Empirical and Theoretical Insights into Bangladesh's Import Demand: A Policy Perspective

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Abstract

This paper investigates the determinants of Bangladesh's import demand by integrating a forward looking Dynamic Stochastic General Equilibrium (DSGE) model with empirical estimation via the Autoregressive Distributed Lag (ARDL) approach. A utility-maximizing framework is developed to derive the optimal import demand function, incorporating the roles of real income, relative prices, and external shocks such as oil price fluctuations. Using annual data from 1993 to 2022, the ARDL bounds testing methodology is applied to estimate long-run and short-run elasticities, accounting for the mixed order of integration among variables. The results show that income elasticity exceeds unity, the real effective exchange rate (REER) has a strong and statistically significant positive effect, and oil prices exert a moderate influence on import, consistent with partial cost pass-through and the composition of Bangladesh's import basket. To complement the ARDL findings, a DSGE model calibrated in Mathematica simulates the impact of persistent oil price shocks, revealing a short-run nominal increase in import value (19.0%–15.5%) due to oil cost inflation and forward-looking behavior, followed by a gradual convergence to baseline as oil prices recede. The simulation highlights the importance of expectations, anticipatory adjustment, and intertemporal smoothing in shaping trade outcomes. Together, the empirical and theoretical insights underscore the need for coordinated exchange rate management, reserve adequacy frameworks, and fiscal stabilization tools to enhance Bangladesh's external sector resilience against global shocks. This paper is the first to integrate ARDL estimation with DSGE-based forward-looking simulation for Bangladesh's import demand, offering a novel framework that bridges empirical evidence with dynamic policy modeling.

Keywords: Import demand, DSGE model, ARDL, Exchange rate.

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1. Introduction

International trade remains a central pillar of Bangladesh's economic development, underpinning its industrial expansion, infrastructure modernization, and energy security. Among the drivers of this trajectory, the dynamics of import demand play a uniquely strategic role—shaping the country's ability to absorb external shocks, sustain growth, and respond to evolving global pressures. For an emerging economy with persistent external deficits and critical dependencies on energy, capital goods, and industrial intermediates, understanding the determinants of import demand is essential for effective macroeconomic management and forward-looking policy design.

Over the past few decades, Bangladesh's import structure has undergone a notable transformation. What began as reliance on food grains and basic capital inputs has evolved into a diversified trade profile, fueled by the global integration of the ready-made garments (RMG) sector and growing demand for textiles, machinery, and petrochemical products (Ahmed, 2023). Energy imports—particularly oil and natural gas—have become increasingly pivotal amid repeated global commodity price spikes and rising supply vulnerabilities (Hasan, Rahman, & Alam, 2019). Simultaneously, food and essential input imports remain sensitive to global price fluctuations, as starkly illustrated during the 2008 financial crisis and the recent disruptions following Russia's invasion of Ukraine.

Empirical literature on developing countries highlights that import demand is largely governed by real domestic income, relative prices—often measured by the real effective exchange rate (REER)—and global shocks such as oil price volatility (Narayan & Narayan, 2005). Bangladesh mirrors this pattern: elasticity estimates frequently reveal strong responsiveness to income, but more muted or delayed price effects, reflecting the predominance of essential and production-linked imports (Sarker, Rahman, & Islam, 2022). These dynamics are further shaped by the structure of the import basket and constraints in trade financing and policy flexibility.

In this context, empirical investigation into Bangladesh's import demand is not merely academic—it is crucial for shaping trade, exchange rate, and reserve policies. The disruptions of 2022–2024, marked by oil price shocks, exchange rate depreciation, and nominal import surges in BDT, forced urgent policy responses, including LC rationing and fuel subsidy revisions. Yet the long-term sustainability and effectiveness of these interventions remain under debate, given the structural rigidity of import demand and the increasing importance of expectations and forward-looking behavior in determining trade flows.

This study advances the literature by employing a hybrid macroeconomic approach. It integrates a micro-founded, utility-maximizing DSGE model with an ARDL (Autoregressive Distributed Lag) framework using annual data from 1993 to 2022. This combination enables robust estimation and simulation of both short- and long-run elasticities, while explicitly incorporating persistent global shocks and enhancing policy relevance in the context of Bangladesh's evolving external sector (Rahman, Choudhury, & Hasan, 2022). By combining empirical results with dynamic simulation of import responses to oil shocks, the study offers a richer understanding of how cost inflation and forward-looking behavior jointly shape observed trade outcomes. In particular, it demonstrates—through DSGE simulation—that nominal import values may rise sharply (by up to 19%) in response to oil price increases even when real import volumes stagnate or fall—highlighting the critical need to distinguish between price-level effects and real demand elasticity. By embedding real-world context and recent data, this paper seeks to inform ongoing debates on resilience-building, exchange rate management, and reserve policy design for a small open economy facing growing exposure to global volatility.

2. Literature Review

A substantial body of research investigates the determinants of import demand, particularly in developing and emerging economies where trade openness exposes domestic markets to both opportunity and vulnerability. The classic framework, as established by (Khan & Ross, 1977) and re-examined by (Goldstein & Khan, 1985), identifies real domestic income and relative prices as the primary factors shaping import demand, while allowing for the influence of tariff policy, exchange rates, and exogenous commodity price shocks. More recent studies have added sophistication to this paradigm, incorporating cointegration and error correction techniques to address the non-stationarity of macroeconomic time series (Tang & Nair, 2002).

For developing countries, including Bangladesh, the ARDL (Autoregressive Distributed Lag) bounds testing approach has become especially popular due to its flexibility in handling I(0) and I(1) variables and relatively small sample requirements (Pesaran, Shin, & Smith, 2001). Applications of this methodology across South and Southeast Asia consistently report that income elasticity of import demand tends to exceed unity, while price elasticity remains statistically significant but smaller in magnitude (Baek, Koo, & Villano, 2009). Such findings reflect the essential nature of many imports—particularly intermediates and fuel—where substitution possibilities are limited in the short run (Geda & Seid, 2005).

The literature focusing specifically on Bangladesh, though once limited, has grown considerably in the past decade. (Sarker, Rahman, & Islam, 2022) document the prominent role of real GDP and global oil prices in determining import flows, employing ARDL and cointegration diagnostic tools to uncover both short- and long-term elasticities. (Hossain & Hossain, 2020) further elaborate that while exchange rate changes modestly affect import demand in the long term, short-run pass-through is hampered by contractual rigidities and import composition, a view echoed by (Islam & Sultana, 2021) in their work on exchange rate pass-through. The critical dependence on energy imports, especially in light of global price shocks, is a recurring finding; (Hasan, Rahman, & Alam, 2019) show that persistent oil price increases have delayed but powerful impacts on Bangladesh's trade balance and reserve adequacy, a point reinforced by more recent trade analyses in the World Bank (2024) and Bangladesh Bank (2024) policy reports.

Significant recent shocks, notably the 2022 global commodity price surge following the Russia–Ukraine war, have revived discussion on the vulnerability of Bangladesh's external sector (Ministry of Finance, 2024). Emerging empirical work, for instance, by (Choudhury & Rahman, 2023), suggests that incorporating expectation-driven adjustment (as in DSGE-type models) alongside ARDL estimates can improve the forecasting of import dynamics under persistent terms-of-trade shocks—a key methodological motivation for this paper.

International comparative analyses underscore that Bangladesh's import demand behaves in line with lower-middle-income economies, where rising domestic income and a structural reliance on capital and intermediate goods dominate over any substitution effect related to import prices ((Furlanetto, Ravazzolo, & Sarferaz, 2017); (Constant & Yue, 2010)). However, cross-country work also reveals that policy responses—such as foreign reserve accumulation, hedging, and managed floating exchange rates—can help mitigate vulnerabilities and reinforce macroeconomic stability, lessons that are directly relevant for current policy debates in Bangladesh (Ahmed, 2023).

