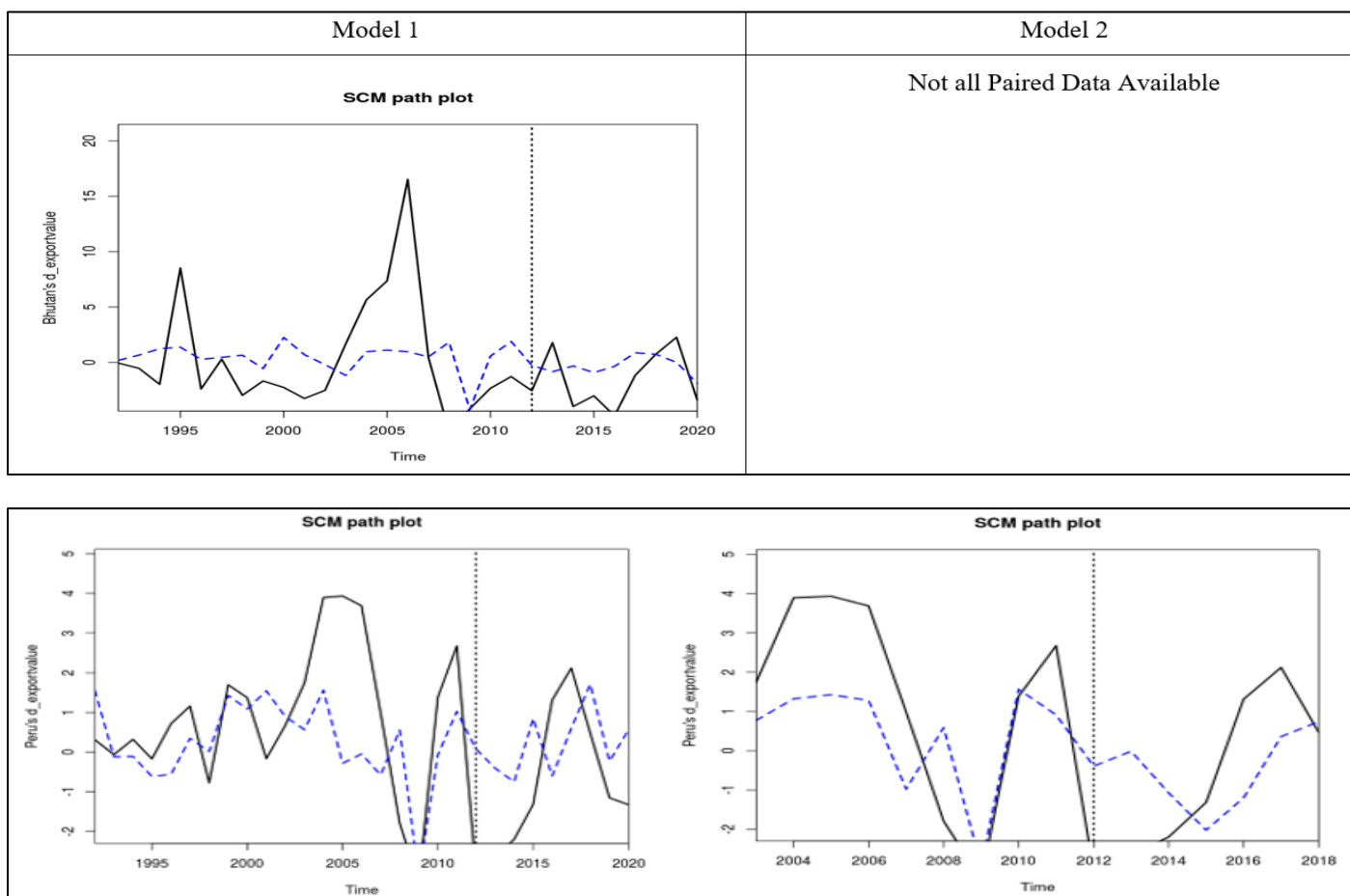


Fig 12 SCM path plot, SCM gap plot, Placebo test, Bootstrap, Non-parametric and Parametric Estimation of Bhutan

Building on these insights, Bhutan’s distinct economic characteristics and smaller scale limit its relevance as a comparison unit for assessing Bangladesh’s response to devaluation. The substantial disparities in market size, structural dynamics, and economic resilience suggest that Bhutan's macroeconomic reactions are unlikely to align with those of larger, more diversified economies like Bangladesh. Consequently, comparisons with Bhutan might offer limited analytical value, reinforcing the importance of selecting control units with closer economic parallels to ensure more robust and meaningful evaluations of devaluation impacts.

• *Newly Evolved Heavy-weighted Countries*

The Synthetic Control Method (SCM) paths shown in Fig 13 B illustrate the comparative export trajectories of Bhutan, Peru, and South Africa under Model 1. These countries play a role in shaping synthetic Bangladesh during the SCM analysis, reflecting varied economic responses to devaluation. However, their divergent export pathways emphasize the limitations of relying solely on devaluation as a variable. The lack of consistent alignment with Bangladesh’s performance suggests that structural and macroeconomic differences among these countries influence their ability to adapt to and benefit from devaluation.



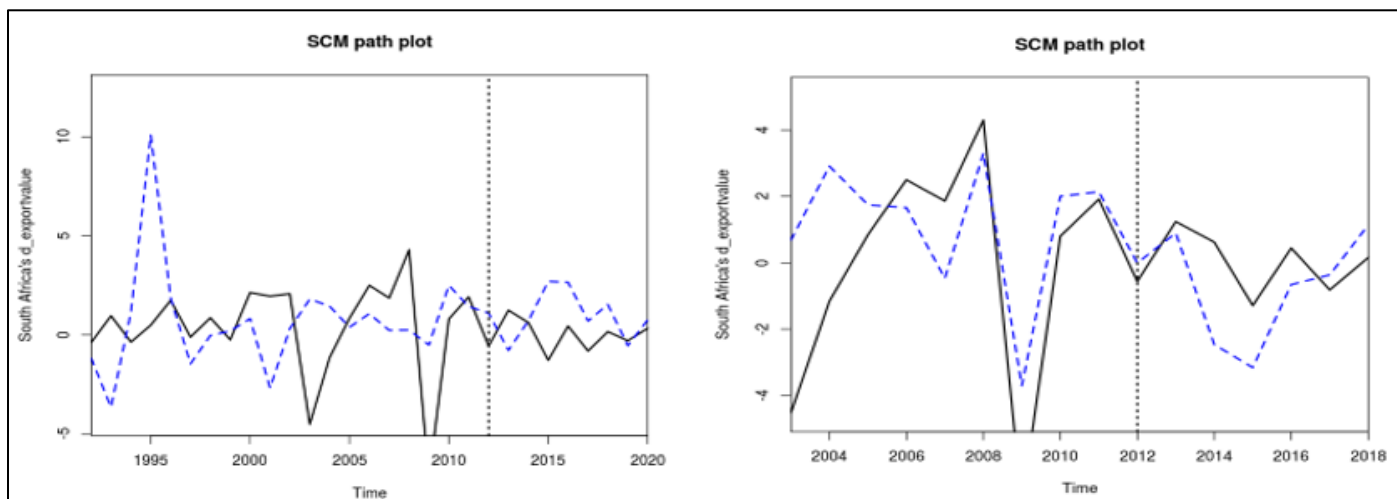


Fig 13 SCM Path of Heavy-Weighted Matching (Bhutan, Peru, South Africa) Countries under 2 Models

Bhutan's path, marked by sharp fluctuations, highlights the influence of factors beyond currency devaluation on its export performance. These fluctuations may stem from Bhutan's unique structural characteristics, such as its small market size, limited diversification, and reliance on specialized trade relationships. These dynamics underline the limited comparability of Bhutan with Bangladesh, given the substantial differences in their economic scales and structural contexts.

