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# Navigating Risks in Bangladesh's Garment Industry: Analyzing the Effects of Rising Costs of Labor on Firm Profitability

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**Abstract:** Ready-made Garments (RMG), the largest and most significant industry in Bangladesh, contributing to its gross domestic product (GDP), is gradually losing its growth potential and competitiveness due to rising labor and raw material costs. These two factors pose the foremost critical threat to the RMG industry in Bangladesh. This study examines the asymmetric impact of wage shocks on the profitability of the RMG sector in Bangladesh, considering the industry's dynamic challenges, including increasing labor and raw material costs. A panel nonlinear autoregressive distributed lag model is employed to analyze this impact. The study uses the Hausman test to choose between the pool mean group (PMG) and the mean group (MG) models, determining the most appropriate analysis model. Furthermore, to address the issue of cross-sectional dependency, this study applies GMM, CCEMG, and DKSE approaches as robustness tests. The findings reveal both short- and long-run asymmetries in the impact of wage shocks on firms' profit margins. In the short run, positive wage shocks negatively affect gross profit, while in the long run, positive wage shocks help firm to generate more profit by improving productivity. Conversely, negative wage shocks positively influence gross profit both in the short run and long run, indicating increased profitability over time. Additionally, the findings indicate that both raw material and capital costs negatively impact firm profitability. This study contributes to understanding the nuanced dynamics of wage shocks and their effects on the profitability of the RMG sector in Bangladesh. Identifying short- and long-run impacts offers valuable insights for policymakers and industry stakeholders.

**Keywords:** Bangladesh; Firm Profitability; Panel Nonlinear ARDL; Ready-Made Garments (RMG); Rising Wage.

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## 1. Introduction

### 1.1. Background Study

Bangladesh is the world's second-largest RMG manufacturer and exporter after China [1], [2]. The RMG industry in Bangladesh has become one of the fastest-growing industries globally since the 1990s and has been the primary source of foreign earnings for the last three decades [3]. Desh Garments is the first RMG exporting company from Bangladesh. In 1979, Desh Garments started a joint project with the South Korean company "Daiyuu" and exported its first consignment to France,

which was valued at 10 million USD [4], [5]. From there, the RMG sector of Bangladesh was developing day by day and did not need to look back [6].

Bangladesh's ready-made garment (RMG) exports increased by 7.23% in 2024 to \$38.48 billion from \$35.89 billion in 2023 [7]. According to the Export Promotion Bureau, the country's garment export earnings exceeded Vietnam's \$32.75 billion. Currently, 9.25% of Bangladesh's total GDP is the most considerable single-sector contribution to its GDP [8], [9]. In this way, along with employment generation, this industry contributes to women's empowerment in Bangladesh. Several factors work behind the tremendous growth of the RMG sector from 1980-2010. It can be categorized in two ways: internal drivers and external drivers. External Drivers are quota facilities of multi-fiber agreements, tariff-free facilities of the generalized system of preference (GSP), and many others [10], [11], [12]. Internal drivers are government policy of duty drawbacks, cash incentives, bonded warehouse facilities (BWF), and back-to-back letters of credit (L/C) facilities [10], [11], [12].