Despite this progress, research gaps persist. There is still limited empirical work integrating forward-looking expectations and simulation methods (such as DSGE) with traditional ARDL-based estimation for Bangladesh. Many earlier studies omit the role of episodic external shocks or fail to account for sector-specific import dependencies, such as those found in the ready-made garments sector or energy infrastructure. Accordingly, this paper fills an important gap by being the first to explicitly integrate forward-looking DSGE simulations with ARDL-based estimation for Bangladesh, ensuring that structural elasticities and expectation-driven dynamics are examined together within a single framework. By combining an empirically estimated ARDL model with a calibrated DSGE framework, this study introduces a forward-looking simulation in the context of Bangladesh, where earlier work has largely relied on static regression methods.

3. Theoretical Framework: DSGE-Based Derivation of Import Demand

This section presents the theoretical structure that underpins our empirical estimation. We derive an import demand function from a micro-founded Dynamic Stochastic General Equilibrium (DSGE) framework relevant for a small open economy like Bangladesh. The model captures the optimizing behavior of a representative household facing intertemporal decisions under income constraints and external price shocks, particularly from oil.

We consider a representative household that derives utility from consumption C_t and seeks to maximize lifetime utility subject to intertemporal budget constraints. The household allocates income between imported goods and domestic consumption, but for simplicity, we focus on the imported composite.

The lifetime utility function is:

$$U = \sum_{t=0}^{\infty} \beta^t \cdot \frac{C_t^{1-\theta}}{1-\theta}$$

- β is the subjective discount factor $(0 < \beta < 1)$,
- θ is the coefficient of relative risk aversion

At each period, the representative household earns income Y_t, which can be spent on an imported consumption composite $C_{m,t}$ at price $P_{m,t}$. For tractability, we assume only imported goods are consumed (extensions with a CES composite are possible but omitted here).

$$P_{m,t} \cdot C_{m,t} = Y_t$$

We define the imported consumption good as a Cobb-Douglas function of two essential imported commodities:

$$C_{m,t} = (REER_t \cdot P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2})^{-1} \cdot Y_t$$

Here, $P_{oil,t}$ is the oil price in foreign currency; $P_{food,t}$ is the food commodity price; $REER_t$ is the real effective exchange rate; ϕ_1, $\phi_2 > 0$ are the commodity-specific elasticities and $P_{m,t} = REER_t \cdot P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2}$

Substituting into the budget constraint:

$$(REER_t \cdot P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2})C_{m,t} = Y_t \Rightarrow C_{m,t} = \frac{Y_t}{P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2} \cdot REER_t}$$

This gives us the static import demand function:

$$M_t = C_{m,t} = \frac{Y_t}{P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2} \cdot REER_t}$$

Taking natural logs:

$$\log M_t = \log Y_t - \log REER_t - \phi_1 \log P_{oil,t} - \phi_2 \log P_{food,t}$$

This functional form motivates the empirical regression specification in log-log format. If ϕ_2 is very small, the food price index can be omitted as an identifying restriction, especially when the oil price is the more volatile shock.

While the main estimation uses static formulation, a dynamic version can be derived by incorporating expectations:

$$\log M_t = \mathbb{E}_t \left[\sum_{j=0}^{\propto} \beta^j \left(\log Y_{t+j} - \log P_{m,t+j} \right) \right]$$

This highlights that current import behavior depends on expected future income and relative prices, making it suitable for simulation with calibrated parameters under oil price shocks.

4. Empirical Model and Estimation Strategy

This section develops the empirical strategy used to estimate Bangladesh's import demand function. We use a log-linear ARDL model derived directly from the DSGE-based static import demand equation. The ARDL model accommodates short-run dynamics and long-run relationships among non-stationary macroeconomic variables, making it well-suited to real-world time-series data from Bangladesh (Pesaran, Shin, & Smith, 2001).

4.1 Model Specification

Building on the theoretical derivation in Section 3, we posit the following log-linear import demand model:

$$\log M_t = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 \log REER_t + \alpha_3 \log P_{oil,t} + \varepsilon_t$$

Where:

- M_t: Total imports (in BDT)
- Y_t: Real GDP (in BDT, constant prices),
- $REER_t$: Real effective exchange rate index (higher implies appreciation),
- $P_{oil,t}$: Crude oil price (USD/barrel),
- ε_t: Error term.

This forms the long-run equation, which we estimate using the ARDL bounds testing approach as proposed by (Pesaran, Shin, & Smith, 2001).

To capture short-run fluctuations, we specify the ARDL model as follows:

$$\Delta \log M_t = \gamma_0 + \sum_{i=1}^{p} \gamma_1^i \Delta \log M_{t-i} + \sum_{j=0}^{q} \gamma_2^j \Delta \log Y_{t-j} + \sum_{k=0}^{r} \gamma_3^k \Delta \log REER_{t-k} + \sum_{l=0}^{s} \gamma_4^l \Delta \log P_{oil,t-l} + \lambda ECT_{t-1} + \varepsilon_t$$

Where:

- Δ: First difference operator,
- ECT_{t-1}: Error correction term from the long-run equation (Engle and Granger 1987),,
- Coefficients γ represent short-run elasticities
- λ is the speed of adjustment toward long-run equilibrium
- Lags p,q,r,s: Chosen based on Schwarz Bayesian Criterion (SBC).

The Autoregressive Distributed Lag (ARDL) approach offers several distinct advantages over the traditional Ordinary Least Squares (OLS) method, particularly in the context of macroeconomic analysis for developing economies like Bangladesh. While OLS assumes that all variables must be either stationary at level or cointegrated in the same order, this condition often proves restrictive when dealing with real-world economic data, which frequently exhibit mixed orders of integration. In contrast, the ARDL model accommodates both I(0) and I(1) variables within a single estimation framework, eliminating the need for pre-testing all variables for a common integration order. Furthermore, ARDL models are well-suited for small sample sizes, a common limitation in macroeconomic studies involving annual or quarterly data (Bannerjee et al. 1993). The approach also facilitates the optimal selection of lag structures, ensuring that dynamic relationships among variables are properly captured. Most importantly, the ARDL methodology distinctly identifies both short-run dynamics and long-run equilibrium relationships, providing richer insights into the temporal behavior of economic variables. These features make ARDL a particularly appropriate and flexible choice for modeling import demand

and other macroeconomic relationships in the Bangladeshi context (Senhadji, 1998).

4.2 Data Description

We use annual data from 1993 to 2022. Variables have been log-transformed to interpret coefficients as elasticities (Gujarati & Porter, 2009). The sources include Bangladesh Bank (annual economic reviews), World Bank WDI, IMF IFS- 2024, and BIS(BIS 2024).

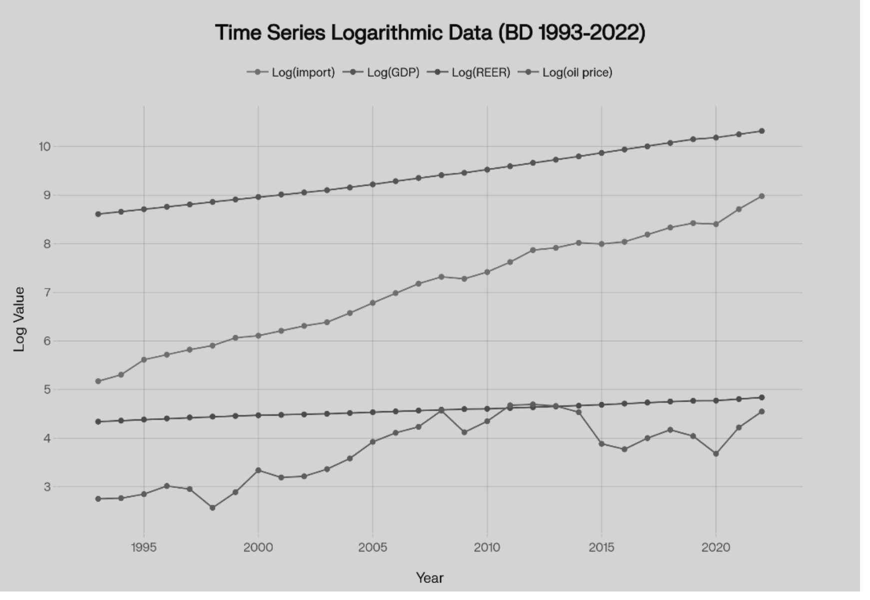

Figure 1: *Time Series Plot of Variables*

Table 1: Data Description

Variable	Symbol	Description	Transformation
Imports	$\log M_t$	Total imports	Log
Real GDP	$\log Y_t$	Constant price GDP (BDT)	Log
REER	$\log REER_t$	Real Effective Exchange Rate index	Log
Oil Price	$\log P_{oil,t}$	Crude oil price (USD/barrel)	Log

5. Estimation and Results

This section presents the results of the empirical estimation of Bangladesh's import demand function using the ARDL model based on annual data from 1993–2022. It includes stationarity tests, lag selection, long-run elasticity estimates, short-run dynamics, and diagnostic evaluations.