Peru's trajectory reveals a relatively stable alignment between its actual and synthetic export paths during the pre-devaluation period, followed by noticeable deviations post-devaluation. This suggests that while Peru's economic policies may have been effective in maintaining stability initially, external factors or shifts in policy focus could have contributed to its post-devaluation performance gaps. These patterns highlight the role of country-specific structural and policy dynamics in shaping export outcomes.

In the case of South Africa, the divergence between its actual and synthetic paths underscores the challenges of aligning monetary and fiscal policies to optimize the effects of devaluation. South Africa's relatively diversified economy and broader reliance on non-traditional markets may account for some of the discrepancies observed. These unique structural and policy dynamics suggest that South Africa's export response to devaluation is shaped by factors not fully

captured by the synthetic model, reducing its comparability with Bangladesh.

These findings emphasize that the effectiveness of devaluation as a policy tool is not uniform across countries but is contingent upon their unique economic structures, policy environments, and broader macroeconomic contexts. Bhutan's fluctuations underline the importance of structural resilience in smaller economies, while Peru's deviations suggest the critical role of policy consistency and external factors in shaping export outcomes. South Africa's trajectory further underscores the necessity of aligning monetary and fiscal policies with devaluation strategies to achieve sustained export growth. For Bangladesh, these comparative insights highlight the importance of tailoring devaluation policies within a well-integrated framework that accounts for its structural dynamics and macroeconomic conditions. A multifaceted approach that incorporates lessons from diverse contexts, while adapting them to the country's specific needs, could enhance the efficacy of devaluation in driving export competitiveness and long-term economic stability.

C. Analytical Findings

➤ Regression Results

The regression analysis in Table 22 demonstrates the nuanced relationship between currency devaluation and export performance across two models, each integrating distinct sets of macroeconomic variables.

Table 22 Regression Coefficient of Variables under 2 Models

Model 1	
Variable	Coefficient
Devaluation	0.0052623***
Model 2	
Variable	Coefficient
Devaluation	0.0780833
Lending Interest Rate	0.644087
Inflation	0.1005943

Foreign Direct Investment	-0.0505943
Government Expenditure	0.6362186
Final Government Consumption Expenditure	-0.3937499
Export Value Index	0.1303643
Export Volume Index	0.0349247
Import Value Index	-0.0374624
Import Volume Index	0.0569874
Broad Money	0.0126171
GDP Per Capita Growth	0.0431052
Subsidies and Other Transfers	-0.0523765
Tech Value Added	0.0629497
Barter Terms of Trade Index	-0.0045633
Cons	-0.8191629

In Model 1, devaluation exhibits a modest yet statistically significant positive effect (0.0052623***), indicating a direct influence on exports. However, in Model 2, while the coefficient for devaluation increases to 0.0780833, it loses statistical significance, suggesting that its impact is moderated when broader macroeconomic factors are considered.

Key macroeconomic variables in Model 2 offer further insights. Lending interest rates (0.644087) positively correlate with export performance, reflecting their role in fostering investment under conducive conditions. Inflation (0.1005943) demonstrates a small positive coefficient, though its broader impact on export competitiveness remains inconclusive. Conversely, foreign direct investment (-0.0505943) exhibits a negative coefficient, suggesting that in this context, FDI may not directly contribute to export growth, possibly due to inefficiencies in channeling investments toward export-oriented sectors.

Government expenditure (0.6362186) positively influences exports, emphasizing the importance of strategic public spending. However, final government consumption expenditure (-0.3937499) has a notable negative effect, reinforcing the need for fiscal discipline and effective allocation of resources. The export value index (0.1303643)

exhibits a strong positive coefficient, highlighting the role of value addition in driving export growth, while variables such as the import value index (-0.0374624) and subsidies (-0.0523765) indicate potential trade-offs that require careful policy consideration.

Structural variables provide additional dimensions to the analysis. The tech value added (0.0629497) shows a positive but modest contribution, suggesting that technological advancements remain an underutilized lever for enhancing export performance. Similarly, the barter terms of trade index (-0.0045633) indicates slight inefficiencies in trade conditions that could benefit from structural reforms.

These findings underscore the complexity of export dynamics, where devaluation serves as one factor among many. To optimize export performance, policymakers must balance devaluation strategies with targeted investments in value-added sectors, efficient fiscal management, and technological innovation. By addressing these interconnected elements, a more resilient and competitive export framework can be achieved.

Table 23 highlights the role of various macroeconomic factors in shaping export performance beyond the scope of currency devaluation.

Table 23 Regression coefficients for Beyond-Devaluation Factors

SL. No.	Beyond-Devaluation Factors	Regression Coefficient
1	Lending Interest Rate	0.644087
2	Government Expenditure	0.6362186
3	Export Value Index	0.1303643
4	Inflation	0.1005943
5	Devaluation	0.0780833
6	Tech Value Added	0.0629497
7	Import Volume Index	0.0569874
8	GDP Per Capita Growth	0.0431052
9	Export Volume Index	0.0349247

10	Broad Money	0.0126171
11	Barter Terms of Trade Index	-0.0045633
12	Import Value Index	-0.0374624
13	Foreign Direct Investment	-0.0505943
14	Subsidies and Other Transfers	-0.0523765
15	Final Government Consumption Expenditure	-0.3937499
16	Cons	-0.8191629

Positive contributors such as lending interest rates, government expenditure, and the export value index underscore the importance of strategic fiscal and monetary measures. These factors, along with modest contributions from GDP per capita growth and tech value added, emphasize the potential of improving financial and trade conditions to bolster export outcomes.

Conversely, factors such as the import value index, foreign direct investment, and subsidies show negative coefficients, indicating challenges related to trade imbalances, inefficiencies in resource allocation, and limited

capital utilization. Final government consumption expenditure emerges as a significant obstacle, pointing to the need for fiscal discipline to ensure efficient spending.

Devaluation itself exhibits a moderate and positive effect but remains relatively minimal compared to other variables, reinforcing the importance of complementary policy measures. The nuanced roles of these factors highlight that beyond devaluation, targeted interventions addressing trade structures, technological innovation, and cost efficiency are essential for achieving sustainable export growth.

Table 24 Sectoral and Product Level Regression Coefficients

Sectoral	GPLJ	Garments	Pharmaceuticals	Leather	Jute
Model 1		0.0008503	-0.0000958	-0.0008272	-0.0037853
Model 2		0.0033479	0.0015487	0.0017597	-0.0004215
Product Level					
Model 1	-0.0048441	-0.0001058	0.0021722	-0.0155751	-0.0187158
Model 2	0.0009287	-0.0006893	-0.0023397	-0.0032815	-0.029992

The regression analysis presented in Table 24 explores the effects of currency devaluation on Bangladesh's primary export sectors—garments, pharmaceuticals, leather, and jute—at both sectoral and product levels. The results are analyzed under two models: Model 1, which examines the direct impact of devaluation, and Model 2, which incorporates additional macroeconomic variables to account for broader influences.