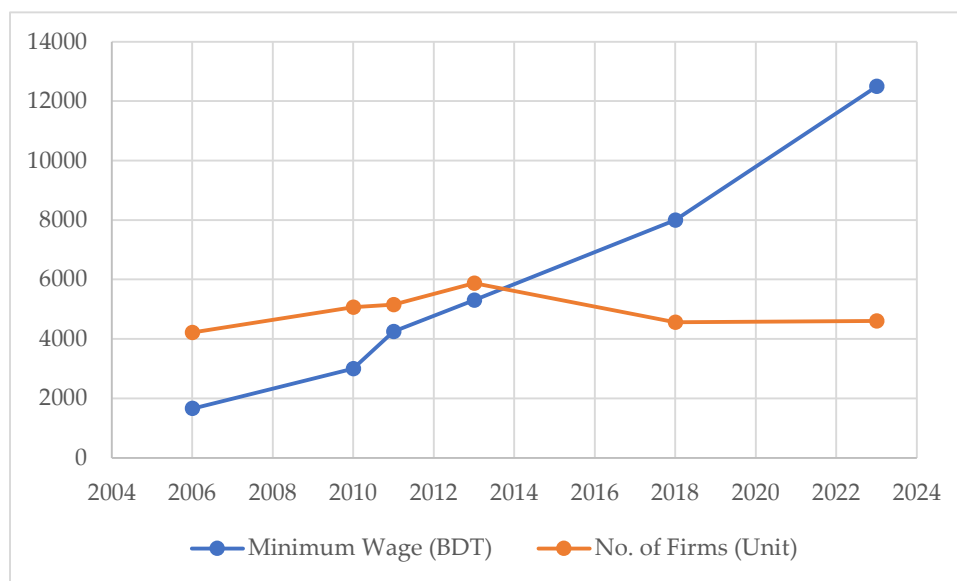
Besides internal and external drivers, Bangladesh RMG has enjoyed other comparative advantages in producing textile products, like a large labor force, cheap labor, large firm size, availability of domestic raw materials, etc. [11], [13]. However, from all internal drivers, external drivers, and comparative advantages, the most crucial factor is cheap labor [11]. Bangladeshi RMG workers' average monthly wage is meager, even in some cases lower than that of competitors like China, India, the Philippines, and Vietnam. Data from the Clean Clothes Campaign, July 2021, stated that the global estimated wage for RMG workers is 200\$, whereas Bangladeshi workers only get 95\$. This is one of the main impediments to the higher productivity of Bangladeshi workers. The average wage of RMG workers in Bangladesh is the lowest among the Asian competitors. Because of this, the average cost per unit of RMG production in Bangladesh is lower than the competitor. As a result, Bangladesh can offer the RMG at the lowest possible price than other competitors and can attract customers very quickly. For example, according to [14] in 2023, the cost of male woven cotton trousers produced in Bangladesh was \$7.01 per item, 9.20 percent less than the world average of \$7.72.

### *1.2. Statement of the Problem*

However, this most crucial comparative advantage of Bangladesh's RMG sector is slowly vanishing [8], [9]. Several reasons are responsible, like minimum wage laws, high payments to foreign workers, increasing living standards, globalization, inflation, etc. [15]. In the last 20 years, the government revised the minimum wage law for RMG workers five times. The usual rationale for minimum wages is their ability to increase the earnings of low-paid workers to prevent "exploitation" and reduce poverty [16]. Figure 1 illustrates the evolution of the minimum wage over the past 15 years. Between 1985 and 2000, there was only one change in the minimum wage for RMG workers. However, the law of minimum wage for RMG workers has changed five times in the last 20 years. From 2006 to 2018, there was a 481.2% increase in the minimum wage, significantly contributing to the wage hick of the RMG sector [17], [18].

Another important reason for increasing wages in the RMG sector is the high salaries paid to foreign workers [19]. Due to the lack of trained local labor, foreigners control a substantial portion of senior positions in Bangladesh's expanding RMG industry, transferring billions of dollars annually from the country's economy. According to the Asian Center for Development (ACD), roughly 2,200 foreign experts were working in various positions in Bangladesh's RMG sector. The percentage of factories using foreign workers is close to 15%, and a total of 5 to 7 lakh foreign workers work in the

garment sector [20]. A Transparency International Bangladesh (TIB) analysis found that an estimated \$ 3.1 billion, or around Tk 26,400 crore, is transferred annually by foreign employees employed in Bangladesh [21]. Inflation is another reason why workers are claiming higher wages consecutively. In the last ten years, the average inflation in Bangladesh was more than 5.5%. So, to match daily spending, workers were bound to demand a higher wage. To achieve it, they often go for strict and call off, which are detrimental to the production process. As a result, RMG factory owners were forced to pay a higher wage, sometimes higher than the value of the worker's marginal productivity. The supply of surplus labor from agriculture to RMG may already have finished. This could be another reason for the recent high trend of wages in this sector [22].



**Figure 1.** Growth of RMG and minimum wage.

### 1.3. Rationale of the Study

To understand the role of rising labor costs on firm profitability and how they affect the growth of this sector, it is important to comprehend how firms respond to different positive and negative wage shocks. The effects of wage fluctuations on firm profits remain inconsistent, as rates of wage increase and decrease create opposing outcomes. An increase in employee wages drives up labor expenses, which firms cannot fully pass on to their customers due to global market competition, thus lowering their profit margins [23], [24]. Wage decreases may not boost profitability to the same extent because inflexible wage contracts, employee union influence, or production system constraints can be contributing factors [25]. According to [26], [27], firms generally react differently when costs rise compared to when they decrease. Organizations experience greater short-run productivity gains from higher wages, even though these increased wages eventually create long-term profitability challenges due to added costs. Organizations face the challenge of retaining profits when wages decline, since efficiency wages and employee retention issues might arise. Wage shock components are categorized into positive and negative sections within the nonlinear ARDL framework, which allows for accurate estimation of short-run and long-run asymmetries [28].