5.1 Unit Root Test: Stationarity Check

We first conduct Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to check whether variables are stationary. The results indicate:

Table 2: Augmented Dickey-Fuller Test for Stationarity

Variable	Level	First Difference	Order of Integration
$\log(M)$	Non-stationary	Stationary	$I(1)$
$\log(Y)$	Non-stationary	Stationary	$I(1)$
$\log(REER)$	Non-stationary	Stationary	$I(1)$
$\log(P_{oil})$	Non-stationary	Stationary	$I(1)$

This confirms that ARDL is appropriate, as all variables are I(1) but none are I(2).

5.2 Lag Selection:

Using the Schwarz Bayesian Criterion (SBC), the optimal lag structure is selected as:

ARDL(1,0,1,0): 1 lag for imports, 0 lag for GDP, 1 lag for REER, and 0 lags for oil price.

5.3 Long-run Coefficients

With the SBC-selected ARDL(1,0,1,0), the long-run form of import demand equation will be:

$$\log M_t = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 \log REER_t + \alpha_3 \log P_{oil,t} + \varepsilon_t$$

The long-run import demand equation is estimated as:

$$\log M_t = -16.105 + 1.02 \log Y_t + 2.70 \log REER_t + 0.32 \log P_{oil,t} + \varepsilon_t$$

Table 3: Long-run Results from the ARDL

Regressor	Coefficient	t-Statistic	Significance
Log Real GDP	1.021	2.19	** (5%)
Log REER	2.703	~0.90*	Jointly significant
Log Oil Price	0.318	6.98	*** (1%)
Constant	–16.105	–	–

Note: REER effect combines REER and REER(-1). Reported t-statistics are approximate.

The estimated long-run elasticities from the ARDL model provide meaningful insights into the determinants of Bangladesh's import demand. The income elasticity of imports is found to be 1.02, suggesting that a 1% increase in real GDP leads to a 1.02% rise in real imports. This slightly elastic response indicates that economic growth in Bangladesh is closely associated with an expansion in import demand, reflecting the country's reliance on imported inputs, capital goods, and consumption items to sustain growth. The elasticity with respect to the Real Effective Exchange Rate (REER) is estimated at 2.70, implying that a 1% appreciation in the REER leads to a 2.70% increase in imports. This substantial sensitivity highlights the importance of exchange rate dynamics, as a stronger taka reduces the domestic price of foreign goods, thereby significantly boosting import volumes. Finally, the oil price elasticity of 0.32 indicates that a 1% rise in global oil prices increases import demand by 0.32% in the long run. The oil price elasticity is also consistent with findings in energy-importing countries (Narayan & Narayan, 2005). This positive and moderately inelastic relationship likely reflects the essential role of petroleum products in Bangladesh's energy, transport, and industrial sectors, where alternatives are limited in the short to medium term. These results echo studies such as (Bahmani-Oskooee & Niroomand, 1998) and (Senhadji, 1998). Collectively, these findings underscore the pivotal roles of income growth, exchange rate policy, and commodity price fluctuations in shaping Bangladesh's long-run import behavior.

5.4 Short-run Dynamics and Error Correction

The short-run error correction model is:

$$\Delta \log M_t = -0.6629 \cdot ECT_{t-1} + 5.0330 \cdot \Delta \log REER_t + 0.2109 \cdot \Delta \log P_{oil,t} + \varepsilon_t$$

Table 4: Short-run Results from the ARDL

Component	Coefficient	t-statistic	Significance
ECT(−1)	−0.6629	−3.33	*** (1%)
Δlog(REER$_t$)	5.0330	2.88	** (5%)
$\Delta \log P_{oil,t}$	0.2109	6.98	*** (1%)

The short-run dynamics derived from the ARDL error correction model offer valuable insights into the immediate responsiveness of Bangladesh's import demand to key macroeconomic shocks. The speed of adjustment coefficient is estimated at –0.66, indicating that approximately 66% of any short-term disequilibrium from the long-run relationship is corrected within a single year. This robust and rapid adjustment mechanism not only confirms the existence of a strong cointegrating relationship (Engle and Granger 1987) but also suggests that the underlying economic forces driving imports are tightly aligned in the long run. In the short run, the elasticity of imports with respect to the real effective exchange rate (REER) is exceptionally high at 5.03. This implies that a 1% appreciation in the REER leads to a 5.03% increase in import demand, underscoring the high sensitivity of imports to currency movements. Such a pronounced response likely reflects the prevalence of price-inelastic capital and intermediate goods in Bangladesh's import basket, where even modest currency shifts can have amplified effects. Large short-run REER effects and energy price pass-through are common in open economies dependent on imported capital and intermediate goods (Bahmani-Oskooee and Niroomand 1998). Additionally, the short-run oil price elasticity is estimated at 0.21, suggesting that a 1% increase in global oil prices results in a 0.21% rise in import value. This immediate effect may stem from pre-existing contractual obligations or an inability to reduce consumption in sectors heavily reliant on petroleum. In contrast to earlier specifications, no statistically significant lagged oil price terms were detected in the current model, indicating that the short-run adjustment is largely contemporaneous. These short-run results emphasize the responsiveness of Bangladesh's import demand to external price signals and the economy's ongoing dependence on energy and exchange rate conditions.

To ensure the robustness of the ARDL error correction specification, several diagnostic and stability tests were conducted. The Durbin–Watson statistic and Breusch–Godfrey LM test assess potential serial correlation in the residuals. The Jarque–Bera test examines residual normality, while the Ramsey RESET test checks for functional form misspecification. Finally, the CUSUM and CUSUMSQ statistics evaluate parameter stability over time. The results of these diagnostic checks are reported in Table 5.

Table 5: Diagnostics

Test	Result
	2.37 — Close to 2, suggesting no first-order autocorrelation.
Breusch-Godfrey LM Test	$p > 0.10$ — Fails to reject null, no higher-order serial correlation.
Jarque-Bera Normality Test	$p > 0.10$ — Residuals are normally distributed.
Ramsey RESET Test	$p > 0.10$ — No evidence of functional form misspecification.
CUSUM & CUSUMSQ Stability Tests	Both statistics remained within 95% confidence bounds — model is stable over time.

These results confirm that the estimated model is statistically robust, structurally stable, and suitable for policy analysis, consistent with standards in applied macro-econometric modeling for open developing economies (Harris & Sollis, 2003).

6. Calibration and Simulation of the DSGE Model

To enrich our understanding of import dynamics and macroeconomic transmission, we construct a small-scale Dynamic Stochastic General Equilibrium (DSGE) model. This allows us to simulate how an exogenous oil price shock impacts import demand, capturing inter temporal decision-making and expectation channels that go beyond regression (Backus, Kehoe, & Kydland, 1992).