At the sectoral level, the aggregated category of garments, pharmaceuticals, leather, and jute (GPLJ) demonstrates a minimal positive response to devaluation in Model 1. However, this response becomes more pronounced when macroeconomic conditions are factored in under Model 2, suggesting that favorable economic adjustments can amplify the benefits of devaluation. Among individual sectors, garments show a near-neutral response in Model 1, with a slight improvement in Model 2, reflecting the potential for modest gains under supportive conditions. Pharmaceuticals initially exhibit a marginal decline but shift to a positive response when broader factors such as regulatory support and supply chain improvements are considered. Leather faces a significant negative impact in Model 1, though its performance improves slightly in Model 2, indicating that macroeconomic adjustments can partially mitigate adverse effects. Jute, however, consistently

struggles, with the steepest decline among all sectors, highlighting persistent structural challenges.

At the product level, ready-made-garments results indicate a slight decline in export performance following devaluation, though this effect diminishes when accounting for macroeconomic variables. While some products, such as leather, show minor positive responses, others, including jute, continue to face significant declines due to global competition and limited value addition.

The findings emphasize that the effectiveness of devaluation varies across sectors and products, depending on underlying economic conditions. While devaluation may provide opportunities for growth in sectors like garments and pharmaceuticals, its benefits are limited without targeted policy measures to address structural inefficiencies, enhance value addition, and support sectors like jute and leather that are more vulnerable to external pressures.

While currency devaluation has a role in shaping export outcomes, it cannot act as an isolated driver of growth. The findings reinforce the necessity for comprehensive economic strategies that integrate structural reforms, targeted fiscal policies, and sector-specific support to optimize the benefits of devaluation and enhance export competitiveness.

➤ *SCM Results*

multifaceted nature of devaluation impacts on export performance.

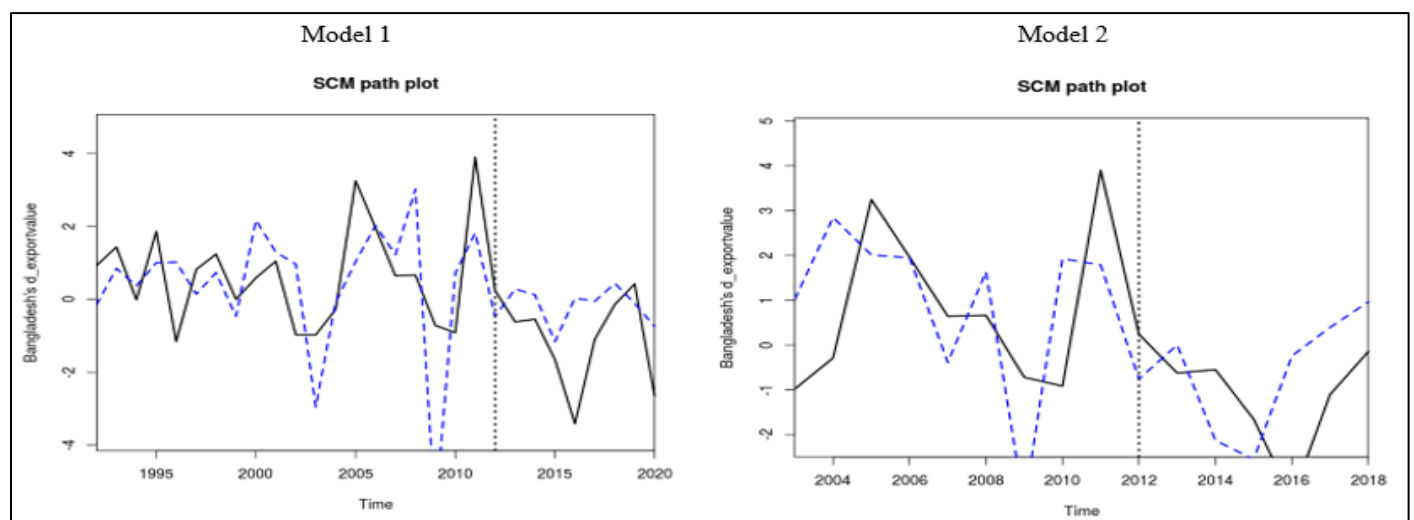
• *Bangladesh vs Synthetic Bangladesh*

The comparative analysis between Bangladesh and its synthetic counterpart, outlined in Table 25 and illustrated through Fig 14A, Fig 14B, and Fig 14C, highlights the

Table 25 Treated and Synthetic Control for Bangladesh under 2 Models

Model 1				
Variable	First Order Difference	Treated	Synthetic	Sample Mean
Devaluation	d_devaluation	-0.18	-0.18	-1.88
Model 2				
Variable	First Order Difference	Treated	Synthetic	Sample Mean
Devaluation	d_devaluation	0	0.11	-0.27
Lending Interest Rate	d_lendinginterestrate	-0.18	-0.2	-0.27
Inflation	d_inflation	0.14	0.01	-0.02
Foreign Direct Investment	d_fdi	0.04	0.01	0
Government Expenditure	d_governmentexpenditure	-0.03	0	0.16
Final Government Consumption Expenditure	d_fgce	-0.35	-0.26	-0.08
Export Value Index	d_exportvalueindex	6.39	6.41	5.58
Export Volume Index	d_exportvolumeindex	6.18	4.66	3.35
Import Value Index	d_importvalueindex	7.71	6.9	6.1
Import Volume Index	d_importvolumeindex	6.01	5.42	4.61
Broad Money	d_broadmoney	0.76	0.78	0.89
GDP Per Capita Growth	d_gdppercapitagrowth	0.26	0.14	0.03
Price Level of Exports	d_pricelevelofexports	0.53	0.18	0.27
Price Level of Imports	d_pricelevelofimports	-0.99	0.22	0.04
Subsidies and Other Transfers	d_subsidiesandothertransfers	-3.55	0.82	1.27
Tech Value Added	d_techvalueadded	0	0.11	-0.27
Barter Terms of Trade Index	d_bartertermsoftradeindex	-0.18	-0.2	-0.27

Under Model 1, the devaluation trends in Bangladesh and its synthetic counterpart show a consistent alignment, though the overall magnitude of Bangladesh’s currency adjustments appears more restrained compared to the broader sample.