As labor wages are an essential portion of production costs, when wages increase, it reduces the profit margin and discourages owners of this sector from producing more [29]. Increasing wages is

becoming an essential concern for a developing country like Bangladesh. China is already experiencing the problem. Because of the high labor wage in China, they are now gradually shifting their attention from the comparative advantage of cheap labor to other competitive advantages [22], [30]. According to the flying geese theory, countries with increasing incomes will typically see a shift in the location of labor-intensive sectors because cost-effectiveness is critical in these businesses' ability to compete in the global export market [31], [32]. Because of this, Japan moved its labor-intensive industries to East Asia, where they later moved East Asian economies, which moved to China and, to a lesser extent, Bangladesh [33]. Nowadays, China's policymakers are trying to shift their attention from the labor-based industry, like the RMG sector to other sectors because they are losing their comparative advantage of cheap labor [34]. So, it is evident that if the labor wage of the Bangladesh RMG sector continues to rise like the present situation, then in the future, RMG will fly from Bangladesh to another country where cheap labor will be readily available.

#### *1.4. Objectives of the Study*

Rising labor cost is one of the greatest threats to RMG sector development but previous studies did not pay much attention to it. To fill this void of existing literature on Bangladesh RMG this study initiates a discussion on it. So, the main objective of this study is to analyze the impact of increasing labor wages on the profitability of RMG firms, whether they are affected by it or not. By establishing a chain relation, this study aims to find whether rising labor costs impact this sector's growth or not. Another important objective of this study is to analyze the asymmetric role of rising labor costs on firm profitability. The study wants to analyze whether firms' response to rising labor costs is similar to a fall in labor costs. Along with this, the study aims to suggest appropriate policies for solving the problem of increasing labor wages in the RMG sector.

#### *1.5. Potential Outcome of the Study*

Currently, Bangladesh RMG is facing threats from different dimensions, including labor unrest, political turmoil, international competition, cancellation of GSP and LDC facilities, etc. More recently, the Trump administration's enforcement of a 37% reciprocal tax on Bangladeshi exports, aimed at RMG products, has created a new external challenge to the industry's ability to compete globally [35]. This tariff has the potential to significantly limit profit margins, reduce export volumes, and hinder long-term growth when combined with increasing internal cost pressures, such as labor wages, raw material prices, and capital costs. Given this, it is even more critical to understand how these cost-side issues affect profitability, particularly as the sector navigates a more restrictive global trade environment.

The findings of this study will not only help the firms to maintain their profitability but also save the largest foreign currency-earning source of Bangladesh. Through the evidence-based findings of this study, Bangladesh will be able to avoid the potentially catastrophic situation that could arise due to the fall of the RMG sector. This will not just help Bangladesh economically, but also help to maintain a stable social life because a large portion of Bangladesh's people directly and indirectly depend on this sector. The result of this project will also open an opportunity for other researchers to analyze the different future threats of the RMG sector, and they will also be able to formulate research to solve them by taking an idea from this study. The empirical validation of the correlation between labor costs and company profitability in the RMG sector is one of how the research findings add to

the existing labor market theory. This bolsters the theoretical claim that higher labor costs might result in lower profitability and hamper the growth of the industry, highlighting the significance of labor cost management techniques in improving business performance.

The remaining portions are organized as follows: Section 2 discusses the literature reviews and study gap, the methodology is explained in Section 3, Section 4 summarizes the econometrics estimation results, a discussion of results with arguments behind them is given in Section 5, a short conclusion is given in Section 6, Section 7 discusses the recommendations of necessary policy measures, and Section 8 explain this research's limitations with a guideline for future researchers.

## **2. Literature Review**

This section will briefly explain past studies related to the role of rising labor and raw material costs on firm profitability and how these factors affect the growth of the RMG industry in Bangladesh. As there is a dearth of literature and a need for more studies related to this topic in the Bangladesh RMG sector, this section will incorporate some studies from China as examples.