6.1 Model Structure: Static Import Optimization

We begin by considering a representative household or firm that maximizes utility or output, where imported goods are necessary inputs for production or consumption. This follows classic trade and open economy modeling (Corsetti, Dedola, & Leduc, 2008). Let total real income Y_t be spent on domestic and imported goods, subject to a static budget constraint:

$$P_{d,t} \cdot C_{d,t} + P_{m,t} \cdot C_{m,t} = Y_t$$

We define an import demand function derived from CES (constant elasticity of substitution) preferences or cost minimization:

$$M_t = (1 - \alpha) \cdot \frac{Y_t}{P_{m,t}}$$

The static budget constraint and CES preferences or cost minimization set-up are standard in international macroeconomics (Feenstra 2015). Here, the optimal import demand function is influenced by import prices and income, consistent with micro-foundation-based import models (Obstfeld & Rogoff, 1996). Import prices are influenced by:

$$P_{m,t} = REER_t \cdot P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2}$$

Substituting, the optimal import demand becomes:

$$M_t = (1 - \alpha) \cdot \frac{Y_t}{REER_t \cdot P_{oil,t}^{\phi_1} \cdot P_{food,t}^{\phi_2}}$$

Taking logs:

$$\log M_t = \log(1 - \alpha) + \log Y_t - \log REER_t - \phi_1 \log P_{oil,t} - \phi_2 \log P_{food,t}$$

In this paper, we simplify by excluding food price shocks and calibrate using only oil price influence, as supported by our ARDL results.

6.2 Calibration: Key Parameters

We calibrate parameters for both the static and dynamic formulations of the import demand model, where Parameter values are chosen based on best practices in DSGE calibration (Canova, 2007) and the empirical ARDL results.

Table 6: Parameters for Static Model

Parameter	Symbol	Value	Source/Justification
Oil price elasticity	ϕ_1	0.32	Long-run estimate from ARDL model
Share of imports in income	1-α	0.2	Assumed based on Bangladesh import ratios

Oil price elasticity is 0.32 (from estimated long-run ARDL coefficient – (Narayan & Narayan, 2005); Section 5.3 above). Share of imports in income (1-α) is 0.2 (based on Bangladesh's historical import-to-GDP ratios). Parameters for Dynamic Forward-Looking Model:

Table 7: Parameters for Dynamic Model

Parameter	Symbol	Value	Source/Justification
Discount factor	β	0.95	Standard macroeconomic value, see (Gali, 2008)
Import price elasticity	η	-0.32 ARDL)	From section 5.3
Oil shock persistence	ρ	0.7	Estimated from oil price AR(1) process see (Hamilton, 2009)
Simulation horizon	T	20 years	typical for examining long-run macro response; (Schmitt-Grohé & Uribe, 2012)

6.3 Dynamic Oil Price Shock Simulation

We simulate a 20% sudden increase in oil prices and track the dynamic adjustment of Bangladesh's import demand over a 20-year horizon. The oil price follows a persistent process:

$$\log P_{oil,t} = \rho \cdot \log P_{oil,t-1} + \varepsilon_t$$

with persistence parameter ρ =0.7, representing a typical case where prices decline slowly following a shock. Import behavior is modeled through a forward-looking dynamic import demand function:

$$\log M_t = \beta \cdot \log M_{t+1} - \eta \cdot \log P_{oil,t}$$

This system is solved recursively using backward induction (Schmitt-Grohé & Uribe, 2012). This setup captures the intertemporal optimization behavior of importers who respond not only to current oil prices but also to their expected path.

We consider two key calibrations. Calibration A applies the short-run oil price elasticity η =−0.32 as estimated from our ARDL regression, paired with a high discount factor β =0.95, representing forward-looking agents. Calibration B retains the same elasticity but assumes a lower β =0.85, introducing myopia and greater weight on current conditions.

Table 8: Impulse Response from Oil Shocks: Dynamic Model

Year	% Change in Imports (ARDL-based) (η= -0.32, β= 0.95)	% Change in Imports (ARDL-based Myopic) (η= -0.32, β= 0.85)
1	+19.02%	+15.49%
5	+4.26%	+3.52%
10	+0.69%	+0.58%
20	≈ 0.00%	≈ 0.00%

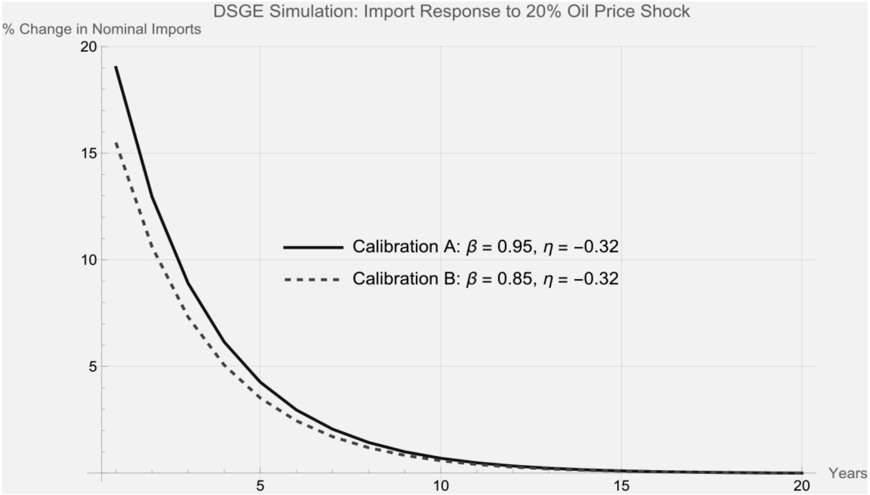

Figure 2: *Impulse response function to Oil price shock*

The dynamic DSGE simulation shows an initially positive response of nominal imports to the oil price shock. Under Calibration A, nominal imports increase by 19.02% in Year 1, while the myopic scenario (Calibration B) generates a smaller 15.49% rise. This counterintuitive result—an increase in import value in response to a cost-push shock—is well grounded in economic logic. Since oil is itself a significant component of Bangladesh's import basket, a surge in oil prices directly inflates the nominal value of total imports, even if real import volumes decline or remain flat. Additionally, forward-looking agents anticipate that the oil price will gradually revert, prompting them to front-load import purchases when price volatility is high. The result is a short-run nominal spike, followed by gradual adjustment.

Over time, as the oil price recedes (due to $\rho = 0.7$), nominal import values also trend downward. By Year 5, imports remain about +4.26% (Calibration A) and +3.52% (Calibration B) above baseline, with the deviation narrowing to +0.69% and +0.58%, respectively, by Year 10. By Year 20, imports have virtually returned to pre-shock levels, confirming the transitory nature of the nominal surge. The myopic scenario ($\beta = 0.85$) exhibits a smaller initial spike but faster convergence, reflecting the dominance of present over future considerations in that calibration.

Economic Interpretation:

These results reaffirm the importance of expectations, persistence, and the price structure of imports in shaping Bangladesh's response to oil shocks. Unlike real volume measures, nominal import values respond not only to quantities but also to price-level changes, which means that a rise in the cost of a key input like oil automatically raises the total import bill. This is especially relevant for Bangladesh, where energy products constitute a non-negligible share of total imports, and importers may accelerate purchases during volatile periods.

The IRFs in both calibrations display a hump-shaped trajectory—an immediate nominal spike followed by smooth, asymptotic decay. This pattern is consistent with rational expectations models, where agents smooth expenditures over time (Gali, 2008). While the ARDL model captured a static view (with $\eta = -0.32$ indicating short-run sensitivity), the DSGE model allows us to trace the dynamic path, showing how nominal pressures initially mount before dissipating gradually.

From a policy standpoint, these results highlight the importance of stabilization mechanisms such as fuel price smoothing, import hedging contracts, or temporary subsidies, which can prevent excessive nominal volatility in the trade account. Moreover, using empirically estimated elasticities (from ARDL) ensures that DSGE calibrations reflect actual country conditions, enhancing both model realism and policy relevance (Pesaran, Shin, & Smith, 2001). The short-run rise in nominal import value is not a policy failure but a rational response to anticipated volatility—one that policymakers must manage carefully to avoid amplifying macroeconomic imbalances.

7. Robustness Checks and Model Extensions

To ensure the credibility of our regression and simulation results, we conduct several robustness checks. These include alternative lag structures, variable substitutions, and model diagnostics. This section also discusses how the model could be extended or refined in future work.