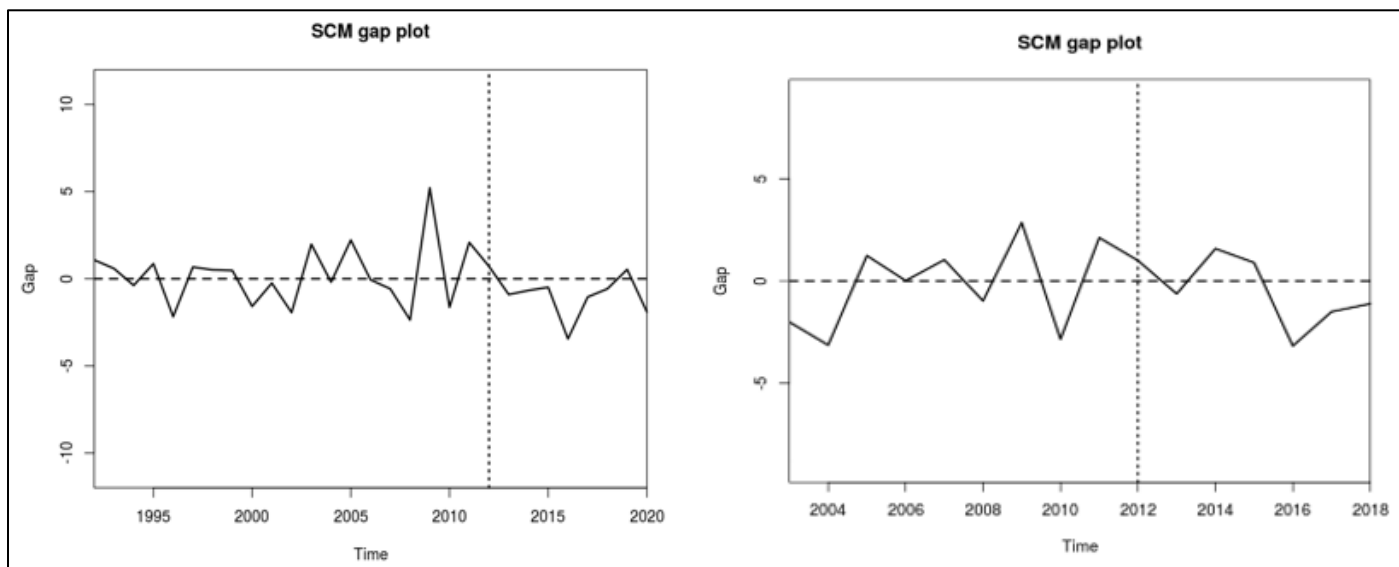


Fig 14A: Path, Gap Estimation of Bangladesh under 2 Models

In contrast, Model 2 indicates a shift towards a real depreciation for Bangladesh, suggesting a trend of increased devaluation.

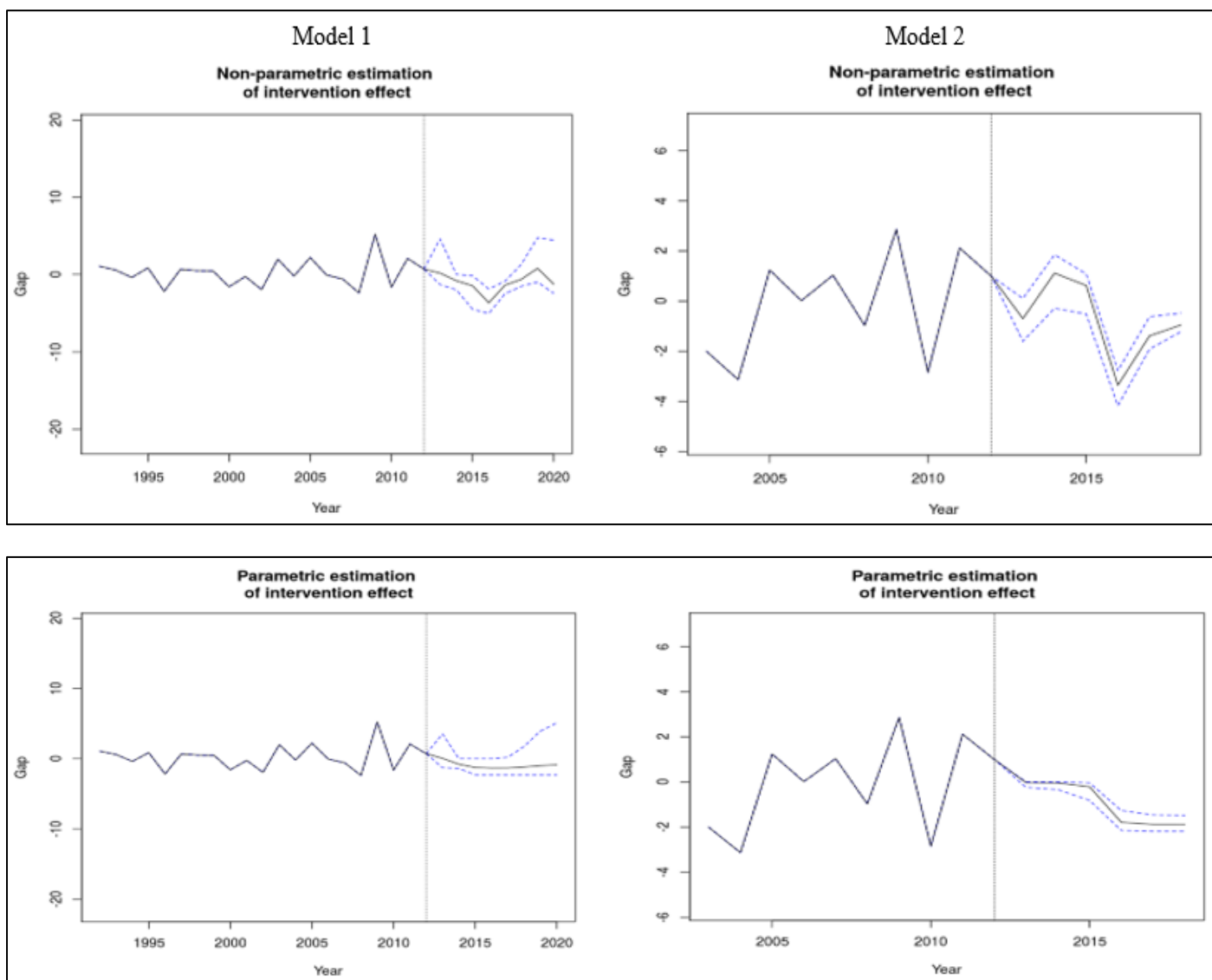


Figure 14B: Non-parametric and Parametric Estimation of Bangladesh under 2 Models

Table 26 Gap Between Synthetic Bangladesh and Treated Bangladesh for Beyond Devaluation Factors

Treated unit vs. Synthetic control unit						
Sl. No.	Variable	Treated	Synthetic	Gap	Measurement	Structural Component
1	Barter Terms of Trade Index	-3.55	0.82	4.37	High	Trade Competitiveness
2	Tech Value Added	-0.99	0.22	1.21	High	Innovation Capacity
3	Devaluation	0	0.11	0.11	Low	Monetary Policy
4	Final Government Consumption Expenditure	-0.35	-0.26	0.09	Low	Fiscal Policy
5	Government Expenditure	-0.03	0	0.03	Low	Public Sector Spending
6	Export Value Index	6.39	6.41	0.02	Low	Trade Competitiveness
7	Broad Money	0.76	0.78	0.02	Low	Financial Market Stability
8	Lending Interest Rate	-0.18	-0.2	-0.02	Low	Monetary Policy
9	Foreign Direct Investment	0.04	0.01	-0.03	Low	Investment Climate
10	GDP Per Capita Growth	0.26	0.14	-0.12	Average	Economic Development
11	Inflation	0.14	0.01	-0.13	Average.	Price Stability
12	Subsidies and Other Transfers	0.53	0.18	-0.35	Above Average	Social welfare and Accountability
13	Import Volume Index	6.01	5.42	-0.59	Below Optimum	Import Dependency
14	Import Value Index	7.71	6.9	-0.81	Very Low	Import Dependency
15	Export Volume Index	6.18	4.66	-1.52	Very Low	Export Growth Potential

The observation from Table 26, when looking beyond devaluation, several macroeconomic variables reveal notable differences. Lending interest rates for both Bangladesh and the synthetic unit show similar trends, reflecting comparable conditions in terms of borrowing costs. However, inflation trends in Bangladesh diverge from those in the synthetic unit, pointing to greater inflationary pressures within Bangladesh’s economy.