On the one hand, a higher wage can improve productivity and raise firm profitability. Still, on the other hand, higher wages lead to higher costs for firms, eventually decreasing firm profitability. There is a paradox of higher wages. According to [36], [37], increasing minimum pay encourages employees to work harder. When workers perceive a direct link between their efforts and the rewards they would receive, they become inspired to put in more significant effort. The perceived likelihood of accomplishment and the degree to which the employee respects the reward impact motivation for giving it one is all at work. According to [38], productivity is significantly increased by raising the minimum wage. Furthermore, increased pay may increase worker satisfaction and productivity, ultimately boosting business success [39]. [40] contend that although growing labor expenses are problematic, they also offer chances for creativity and productivity gains. However, higher wages don't always lead to high productivity and can lead to higher costs for firms, eventually decreasing firm profitability [41], [42], [43]. According to panel research by [44], a 1% rise in the minimum wage reduces productivity by 0.56 percent (at the 0.05 significance level). Businesses can lessen the effects of rising labor costs by investing in automation and technology [45]. However, [46] found that labor productivity rapidly increases to counteract the adverse effects of wage rises, leading to higher production per worker.

In Bangladesh, enterprises face difficulty sustaining profitability when salaries rise due to labor activism and government regulations [47]. Because in the apparel industry, labor expenditures comprise all manufacturing costs [48]. The detrimental effect that growing labor expenses have on business profitability has been shown in numerous research studies. For example, a study by [38] discovered that rising salaries significantly impact Bangladeshi garment makers' profit margins. Furthermore, the issue is made worse by the global garment market's competitiveness, which puts pressure on businesses to maintain cheap costs to stay in business [49]. Due to this circumstance, businesses need more capacity to absorb rising labor expenses without experiencing a decline in profitability. Because of this, many businesses turn to cost-cutting strategies like staff reductions or labor standard compromises, which could have unfavourable long-term effects [50]. [51] use pre-policy data on the distribution of salaries to generate treatment and groups for comparison and perform a difference-in-differences methodology. The quasi-experiment on implementing a national minimum wage in the job market in the United Kingdom in 1999 served as the basis for this method.

According to the report findings, adopting the minimum wage also resulted in a considerable wage increase and a significant decrease in business profitability. Changes in labor costs will result in changes in operational expenses, impacting firms' profits. Along with firm profitability rapid increase in labor costs harms competitiveness and employment growth. [52] states that an essential consequence of rising labor costs is structural unemployment due to the rise in the average wage and decline in employment. labor costs also affect economic growth by reducing the growth of the industry [53].

Manufacturing companies in China that depend on cheap labor are losing some advantage over competitors abroad due to increased labor wages [54]. [22] also said that China's primary comparative advantage was its ability to export goods that required much labor. For instance, the average income for workers in China's textile industry in 2007 was \$ 0.785 per hour, significantly less than the wages in South Korea, Taiwan, Hong Kong, the United States, Japan, and other industrialized nations. Chinese textiles, therefore, had a clear comparative advantage in terms of labor costs. [55] discovered that a 10% rise in the minimum wage in China resulted in a 0.9% decline in export sales. The impact of an increase in the minimum wage in China on the global cotton market and the textile industry in China was studied by [56]. According to econometric analysis, China's textile demand has an income elasticity of 0.6. According to simulation model findings, raising the minimum wage increases domestic textile consumption in China, reduces textile exports, boosts the use of cotton in mills outside of China, and increases apparel costs globally.

[57] estimated that over the 17 years ending in 2016, labor costs in China climbed by 188% in real terms, while per capita income rose by 162%. The cotton yarn business in China is used in this study's multi-type displacement equilibrium model to predict how these changes may affect a worldwide supply chain. According to [30], wages are increasing more quickly than worker productivity in labor-intensive nations. Particularly in labor-intensive exporting industries like apparel and electronics, which are moving out of China and going to places like India, Bangladesh, and Vietnam, wages are increasing faster than labor productivity. From the evidence and literature, it is clear that China is slowly shifting its attention from RMG. However, Bangladesh's share of RMG export earnings in total export earnings until now has increased annually because Bangladesh has yet to face the problem of labor wages.