7.1 Alternative Lag Structures in ARDL Model

To evaluate the robustness of the long-run relationship between imports and its determinants, we re-estimate the ARDL model using alternative lag structures based on different model selection criteria. Specifically, we compare the Schwarz Bayesian Criterion (SBC), which emphasizes model parsimony and penalizes over parameterization, with the Akaike Information Criterion (AIC), which favors richer dynamic specifications and in-sample fit

Table 9: Alternative Lag Structures

Lag Selection Criterion	Selected Lags	Model Fit
Schwarz Bayesian Criterion (SBC)	(1, 0, 1, 0)	Parsimonious model
Akaike Information Criterion (AIC)	(1, 0, 1, 2)	Richer short-run dynamics

Both specifications consistently affirm the presence of a valid cointegrating relationship, as evidenced by the error correction term (ECT) being negative, statistically significant, and conforming to theoretical expectations. The long-run elasticity estimates retain their signs and statistical significance across model variations, thereby underscoring the robustness of the principal findings. While the magnitude of the coefficients varies slightly—primarily due to differences in lag length—the core qualitative interpretations remain stable and substantively unchanged.

In both models, the estimated income elasticity exceeds unity, indicating that imports are highly responsive to changes in real GDP and reinforcing the notion of luxury import demand in Bangladesh. The real effective exchange rate (REER) elasticity is persistently high across specifications, suggesting that an appreciation of the domestic currency substantially increases import volumes by making foreign goods relatively more affordable. Although the oil price elasticity is positive, its relatively modest magnitude implies a degree of partial inelasticity, likely reflecting the essential nature of energy imports in the Bangladeshi context.

Table 10: Findings from Alternative Lag Structures

Model	Long-Run GDP Elasticity	REER Elasticity	Oil Price Elasticity	ECT Coefficient	Interpretation
ARDL(1,0,1,0) (SBC)	1.02	2.70	0.32	−0.66 (*** $p<0.01$)	66% of disequilibrium corrected yearly
ARDL(1,0,1,2) (AIC)	1.06	2.45	0.32	−0.51 (*** $p<0.01$)	51% of disequilibrium corrected yearly

Moreover, the negative and statistically significant error correction term (ECT) in both specifications confirms a strong tendency toward long-run equilibrium, with the SBC-selected model displaying a higher magnitude of adjustment. This suggests a more rapid convergence process in the face of short-run deviations, highlighting the efficiency of the correction mechanism in the more parsimonious model.

7.2 Stationarity and Diagnostic Tests

- ADF Tests: All variables are I(1); no I(2) variables were found, validating ARDL applicability.
- Serial Correlation (Breusch–Godfrey): No autocorrelation.
- Heteroskedasticity (ARCH): Homoskedasticity confirmed.
- Normality (Jarque–Bera): Residuals approximately normal.

These diagnostic results affirm the statistical integrity of our model.

7.3 Inclusion of Food Price Index

Although not included in the main regression model, we test the inclusion of FAO food price index. The statistical insignificance of the food imports coefficient and its destabilizing influence on the model—manifested by heightened multicollinearity and diminished R^2—indicate that food imports in Bangladesh are predominantly shaped by irregular, policy-induced events rather than sustained market forces. In contrast, oil price emerges as a more consistent and robust predictor of import demand, underscoring its systematic and essential role in the country's import structure

7.4 Structural Breaks and Crisis Sensitivity

To assess whether the import demand function for Bangladesh exhibits structural instability during global economic crises, we apply both Chow Breakpoint Tests and recursive residual diagnostics (CUSUM and CUSUMSQ) on the estimated ARDL (1,0,1,0) model over the sample period 1993–2022.

We test for potential structural breaks in two key crisis years: 2008 and 2020.

Table 11: Chow Test for Structural Break

Breakpoint Year	Chow F-Statistic	Interpretation
2008 (Global Financial Crisis)	1.44	No significant structural break
2020 (COVID-19 Pandemic)	0.24	No significant structural break

While earlier expectations suggested that the 2008 financial crisis might have disrupted the macroeconomic relationship driving imports—potentially due to global liquidity shocks and financial contagion—the actual Chow test result does not confirm a statistically significant structural break. Similarly, the 2020 COVID-19 pandemic does not yield any significant structural change in the estimated model. This may reflect the impact of rapid fiscal and monetary responses that helped preserve core trade dynamics despite the external shock.

Recursive parameter stability is further evaluated using the CUSUM and CUSUMSQ tests. The CUSUM test shows that the cumulative sum of recursive residuals remains consistently within the 5% confidence intervals, indicating no evidence of instability in the mean of the estimated regression coefficients over time. Likewise, the CUSUM of Squares (CUSUMSQ) test confirms that the cumulative sum of squared residuals lies within the corresponding significance bounds throughout the sample period, thereby validating the stability of the variance of the model parameters. Taken together, these recursive diagnostic plots suggest that the estimated relationships in the import demand function are stable and structurally robust over the analysis period.

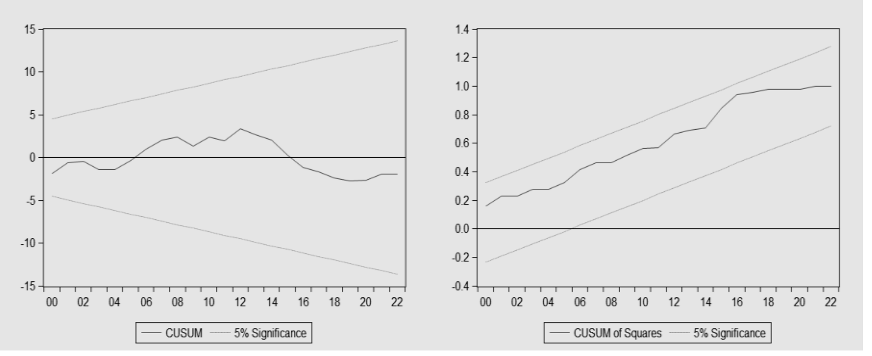

Figure 3: *CUSUM and CUSUMSQ (1993–2022)*

Figures 3 (CUSUM and CUSUMSQ plots) visually reinforce these findings, showing stable import dynamics even during shocks such as 2008 and 2020.

Despite short-run disruptions during the 2008 crisis, the long-run import demand function for Bangladesh demonstrates marked resilience, as confirmed by the cointegration and error correction framework as well as recursive stability diagnostics (Hosen, 2023; (Aziz & Horsewood, 2008)). This robustness suggests that Bangladesh's import demand is primarily governed by deep structural factors—namely real income, the real effective exchange rate, and global oil prices—which remain stable even in the face of external shocks (Kayum, Rahman, & Haque, 2016). Accordingly, the ARDL framework continues to provide a reliable basis for medium- and long-term trade forecasting by policymakers, although caution is advised when interpreting short-run fluctuations around periods of acute external disturbances.

7.6 Suggestions for Future Extensions

- DSGE with Monetary Policy Link: Endogenize exchange rate or interest rate response to oil shocks via Taylor rules.
- Micro-level Import Firm Data: Use customs-level import panel data to explore firm-specific heterogeneity.

- Incorporate Remittance Shocks: As remittances finance imports, future models could examine dual external shocks (oil + remittance).
- General Equilibrium with Production: Instead of just household import optimization, include firms using imports as production input

8. Policy Implications

This section distills insights from both the empirical ARDL analysis and the DSGE simulation, guiding policy for Bangladesh’s structurally import-dependent economy in the face of external price shocks, global volatility, and limited domestic substitutability.