Foreign Direct Investment (FDI) levels in Bangladesh consistently trail those of the synthetic model, indicating a trend of lower investment inflows that could constrain technological and productivity growth in key export sectors.

GDP growth in Bangladesh remains relatively stable, but the synthetic model shows a slightly higher trend in government expenditure, suggesting that peer countries may be using fiscal policies more effectively to boost economic activity. Despite stable growth, Bangladesh’s fiscal response appears more conservative, which could explain some of the gaps in economic performance between the two models.

These trends highlight the complexity of Bangladesh’s economic situation. While there are some areas of alignment with the synthetic control, persistent challenges in managing inflation, foreign investment, and fiscal policy need to be addressed for Bangladesh to achieve more robust and sustainable economic growth.

Table 26 highlights the gaps between Synthetic Bangladesh and Treated Bangladesh in relation to various beyond-devaluation factors influencing export performance. Key gaps are evident in areas like technological value added, where Bangladesh falls significantly short, signaling a pressing need for technological advancement and innovation.

Other areas, such as broad money and the export value index, also show notable discrepancies, suggesting that expanding financial liquidity and improving value-added exports could drive economic growth.

Moderate gaps are observed in GDP per capita growth and foreign direct investment, indicating the need for strategic reforms to enhance productivity and attract more investment. Conversely, the barter terms of trade index shows considerable negative differences, pointing to the need for better market regulation and stronger negotiation power in international trade agreements.

In light of these disparities, policy recommendations emphasize upgrading technological capabilities, enhancing export quality, fostering foreign direct investment, and improving institutional budget management to close these gaps. These efforts would contribute to a more competitive export sector.

Regarding the influence of devaluation events, such as the significant adjustment in 2012, the data suggest a J-curve pattern (Fig 14C), where initial trade deficits are followed by a partial recovery. However, the ongoing volatility in export growth highlights the need for complementary policies that support economic resilience. When incorporating broader variables in Model 2, the analysis shows that while devaluation’s impact may appear slightly positive when considering factors like inflation and FDI, it remains insufficient without a comprehensive macroeconomic strategy. This reinforces the need for Bangladesh to adopt a multifaceted approach, combining currency management with structural and institutional reforms to foster sustainable export growth.

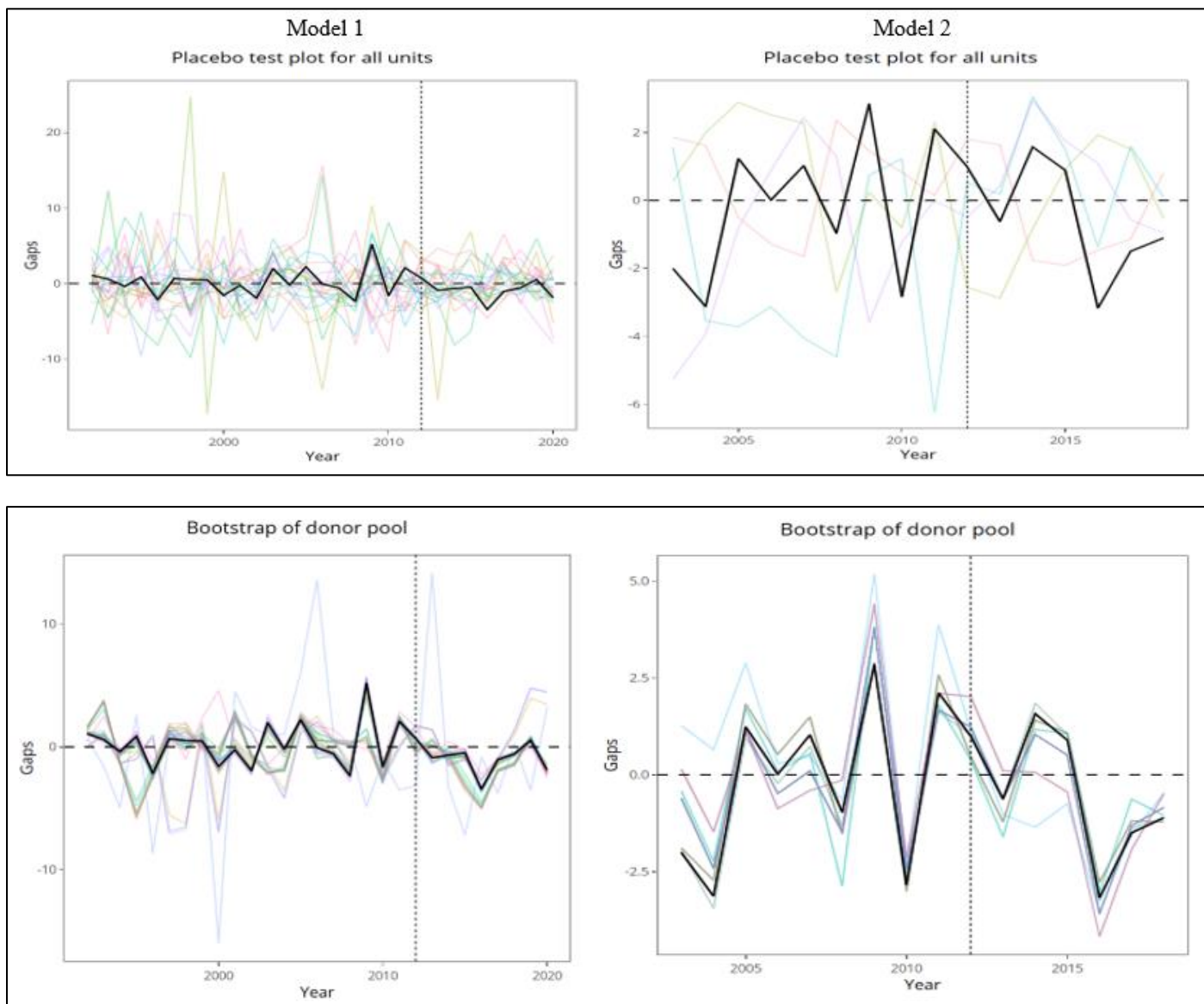


Fig 14C: Placebo Effect and Bootstrapping of Bangladesh under 2 Models

The comparative findings underscore the limitations of relying solely on currency devaluation as a policy tool. In contrast to Bangladesh, India’s consistent export performance (Figure 4.6A) amidst devaluation as observed in results of comparing countries demonstrates the benefits of a diversified export base and robust institutional support. Bhutan’s short-term benefits further emphasize that devaluation must be part of a broader strategic mix to achieve long-term success. These insights advocate for targeted reforms in Bangladesh’s key export sectors, particularly in ready-made garments (RMG), pharmaceuticals, and leather, focusing on reducing import reliance, improving technological infrastructure, and supporting small and medium enterprises (SMEs) with better access to financial tools. Additionally, broader initiatives such as improving logistics and maintaining stable inflation will help create the conditions for devaluation to contribute effectively to export growth.