Along with rising labor costs, rising raw material and capital costs also pose a significant threat to the growth of RMG in Bangladesh. The RMG sector in Bangladesh primarily relies on imported raw materials due to the country's limited production capacity for domestic textile materials. This reliance results in escalating material costs, which pose a significant challenge. The total production costs tied to raw materials constitute 60–70% of the final price, including cotton and synthetic fibers, thus making businesses highly sensitive to fluctuations in global market prices [58]. Businesses must adopt cost-reduction measures since a 10% to 15% increase in raw material prices can lead to profit margin reductions of up to 20%, as noted by [59]. For instance, in 2011, a 20% surge in cotton prices resulted in a 12% rise in overall manufacturing costs in Bangladesh, according to [60]. This scenario forced businesses to either endure financial losses or raise their prices, consequently diminishing their competitiveness in export markets. Profitability challenges are exacerbated by the inability to transfer these cost increases to consumers due to intense competition from China, Vietnam, and India [58]. Furthermore, longer lead times averaging 90 to 120 days compared to 40 to 70 days in China and India, stemming from Bangladesh's dependence on imported raw materials, compel businesses to

maintain substantial inventory buffers, which in turn elevate working capital requirements and financial strain [59]. These costs also adversely affect order fulfilment and international competitiveness, a situation worsened by inefficiencies in port handling and transportation delays.

The foundation of this study relies on the efficiency wage theory that illustrates how wage and raw material price increases with capital costs reduce business profitability levels. This theory states that increasing production expenses leads to price rises that minimize market demand levels and market competitiveness [61], [62]. Higher wages have the potential to reduce profit margins in the long term, even though they initially boost productivity per the concepts of efficiency wage theory [63]. Additionally, the idea that businesses respond differently to positive and negative cost shocks is supported by the asymmetric adjustment theory [28], [63].

#### Literature Gap:

Although the Ready-Made Garments (RMG) industry is crucial to the economic development, employment, and export revenue of Bangladesh, the consequences of rising input costs, particularly wage rates, raw materials, and capital, remain poorly understood in the literature. While a few studies have qualitatively noted that increasing costs could impact the sector's competitiveness, these research efforts often rely on descriptive analysis or clusters of case studies rather than rigorous econometric analysis and empirical verification of the sector as a whole. Furthermore, the RMG industry in Bangladesh has not been thoroughly analyzed regarding the asymmetric effects of wage shocks, specifically whether positive and negative wage changes have different impacts on firm profitability. This is particularly significant in the RMG sector, where labor costs dominate operational expenses, and wage policies frequently shift due to political and social pressures. Some Chinese researchers have attempted to address this issue in relation to their country's socioeconomic context, but China's socioeconomic conditions differ greatly from those in Bangladesh. This study explores the rising wage issue within the context of Bangladesh's socioeconomic landscape. Additionally, while some international studies have successfully applied advanced panel econometric methods to analyze cost-profit relationships, there is a notable gap in data-driven research that includes labor costs, raw material costs, and utility expenses in a unified analysis. This gap arises from the predominant use of firm-level data or panel data in evaluations concerning Bangladesh. To our knowledge, existing research has not examined the differences in asymmetries between short-run and long-run wage shocks and other production inputs using non-linear panel-ARDL models, although some studies have been conducted using linear panel-ARDL estimations.

### **3. Data and Methodology**

#### *3.1. Data*

The study uses a quantitative method to gather balanced panel data. The data were collected from secondary sources. Most of the data were collected from the listed companies of the [64], but some information was missing from the [64] website and was gathered directly from the respective companies' websites. Nonetheless, more than three thousand firms operate in the RMG sector of Bangladesh. The study gathered data for 50 firms listed on the Dhaka Stock Exchange (DSE) from 2010 to 2024 due to time and resource constraints. To make the data more representative of the Bangladesh RMG sector, the study included firms of various sizes: twenty large, twenty mediums, and the remaining small. This categorization is based on the average turnover of these firms over the

last 15 years. Firms with an average turnover of more than 100 crores are classified as large, those with an average turnover of over ten crores but less than 100 crores are classified as medium, and those with an average turnover of less than ten crores are classified as small. All firms from different categories were selected randomly. The study focused on data from 2012 to 2024 because, during this period, the minimum wage in Bangladesh increased five times, significantly impacting the company's profitability. The data set contains annual data of the main variables like profitability (in terms of net profit margin), cost of labor wage, cost of raw material, and cost of utilities. As the dataset is firm-level and time-series in nature, a panel data method is utilized to ensure that the cross-sectional and the time dynamics are accounted. Table 1 presents the data source and its related information.