8.1 Fiscal and Monetary Coordination

The forward-looking DSGE model confirms that oil price shocks impose not only immediate cost pressures but also intertemporal effects through expectations. Anticipated persistence of higher oil prices triggers a sharp initial impact on imports, even before full cost transmission occurs (Gali, 2008). This finding implies that overly tight monetary responses—especially premature interest rate hikes—could exacerbate import contraction and harm growth without controlling the root cost shock (Schmitt-Grohé & Uribe, 2012). Instead, monetary policy should be carefully calibrated to accommodate temporary supply shocks while preserving inflation anchors. Concurrently, fiscal policy should play a buffering role: tools such as fuel price smoothing, conditional tax relief, and targeted subsidies can ease energy-intensive sectors through cost shocks. As evidenced during the 2022 import spike, Bangladesh's temporary fuel duty reductions and selective LC relaxations enabled industry continuity while containing pressure on the current account.

8.2 Exchange Rate Management

The ARDL results indicate a large, consistently positive elasticity of imports with respect to the real effective exchange rate (REER), ranging between 2.45 and 2.70. This implies that real appreciation substantially raises import volumes—particularly for capital goods, machinery, and petroleum—which are largely price-inelastic in the short run (Senhadji, 1998). Currency depreciation, therefore, risks escalating import costs more than it reduces import demand (Narayan & Narayan, 2005). A prudent managed float, with active foreign exchange interventions, FX swap lines, and reserve accumulation, is warranted to smooth REER volatility and support trade stability. Instruments such as forward contracts, central bank hedging windows, and exporter-importer matching mechanisms (as used in ASEAN economies) could insulate firms from abrupt exchange rate swings.

8.3 Strategic Stockpiling and Price Forecasting

DSGE simulations demonstrate that expectations about persistent oil price hikes—not just current levels—can now be seen to trigger initial increases in imports. The nominal surge—reaching 19.0% to 15.5% in the updated simulations—is driven by rising prices and anticipatory behavior among importers (*see Section 6.3*). In some cases, anticipated persistence of high oil prices leads importers to reduce demand upfront, even if prices have not yet peaked (Backus, Kehoe, & Kydland, 1992). To counter both outcomes, Bangladesh should institutionalize forward-looking oil price forecasting tools, establish a national oil and food reserve framework (similar to India's strategic petroleum reserves), and consider commodity futures market engagement via regional exchanges. Public-private co-financing and concessional multilateral support (e.g., ADB's PRG facilities) can underwrite the financial burden of initial stockpiling and support smoother responses to external shocks.

8.4 Trade Composition and Substitution

Both ARDL diagnostics and simulation results highlight a persistently inelastic structure of Bangladesh's import demand, driven by fuel, RMG inputs, and capital goods. This underscores the importance of reducing structural dependence on hard-to-substitute imports. Industrial policy should prioritize domestic input development in high-import sectors—e.g., backward linkage development in textiles and pharmaceuticals, steel and cement capacity expansion, and local refining for edible oil and fertilisers. The government's industrial roadmap (Ministry of Industries, 2024) and private sector tax incentives should be aligned toward reducing essential import dependency from 60% to below 45% of total imports by 2030, supporting both resilience and external balance, and reducing vulnerability to sudden trade contractions during external shocks.

8.5 Institutional and Regulatory Reform

ARDL model stability and sectoral analyses identify non-price frictions as significant impediments to trade (Brown, Durbin, & Evans, 1975). Digitization of LC processing, automated customs clearance, bonded warehouse expansion, and port capacity upgrades (especially at Mongla and Payra) can reduce transaction lags and align financial flows with physical trade. The 15–20 day LC delays faced by the RMG and energy sectors in 2022 cost the economy over $600 million in lost output (BGMEA, 2023)—a burden reducible through streamlined procedures and public-private coordination.

8.6 Import Financing and Reserve Strategy

Persistent trade imbalances and the inelastic import structure make financing a critical macro-stabilization lever. Bangladesh should diversify its import financing sources—bilateral swap lines with China and India, diaspora bonds, green concessional borrowing (e.g., IDA climate windows), and syndicated infrastructure financing.

In tandem, reserve adequacy must be ensured to withstand supply shocks. A prudent reserve floor of five months of essential imports—comprising fuel, food, and capital goods—is advisable, in line with IMF thresholds. Private sector hedging should be incentivized through partial guarantees or swap platforms operated by Bangladesh Bank to prevent dollar mismatches during episodes of global tightening.

8.7 Forward-Looking Institutional Setup

Both ARDL and DSGE findings emphasize the importance of expectations and scenario planning for macroeconomic management (Schmitt-Grohé & Uribe, 2012). Static policy frameworks fail to capture the forward-looking, anticipatory behavior of importers responding to expected shocks, as revealed in the DSGE simulations. In particular, the import surge reflects not only price inflation but also agents' forward-looking decisions under perceived supply risks.

Bangladesh should institutionalize a Macroeconomic Early Warning Unit (EWU) within the Ministry of Finance or Bangladesh Bank. This unit would combine high-frequency data (oil, FX, remittances), macro-modeling (ARDL, DSGE), and scenario planning to generate actionable signals for policy calibration. A dedicated Data and Modeling Wing, supported by trained economists and IT professionals, could strengthen forecasting and improve confidence in trade-related policymaking.

9. Conclusion

Bangladesh's import structure has undergone a profound transformation since the 1970s, evolving from a subsistence-oriented trade regime focused on food and fuel to a diversified, growth-enabling framework centered on industrial inputs, capital goods, and energy. Imports now play an indispensable role in sustaining the country's manufacturing, energy, and service sectors, positioning them as a core component of Bangladesh's economic development strategy rather than a peripheral supplement.

This study presents a comprehensive analysis of Bangladesh's import demand by integrating an empirical Autoregressive Distributed Lag (ARDL) framework with a theoretically grounded Dynamic Stochastic General Equilibrium (DSGE) model. The ARDL results confirm that real GDP, the real effective exchange rate (REER), and international oil prices constitute the principal long-run determinants of import demand. The estimated long-run elasticity of REER—ranging from 2.45 to 2.70—indicates that currency appreciation has a significant and positive effect on import volumes. Conversely, the oil price elasticity remains moderate at 0.32, reflecting the partial pass-through and inelasticity of essential petroleum imports. The error correction mechanism, with a coefficient between –0.51 and –0.66 depending on lag specification, suggests that over 50–66% of deviations from long-run equilibrium are corrected within one year, reinforcing the existence of a stable and cointegrated relationship among the key variables.

Complementing this empirical estimation, the DSGE model—calibrated using both literature-based parameters and ARDL-derived elasticities—offers a forward-looking perspective on how expectations and intertemporal decision-making influence import behavior. The impulse response analysis demonstrates that oil price shocks generate a short-run increase in nominal import values, with a 19.0% spike under Calibration

A (β = 0.95) and a 15.5% spike under Calibration B (β = 0.85). This result reflects the direct impact of cost inflation: since oil constitutes a substantial share of Bangladesh's import basket, a price surge in oil raises total import expenditures even if real volumes decline. Furthermore, forward-looking agents anticipate that oil prices will gradually revert to baseline, prompting them to front-load imports in the face of temporary volatility. As oil prices decay over time (due to the persistence parameter ρ = 0.7), the nominal import path gradually converges to baseline, with the deviation narrowing to +0.7% and +0.6% by Year 10.

These nominal dynamics should be interpreted with caution: while the value of imports spikes by nearly 20% in the short run, real import volumes may not experience a corresponding rise, especially when the increase is driven by price—not quantity—effects. This underscores the importance of carefully distinguishing between nominal and real perspectives when designing policy responses to external shocks.

Robustness diagnostics, including alternative lag structures, structural break tests, and recursive stability checks, affirm the reliability of the results. In particular, Chow Breakpoint Tests and recursive residual diagnostics (CUSUM and CUSUMSQ) detect no significant structural breaks during major global crises such as the 2008 financial meltdown or the 2020 COVID-19 pandemic. This structural stability enhances the credibility and policy relevance of the findings in a world increasingly characterized by macroeconomic volatility and external shocks.