- *Robustness Check*

The robustness check, conducted using placebo and bootstrap analyses, validates the main findings of the Synthetic Control Method (SCM). The significant post-intervention gaps observed for Bangladesh in comparison to placebo units confirm that the currency devaluation had a measurable impact on its export performance. Conversely, Bhutan’s varied results, particularly around the 2012 devaluation, indicate that additional factors may have influenced its export outcomes. India, showing consistent trends with minimal deviations, reflects resilience to devaluation, underlining the role of its diversified economy and sound macroeconomic policies. Using Model 1, Table 27 provides a comparative analysis of model outputs for Bangladesh, Bhutan, and India, focusing on pre- and post-intervention gaps and their statistical significance. The table includes coefficient values, p-values, and bootstrap confidence intervals for different time frames, highlighting variations in how currency devaluation impacts export performance across the three countries.

Table 27 Model Output Comparison

Bangladesh				Bhutan			India		
Variable	Value	P_value	Bootstrap_interval	Value	P_value	Bootstrap_interval	Value	P_value	Bootstrap_interval
gap_pre_3	1.89	0.13	[-0.055 , 2.07]	-2	0.74	[-3.091 , -1.653]	0.85	0.43	[0.039 , 1.258]
gap_pre_1	2.08	0.17	[-0.072 , 2.566]	-3.17	0.83	[-4.058 , -2.602]	0.38	0.35	[-0.423 , 1.063]
gap_post_1	-0.9	0.48	[-1.275 , 1.418]	2.62	0.04	[1.831 , 3.536]	1.7	0.26	[0.755 , 2.855]
gap_post_3	-0.69	0.57	[-1.339 , -0.225]	-1.04	0.7	[-1.365 , -0.685]	-0.87	0.61	[-1.478 , -0.441]
gap_last_1	-1.9	0.74	[-2.312 , 4.007]	-1.51	0.57	[-2.318 , 0.656]	2.06	0.04	[1.302 , 3.758]
gap_pre_all	0.23	0.3	[-0.739 , 0.289]	-0.03	0.48	[-0.397 , 0.258]	0.34	0.22	[0.081 , 0.502]
gap_post_all	-1.06	0.87	[-1.731 , 0.608]	-1.11	0.91	[-1.458 , -0.42]	-0.36	0.43	[-0.853 , 0.214]

Detailed non-parametric and parametric analyses further emphasize the adverse effects of devaluation on Bangladesh's export sector post-2012, with consistently widening negative gaps over subsequent years. Bhutan's mixed results support the notion that short-lived gains from

devaluation may diminish without strategic policy measures. India's stability in both estimations suggests that its comprehensive economic strategies have buffered it from adverse devaluation impacts.

Table 28 Non-Parametric Estimation

	Bangladesh			Bhutan			India		
	2.50%	mean	97.50%	2.50%	mean	97.50%	2.50%	mean	97.50%
2013	-1.2977	0.1812	4.6164	1.7578	2.9713	4.1907	0.6396	1.8138	3.0123
2014	-1.976	-0.7982	0.0072	-4.3275	-3.6799	-3.1465	-2.9578	-2.0633	-1.3813
2015	-4.4854	-1.463	-0.1612	-3.5219	-2.3466	-1.4838	-3.6204	-2.4207	-1.3882
2016	-5.0266	-3.6481	-1.8773	-5.3809	-4.3719	-3.4438	-1.2846	-0.0669	0.9825
2017	-2.4741	-1.3779	-0.8606	-2.6985	-2.1529	-1.7328	-2.5315	-1.2506	-0.2122
2018	-1.525	-0.6216	1.3156	-0.4976	0.068	0.8931	-0.2977	0.4294	1.2316
2019	-0.9779	0.7998	4.7629	1.5175	2.3534	4.0821	-1.9813	-1.3188	-0.2271
2020	-2.4304	-1.2334	4.4638	-2.4342	-1.1884	0.7457	1.1365	2.2368	4.3089

Using Model 1, Table 28 presents non-parametric estimation results for Bangladesh, Bhutan, and India, illustrating the 2.5%, mean, and 97.5% confidence interval bounds for each year from 2013 to 2020. The findings highlight differing impacts of devaluation on export values across these countries, with Bangladesh consistently showing negative mean values, while Bhutan and India exhibit more varied results, indicating potential resilience or differing economic conditions in response to currency shifts.

bootstrap intervals highlight the necessity for incorporating other economic determinants, reinforcing that devaluation in isolation does not foster substantial export growth. Using Model 1, Table 29 provides the parametric estimation results for Bangladesh, Bhutan, and India, showcasing the 2.5%, mean, and 97.5% confidence interval bounds from 2013 to 2020. The data reveals that Bangladesh consistently experiences negative mean values, suggesting significant challenges linked to devaluation. Bhutan's results indicate variability with positive mean values, implying some resilience, while India shows largely negative mean values, highlighting potential economic vulnerabilities in response to devaluation during the period studied.

Where Bangladesh exhibits persistent export declines, Bhutan's response fluctuates over time, and India demonstrates stable performance. High p-values and wide

Table 29 Parametric Estimation

	Bangladesh			Bhutan			India		
	2.50%	mean	97.50%	2.50%	mean	97.50%	2.50%	mean	97.50%
2013	-1.2925	0.0452	3.5125	1.74	2.9548	4.18	0.135	1.6248	2.74
2014	-1.3925	-0.7858	0	-2.095	-1.609	-0.9275	-1.51	-0.6287	0.0675
2015	-2.2875	-1.2565	0	-2.105	-1.6148	-0.935	-1.52	-0.6277	0.1
2016	-2.2875	-1.3377	0	-2.105	-1.6148	-0.935	-1.52	-0.6216	0.1475
2017	-2.2875	-1.3274	0.1925	-2.105	-1.6148	-0.935	-1.52	-0.6126	0.2175

2018	-2.2875	-1.1852	1.745	-2.105	-1.6148	-0.935	-1.52	-0.599	0.3225
2019	-2.2875	-0.9919	3.94	-2.105	-1.6148	-0.935	-1.52	-0.579	0.4875
2020	-2.2875	-0.8842	5.08	-2.105	-1.6148	-0.935	-1.52	-0.4116	3.17

These analyses confirm that while devaluation may temporarily influence export dynamics, its effectiveness is limited without aligning with robust, multifaceted economic strategies that address sector-specific challenges, infrastructure development, and macroeconomic stability.

D. Summary of Findings

The regression analysis presented in Table 22 and Table 17 provides a comprehensive understanding of the factors influencing export performance, focusing on the role of devaluation alongside broader macroeconomic variables. In Model 1 (Table 4.5), where devaluation is analyzed independently, the coefficient (0.0052623) indicates a modest and positive relationship with export value. However, when additional variables are incorporated in Model 2, the coefficient for devaluation increases to 0.0780833, signifying a more pronounced impact within a comprehensive economic framework. This progression highlights that devaluation's effectiveness is not standalone but is enhanced by complementary macroeconomic factors.

Monetary and fiscal indicators emerge as critical components in shaping export dynamics. Lending interest rates demonstrate a strong positive influence, with a coefficient of 0.644087, reflecting the potential role of higher rates in attracting investment or signifying robust economic activity that indirectly supports exports. Government expenditure also shows a substantial positive contribution (0.6362186), underscoring its importance in stimulating economic activity and enhancing export capacity. Conversely, final government consumption expenditure presents a negative coefficient (-0.3937499), suggesting inefficiencies or crowding-out effects where excessive public consumption detracts from private sector growth.

Trade-specific variables further elucidate export performance. The export value index consistently shows a positive relationship, with a coefficient of 0.1303643, emphasizing the critical role of enhancing the value of exported goods. However, the import value index exhibits a negative coefficient (-0.0374624), reflecting the challenges posed by reliance on imported inputs, which can offset the benefits of devaluation. Additionally, tech value added shows a modestly positive influence (0.0629497), pointing to the role of technological advancements in fostering export growth, albeit with limited statistical significance.

Broader macroeconomic factors reveal mixed impacts. Broad money has a negligible effect (0.0126171), suggesting that liquidity conditions alone are insufficient to drive export performance. Similarly, GDP per capita growth, with a weak positive coefficient (0.0431052), indicates that income growth plays a minor direct role in export dynamics. The barter terms of trade index, with an insignificant and negative

coefficient (-0.0045633), suggests that terms of trade do not substantially influence export performance in this context.

The regression findings underscore that while devaluation positively influences export performance, its impact is significantly enhanced when paired with structural reforms and macroeconomic stability. Key drivers include government expenditure, export value, and lending interest rates, while challenges such as reliance on imports and inefficient public spending detract from growth. These results reinforce the necessity of an integrated policy approach combining devaluation with targeted investments, technological advancements, and trade-specific strategies to optimize export competitiveness and foster sustainable growth.

Table 25 provides a detailed comparison between "Synthetic Bangladesh" and the actual economic scenario, revealing areas where Bangladesh's performance deviates from the optimal model. The comparative analysis between the treated and synthetic units, as illustrated by the table, highlights critical gaps in macroeconomic and trade-related variables, revealing insights into the effectiveness of devaluation and associated economic policies. While devaluation shows a minor positive gap of 0.11, suggesting a modest alignment with the synthetic control, broader economic indicators present varied results, emphasizing areas of strength and concern.

Trade-related variables such as the export value index demonstrate minimal divergence, with a gap of 0.02, indicating near-alignment between the treated and synthetic units. However, significant gaps are observed in the export volume index (-1.52) and import-related indices (-0.81 for value and -0.59 for volume), reflecting persistent challenges in export competitiveness and a reliance on imports. These gaps underline the need for strategies aimed at enhancing export efficiency and reducing import dependency to maximize the benefits of devaluation.

Macroeconomic indicators offer further insights. Government expenditure shows a negligible gap (0.03), suggesting effective alignment with the synthetic model, while final government consumption expenditure (-0.09) reveals minor inefficiencies in public spending. Lending interest rates and broad money exhibit minimal gaps (-0.02 and 0.02, respectively), highlighting balanced monetary policy measures. Conversely, inflation (-0.13) and GDP per capita growth (-0.12) reveal shortfalls, underscoring the importance of stabilizing prices and fostering equitable income growth.

Structural variables such as tech value added and barter terms of trade index display notable discrepancies, with gaps of 1.21 and 4.37, respectively. These findings point to technological underdevelopment and unfavorable trade

conditions as significant barriers to economic resilience. Additionally, foreign direct investment, with a negative gap of -0.03, indicates limited capital inflows, emphasizing the need for improved investment frameworks to support growth.

The analysis underscores that while devaluation contributes to shaping economic outcomes, its impact is deeply interconnected with broader macroeconomic and structural factors. Addressing gaps in trade efficiency, technological advancement, and investment climate is essential to leveraging devaluation as an effective policy tool for sustainable economic growth. The findings advocate for a comprehensive policy framework integrating trade, fiscal, and structural reforms to enhance alignment with synthetic models and achieve long-term resilience.

E. Results Summary

The findings indicate that while currency devaluation can contribute to some improvement in Bangladesh's export performance, its impact is modest and not sufficient to drive substantial export growth on its own. The analysis, utilizing both the Synthetic Control Method (SCM) and regression models, underscores the significance of broader economic factors such as barter terms of trade index, tech value addition, final government consumption expenditure, export volume index, import value index, import volume index etc. and sector-specific conditions in shaping the effectiveness of devaluation as an economic policy.

Devaluation's effects are context-dependent, influenced by both internal and external economic conditions. For example, comparisons with India reveal that while both countries share similar economic structures, devaluation has posed challenges in India as well, limiting the overall success of the strategy. This suggests that Bangladesh should explore strategies beyond regional comparisons, incorporating global best practices to improve export performance.

The study highlights India as a best possible relevant comparator, particularly due to shared ideological, historical and economic ties, including financial practices rooted in Islamic finance principles. These practices prioritize stability and fairness in economic transactions, offering potential insights for Bangladesh's policy framework. A balanced approach that integrates conventional market strategies with religiously rooted ethical finance principles could provide more resilient outcomes for Bangladesh.

Sector-specific findings show that while the Ready-Made Garments (RMG) industry benefits from low labor costs, it faces challenges such as dependency on imported inputs, which limit the positive effects of devaluation. The pharmaceutical and leather sectors are similarly affected by external challenges, including high raw material costs and stringent international standards. Targeted policy interventions, such as export incentives, subsidies, and SME support programs, are recommended to enhance sectoral competitiveness and better manage currency risk.

Technological investment, infrastructure improvements, and research and development (R&D) are

crucial for driving innovation and boosting productivity. Additionally, addressing logistical inefficiencies, controlling inflation, and ensuring stable input supplies are necessary measures to mitigate the negative impacts of devaluation. The study emphasizes the importance of policies that promote FDI, strengthen trade agreements, and support comprehensive economic planning to foster long-term growth and resilience.

The results suggest that a multifaceted strategy combining macroeconomic stability with sector-specific support, institutional reforms, and technological investment is essential for enhancing Bangladesh's export performance. This integrated approach not only aligns with market efficiency but also promotes social equity, ensuring a sustainable and balanced path for economic growth.

V. CONCLUSION

This study emphasizes that while currency devaluation can play a role in improving export performance, it is not a comprehensive solution to the complex challenges facing Bangladesh's export sector. The results from both the Synthetic Control Method (SCM) and regression analyses indicate that devaluation's effects are significantly influenced by broader economic factors, such as inflation, foreign direct investment (FDI), government expenditure, and sector-specific conditions. Comparative analysis highlights India as a relevant regional example, sharing similar economic structures and responses to devaluation. Despite India's strategic management of devaluation, it too faces negative consequences, suggesting that Bangladesh would benefit from exploring global strategies beyond regional comparisons to strengthen its export growth.