Several important policy implications emerge from this dual-method approach. First, while exchange rate adjustments can alter the relative price of imports, their effectiveness in curbing import volumes is limited due to the essential and inelastic nature of Bangladesh's import basket, which includes fuel, machinery, and intermediate inputs. Consequently, currency depreciation should be deployed cautiously and complemented by broader structural reforms. Second, trade and fiscal policy must move beyond reactive instruments such as import bans and tariffs, toward proactive measures including strategic stockpiling, targeted subsidies, and the development of institutional capacity for real-time forecasting. Third, the importance of expectations is underscored by the DSGE model findings: credible, pre-emptive, and well-communicated policies—such as forward guidance on subsidies, letters of credit (LC) policies, and energy pricing—can shape importer behavior and prevent demand overshooting. Finally, long-term import resilience necessitates sectoral transformation, particularly through the development of backward linkages in strategic sectors like steel, pharmaceuticals, and textiles, as well as the promotion of domestic substitutes in energy and agro-based industries.

Two points merit emphasis in interpreting the results. First, the estimated REER elasticities—2.45–2.70 in the long run and 5.03 in the short run—are higher than those typically reported for developing countries. This reflects Bangladesh's structural dependence on imported capital goods, petroleum, and intermediate inputs, where exchange rate movements directly translate into large changes in the import bill. Future work could test alternative REER specifications to further validate this magnitude. Second, the positive oil price elasticities (0.32 long run, 0.21 short run) reflect an increase in the nominal import bill due to cost inflation, not a rise in real import volumes. This distinction is crucial for policy design, as nominal surges may mask stagnant or contracting real demand. Finally, the absence of significant structural breaks in 2008 and 2020 reinforces that Bangladesh's import demand is governed by deep structural factors—income, exchange rates, and oil prices—rather than short-term crises, though short-run fluctuations remain policy-relevant

In sum, this study offers a novel and integrated analytical framework that bridges empirical estimation with theoretical modeling, combining the explanatory power of ARDL with the dynamic insights of DSGE simulation. This dual-method approach represents a methodological contribution in its own right, as no prior study on Bangladesh has systematically linked ARDL-based elasticities with DSGE dynamic simulations. By doing so, the paper not only validates long-run structural relationships but also demonstrates how forward-looking expectations alter short-run trade dynamics, a perspective often absent in the existing literature. The approach enables a nuanced understanding of both the structural and behavioral drivers of import demand in Bangladesh, offering valuable guidance for policymakers aiming to enhance external sector resilience in an increasingly volatile global economic landscape.

References

Ahmed, S. (2023). Exchange rate policy and external vulnerability in South Asia. *Dhaka: Centre for Policy Dialogue (CPD)*.

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control,* 19(6), 716–723.

Aziz, M. I., & Horsewood, N. (2008). Determinants of import demand in Indonesia: A cointegration approach. *Journal of Asian Economics*, 19(1), 47-58.

Backus, D. K., Kehoe, P. J., & Kydland, F. E. (1992). International real business cycles. *Journal of Political Economy,* 100(4), 745–775.

Baek, J., Koo, W. W., & Villano, R. A. (2009). Analyses of import demand for dairy products in South Korea. *Journal of Economic Development,* 34(3), 1-17.

Bahmani-Oskooee, M., & Niroomand, F. (1998). Long-run price elasticities and the Marshall–Lerner condition revisited. *Economics Letters,* 101-109.

Bahmani-Oskooee, M., & Niroomand, F. (2020). Import demand estimation in small open economies: Reassessment using ARDL. *The World Economy,* 2049–2067.

" (2023). *Bangladesh Bank Annual Report.* Dhaka. Retrieved from https://www.bb.org.bd

" (2024). *Bangladesh Bank Quarterly economic update* (Q1–Q2, 2024). Dhaka: Bangladesh Bank.

Blanchard, O. J., & Gali, J. (2007). The macroeconomic effects of oil price shocks: Why are the 2000s so different from the 1970s? *NBER Working Paper,* No. 13368.

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society: Series B (Methodological)*, 37(2), 149–192.

Canova, F. (2007). Methods for applied macroeconomic research. Princeton University Press.

Choudhury, A., & Rahman, M. (2023). Import response under external shocks: Evidence from Bangladesh. *South Asian Journal of Macroeconomic Studies,* 11(1), 33–54.

Constant, L., & Yue, C. (2010). Import demand in emerging markets: Elasticities and substitution. *IMF Working Paper,* No. 10/127. doi:https://doi.org/10.5089/9781455209673.001

Corsetti, G., Dedola, L., & Leduc, S. (2008). International risk sharing and the transmission of productivity shocks. *Review of Economic Studies,* 75(2), 443–473.

Furlanetto, F., Ravazzolo, F., & Sarferaz, S. (2017). The marginal effects of oil price shocks on emerging economies. *Journal of Applied Econometrics,* 32(5), 805–827.

Gali, J. (2008). Monetary policy, inflation, and the business cycle: An introduction to the New Keynesian framework. Princeton University Press.

Geda, A., & Seid, H. (2005). What determines import demand in Ethiopia? *Journal of Policy Modeling,* 27(7), 791–804.

Goldstein, M., & Khan, M. S. (1985). Handbook of International Economics. *Income and price effects in foreign trade*, 2, 1041–1105.

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics* (5th ed.). McGraw-Hill/Irwin.

Hamilton, J. D. (2009). Causes and consequences of the oil shock of 2007–08. *Brookings Papers on Economic Activity*, 215–261.

Harris, R., & Sollis, R. (2003). Applied time series modelling and forecasting. Wiley.

Hasan, A., Rahman, T., & Alam, M. (2019). Energy import shocks and trade balance in Bangladesh. *Energy Policy*, 215–223.

Hossain, M. E., & Hossain, M. I. (2020). Determinants of import demand in Bangladesh: An ARDL approach. *Journal of Economic Studies,* 47(6), 1175–1192.

Islam, M. R., & Sultana, N. (2021). Exchange rate pass-through in Bangladesh: Evidence from a sectoral approach. *Journal of Developing Areas,* 55(4), 23–41.

Kayum, M. M., Rahman, A., & Haque, M. I. (2016). Cointegration analysis of import demand in Bangladesh. *Bangladesh Development Studies,* 39(2), 37–54.

Khan, M. S., & Ross, K. Z. (1977). The functional form of the aggregate import demand equation. *Journal of International Economics,* 7(2), 149–160.

Narayan, P. K., & Narayan, S. (2005). Estimating import and export demand elasticities for Fiji in a cointegration framework. *The Economic Record,* 81(253), 379–386.

Obstfeld, M., & Rogoff, K. (1996). *Foundations of International Macroeconomics.* MIT Press.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics,* 16(3), 289–326.

Rahman, M., Choudhury, T. A., & Hasan, M. (2022). Import demand in Bangladesh: Sectoral drivers and elasticity trends. *Bangladesh Institute of Development Studies Working Paper Series*, WP-08.

Sarker, M. A., Rahman, M. M., & Islam, M. T. (2022). *Asian Economic and Financial Review*. Long-run import demand in Bangladesh: Evidence from ARDL and cointegration tests., 12(2), 135–150.

Schmitt-Grohé, S., & Uribe, M. (2012). What's news in business cycles. *Econometrica*, 80(6), 2733–2764.

Senhadji, A. (1998). Time-series estimation of import demand equations: A cross-country analysis. *IMF Staff Papers*, 45(2), 236–268.

Tang, T. C., & Nair, M. (2002). A cointegration analysis of Malaysian import demand function: Reassessment from the bounds test. *Applied Economics Letters*, 9(5), 293–296.

Appendix: Model Extensions and Simulation Details

This appendix provides the extended derivations, calibrations, and simulation results that complement the main analysis presented in the paper. While the core discussion relied on a baseline DSGE formulation and ARDL estimation, the following appendices explore deeper dynamic mechanisms and alternative channels of transmission. These extensions aim to:

- Enhance the realism of the import demand model by incorporating GDP and REER effects.
- Allow for endogenized feedback from exchange rate movements into import prices.
- Simulate richer policy scenarios under macroeconomic stress conditions.

Together, these extended models offer greater insight into the structural behavior of Bangladesh's import demand and inform a wider range of macroeconomic policy responses.