A key insight from this study is the relevance of India as a comparator for Bangladesh in understanding the dynamics of currency devaluation and export performance. Both countries share similar economic structures, with comparable challenges in sectors such as manufacturing and exports. Despite India's strategic management of devaluation, it has faced significant challenges, particularly in terms of inflation, capital flight, and corruption. This suggests that Bangladesh could benefit from examining India's experience to identify both successful strategies and areas where devaluation alone has not been sufficient. Beyond regional comparisons, Bangladesh should also look at global best practices to bolster its export growth. India's experience highlights the importance of a comprehensive policy approach, considering both macroeconomic stability and sector-specific support, to create a more sustainable export model.

To enhance export performance, Bangladesh needs to adopt a targeted, sector-specific approach. The Ready-Made Garments (RMG) sector, despite benefiting from cost-competitive labor, faces challenges from its reliance on imported inputs, which diminish the benefits of devaluation. The pharmaceutical and leather sectors also struggle with high raw material costs and international compliance standards. Tailored policies, such as export incentives,

subsidies, and support programs for high-growth industries like pharmaceuticals, agro-processing, and leather goods, are essential to foster sectoral competitiveness. Additionally, providing small and medium-sized enterprises (SMEs) with financial tools to manage currency risks is critical, as these businesses typically lack access to currency hedging mechanisms.

Investment in technology, research and development (R&D), and digital infrastructure is vital for driving innovation and improving global competitiveness. Policymakers must address logistical inefficiencies and reduce infrastructure costs to increase productivity. Additionally, maintaining inflation control and ensuring a reliable supply of essential inputs are necessary to mitigate the cost pressures that devaluation can exacerbate. Strengthening FDI policies and fortifying trade agreements will also play a crucial role in advancing technological progress, opening new market opportunities, and providing buffers against economic vulnerabilities. A strategic approach that considers the unique challenges of high-growth sectors, along with institutional reforms to improve governance and attract investment, is key to sustaining economic progress.

Bangladesh's export sector mirrors broader economic disparities often seen in the North-South divide, where resource flows are skewed against developing nations. Currency devaluation, while offering short-term relief, fails to address the underlying structural imbalances that persist. One of the key challenges for Bangladesh is capital flight, where significant outflows of foreign currency and investment hinder long-term economic stability and growth. Additionally, corruption remains a persistent issue, further undermining policy effectiveness and economic resilience. To develop a more equitable and resilient export model, Bangladesh must focus on policies that promote fair trade practices, improve labor productivity, and foster a transparent business environment. A comprehensive approach that addresses capital flight, reduces corruption, and strengthens governance structures is critical for overcoming these systemic issues and achieving sustainable growth.

By tackling these structural challenges and moving beyond the limitations of devaluation, Bangladesh can create a more competitive and stable export sector, paving the way for long-term economic prosperity.

In conclusion, this study advocates for an integrated policy approach that combines macroeconomic strategies to build resilience in Bangladesh's export sector. By focusing on structural reforms, technological adoption, and institutional improvements, Bangladesh can buffer itself against global economic fluctuations while achieving long-term growth that aligns with social equity. This strategy will help Bangladesh chart a path toward a more inclusive, sustainable, and balanced economic future.

POLICY RECOMMENDATIONS

Currency devaluation alone cannot address Bangladesh's complex export challenges. Findings from the Synthetic Control Method (SCM) and regression analyses indicate that the impact of devaluation is significantly influenced by broader economic variables such as inflation, FDI, government expenditure, and industry-specific factors. While India serves as a regional comparator with a parallel economic structure and approach to devaluation, its own struggles with devaluation effects suggest that Bangladesh must look beyond regional insights and incorporate globally competitive strategies to optimize its policies for export growth.

An important comparative insight comes from India, which share similar economic challenges and policy frameworks. India's experience with devaluation has highlighted the limits of currency depreciation as a standalone solution, as it has faced significant hurdles, including inflationary pressures and a reliance on imported inputs in key export sectors like the Ready-Made Garments (RMG) industry. Similarly, Neighbouring Pakistan's ongoing challenges with structural imbalances, such as political instability and weak governance, offer valuable lessons for Bangladesh. Bangladesh can learn from both countries' experiences by diversifying its approach to devaluation and focusing on complementary policies that can strengthen the overall export environment.

Sector-specific policy interventions are crucial for boosting Bangladesh's export performance. While the RMG sector has capitalized on labor cost advantages, it faces challenges related to import dependency that erode the benefits gained from devaluation. Similarly, the pharmaceutical and leather industries encounter significant barriers, including stringent international standards and costly raw materials. Tailored export incentives for high-potential sectors such as pharmaceuticals, agro-processing, and leather goods, as well as support programs for SMEs, are essential to enhance these industries' global competitiveness. SMEs, in particular, would benefit from greater access to financial tools that mitigate currency risk, addressing their current limitations in managing exchange rate volatility.

Investment in technological advancements, R&D, and digital infrastructure is critical for fostering innovation and enhancing productivity. Addressing logistical bottlenecks and reducing infrastructure expenses are equally important to elevate export efficiency. Consistent control of inflation and a stable supply of inputs will further ensure that exporters can manage devaluation-related cost pressures effectively.

Promoting FDI and enhancing trade agreements are strategic measures for facilitating technology transfer, expanding market access, and cushioning the economy against external shocks. A sector-focused approach that identifies and addresses the unique challenges of high-growth industries can complement these efforts. Institutional reforms aimed at governance improvements and investor confidence will also support these policy advancements.

Addressing the deeper issue of global economic disparities, which manifest in an uneven flow of wealth and resources from developing to developed nations, is fundamental. Currency devaluation does not resolve the structural imbalances that challenge developing countries like Bangladesh. A move toward fairer trade practices, enhanced labor productivity, and a robust business environment is necessary to promote sustainable growth.

This study recommends an integrated strategy that combines macroeconomic policies with targeted microeconomic interventions to bolster Bangladesh's export sector. Strengthening structural, technological, and institutional frameworks can foster economic resilience, reduce vulnerability to global economic changes, and align policy with broader goals of social equity and sustainable development. This comprehensive approach positions Bangladesh to pursue a balanced, inclusive, and forward-looking economic trajectory.

ACKNOWLEDGMENT

I am grateful to Prof. ZHAO Bo, Prof. LI Qiang, Prof. YUHang, Prof. ZHANG Junni, Prof. WANG Jinjie, Prof. FU Jun, Prof. ZHA Daojiong, Prof. LIN Yifu, Prof. Zhou Yongmei, Prof. PENG Cong, Prof. LIU Shiyao, Prof. HUANG Yiping of National School of Development and Institute of South-South Cooperation for allowing me learning with recent studies. I am also extending my sincere gratitude to all teaching assistants including Jiarui Li, Yanfei, Duan Dyr and Edward, Helen, Ding and all others from ISSCAD and PKU. In the end, I would also like to thank Institute for South-South Cooperation and Development (ISSCAD), Peking University for providing me with this opportunity with allocation of a lot of resource materials and specified methodology for developing such an important study.

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