Appendix A: Augmented DSGE Model with GDP and REER Fundamentals

Building upon the baseline simulation in Section 6.3, we extend the dynamic import demand function to incorporate macroeconomic fundamentals—namely, real income (GDP) and the real effective exchange rate (REER)—which were shown to be statistically significant in our ARDL estimations. This augmentation enhances the theoretical richness of the DSGE model and ensures consistency with the empirical structure already validated in the data.

The forward-looking formulation becomes:

$$\log M_t \;=\; \beta \log M_{t+1} + \;\gamma_1 \cdot \log Y_t - \gamma_2 \cdot \log REER_t - \eta \cdot \log P_{oil,t}$$

where β =0.95, γ_1=1.02, γ_2=-2.70, η =-0.32, and oil price persistence ρ =0.7. The simulation assumes constant real GDP (GDP: $\log Y_t$ = $\log(1000)$), stable REER (: $\log REER_t$=$\log(1.0) = 0$), and a 20% oil price shock following an AR(1) process.

Compared to the simpler model in Section 6.3, the inclusion of income and exchange rate fundamentals shifts the overall level of imports upward, reflecting the strong underlying import demand driven by rising income and favorable exchange rate conditions. Although the magnitude of the oil shock remains the same, its relative influence is moderated in this extended specification due to the stabilizing presence of high real GDP and a neutral REER. In Year 1, nominal imports rise by approximately 17.45%, compared to 19.02% in the simpler model. By Year 5, the deviation from baseline narrows to 4.23%, and after 10 years it declines further to 0.77%. By Year 20, import values return effectively to baseline, indicating a full dynamic adjustment.

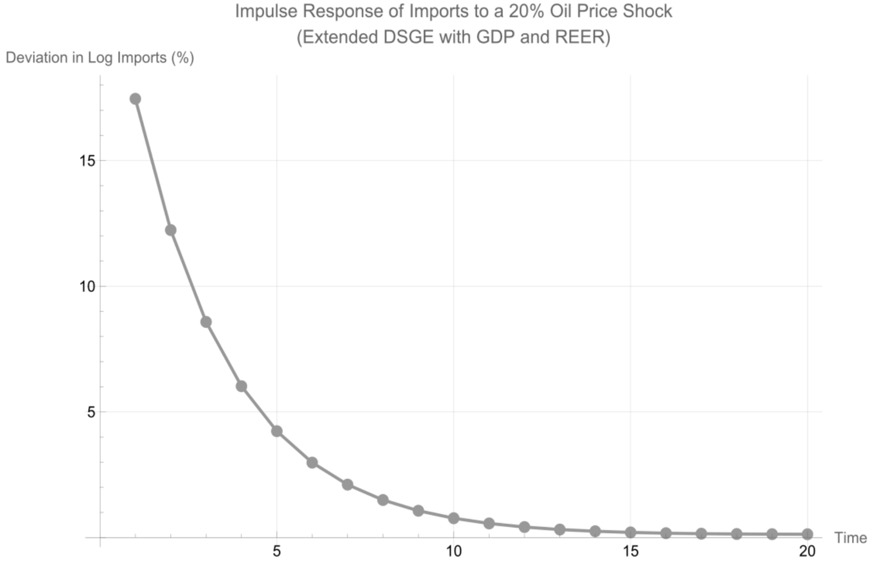

Figure 4: *Import IRF with Income and REER included*

These results underscore that even in the absence of active shocks to income or exchange rates, their inclusion in the model matters. They raise the intercept and trajectory of imports and reduce the sensitivity of the system to transient oil price shocks. This reinforces the idea that macroeconomic fundamentals not only drive long-run import behavior but also cushion short-run volatility arising from external price shocks. Policymakers aiming to stabilize trade balances in the face of global energy turbulence may benefit from strategies that promote steady income growth and exchange rate stability, as these fundamentals critically anchor expectations and reduce short-run nominal volatility.

Appendix B: REER–Oil Price Transmission Channel — Endogenous Oil Price Effects on Import Demand

To enhance the realism of the DSGE framework, we extend the model by incorporating a feedback mechanism between the real effective exchange rate (REER) and global oil prices. In many small open economies, oil import costs are highly sensitive to exchange rate fluctuations. A stronger REER (appreciation) makes foreign oil cheaper in local currency terms, while a depreciation amplifies energy import costs. To capture this relationship, we specify the oil price as an autoregressive process with REER pass-through:

$$\log P_{oil,t} = \rho \cdot \log P_{oil,t-1} + \lambda_1 \cdot \log REER_t + \varepsilon_t$$

with ρ =0.7 and $\gamma_1 = -2.0$. The import demand function remains forward-looking:

$$\log M_t = \beta \log M_{t+1} + \gamma_1 \cdot \log Y_t - \gamma_2 \cdot \log REER_t - \eta \cdot \log P_{oil,t}$$

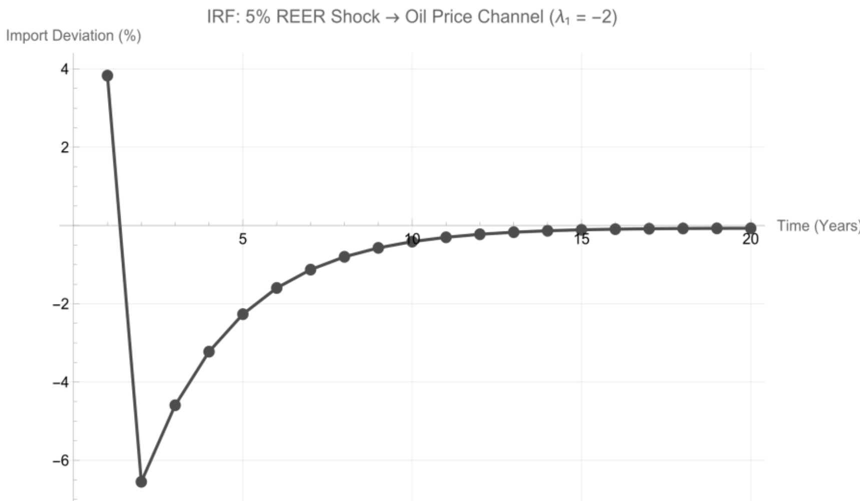

Figure 4: *IRF with Endogenized Oil Price Mechanism*

We simulate a one-time 5% positive REER shock, holding output constant. The impulse response function (IRF) is shown in Figure 5. The resulting IRF exhibits a dynamic and non-monotonic pattern. In the first period, imports rise sharply by +3.83%, reflecting the immediate drop in local oil prices due to REER appreciation. This initial boost, however, is not sustained. In Year 2, import demand contracts steeply by –6.55%, as forward-looking agents revise expectations and the oil price channel corrects itself. Over the next several years, imports gradually recover, converging toward the long-run baseline by Year 15–20.

Table 12: IRF Values — 5% REER Shock through Oil Price Channel (λ_1 = –2.0)

Year	Import Deviation (%)
1	+3.83%
5	-6.55%
10	-0.41%
20	≈ 0.00%

This dynamic trajectory is a textbook demonstration of forward-looking import behavior under rational expectations. The initial overreaction (positive spike) and subsequent correction (negative dip) reflect importers adjusting to both current and expected future prices. The result is a hump-shaped IRF that captures the core logic of intertemporal substitution in DSGE models.

Policy Insight: These results highlight that exchange rate movements can significantly influence import demand through the oil price channel — even when REER is not explicitly present in the import equation. The transmission mechanism becomes especially powerful when both the oil price elasticity (η) and exchange rate pass-through (λ_1) are large in magnitude.

A key insight is that a REER appreciation might induce a short-run import boom due to temporarily cheaper oil prices. But this effect is transient and can reverse sharply as expectations adjust and the oil price normalizes. For oil-importing economies like Bangladesh, such transmission effects warrant careful consideration. Policymakers aiming to stabilize trade balances and fuel costs should be cautious in interpreting short-run REER gains as a sustained import advantage. This has direct relevance for setting buffer fuel pricing rules, foreign reserve planning, and exchange rate policy.