**Table 1.** Variables definition.

Type of Variables	Abbreviation	Definition	Measurement	Source
Dependent	$\Pi$	The profit that is equal to turnover less the cost of production	BDT	
	$LC^+$	The positive shock of labor costs	BDT	[64] and Annual reports of the firms
Independent	$LC^-$	The negative shock of labor costs	BDT	
	$RMC$	Raw materials costs	BDT	
	$KC$	Capital costs	BDT	

**Table 2.** Summary statistics of variables.

Variable	Observations	Mean	Std. Dev.	Variance	Skewness	Kurtosis	Min	Max
$\Pi$	144	2.46e+08	4.91e+08	2.41e+17	-2.011202	23.78423	-3.41e+09	1.70e+09
$LC^+$	144	3.63e+09	1.27e+09	1.62e+18	-1.874312	4.98176	0	4.38e+09
$LC^-$	144	-3.81e+08	1.98e+08	3.91e+16	.5222473	1.736386	-6.00e+08	0
$RMC$	144	7.80e+08	1.10e+09	1.22e+18	1.903385	6.468993	6890904	5.17e+09
$KC$	144	8.14e+07	1.15e+08	1.33e+16	3.236491	15.7619	2028918	7.90e+08

Table 2 displays the variables' summary statistics. These statistics shed light on each variable's skewness, kurtosis, dispersion, central tendency, and range. The profit variable ( $\Pi$ ) exhibits substantial variability, with a mean of approximately 2.46e+08 Taka and a comprehensive standard deviation of 4.91e+08 Taka. Labor costs, represented by positive ( $LC^+$ ) and negative ( $LC^-$ ) shocks, show contrasting distributions, with  $LC^+$  having a mean of approximately 3.63e+09 Taka and  $LC^-$  a mean of approximately -3.81e+08 Taka. Raw materials costs and capital costs display similar patterns of high variability, respectively. Skewness and kurtosis values suggest deviations from

normality, particularly evident in  $\Pi$  and  $KC$ . These statistics provide essential insights into the distributional characteristics of the variables, which are crucial for understanding their implications in the analysis of firm profitability within the garment industry.

### 3.2. Theoretical Framework

This study uses the firm's gross profit as a proxy of growth for the RMG industry. High gross profit automatically leads to high growth in a sector. Because when there is high profit in an industry the existing firms will be encouraged to produce more and to catch the opportunity of high profit there will be more potential new entrants which will ultimately lead to higher growth in the industry. Thus, the study uses the Marshal theory of profit as a theoretical framework to show the rising labor cost, and material cost role on the profitability of RMG firms in Bangladesh. According to [65], profit usually depends on two factors: one is revenue, and another is cost. So, the profit function for RMG firm in Equation (1) will be

$$\text{Gross Profit} = f(\text{Revenue}, \text{Cost}) \dots \dots \dots (1)$$

The relationship between wage trends and profitability, as [66] stated that labor costs may significantly influence firm competitiveness and profitability in the case of manufacturing industries. Considering the constant revenue, the link between cost and profit is now clear. Moreover, there are usually two types of expenses: operating costs and capital costs. Costs that are required to acquire fixed assets and finance investment are known as capital costs like machinery costs, infrastructure costs, etc., and costs that vary depending on the amount of production are called operation costs. It usually includes costs like labor costs, raw material costs, and utility costs. This study aims to show the link between profitability and operating costs like raw material costs, labor costs or wage bills, and capital costs. The research applied the following profit function in Equation (2). [67] used a similar theoretical framework to show the impact of labor and raw material costs on a firm's profit margin.

$$\text{Gross Profit} = f(\text{Labor costs}, \text{Raw material costs}, \text{Capital costs}) \dots \dots \dots (2)$$

To simplify our model,  $LC$  represents labor cost,  $RMC$  represents raw material cost, and  $KC$  represents capital costs. The paper applied  $\Pi$  to refer to gross profit in our discussion. So, Equation (3) is the simplified gross profit equation.

$$\Pi = f(LC, RMC, KC) \dots \dots \dots (3)$$

Variable-intercept models have been widely used to fit regression models using panel data [68]. Equation (4) is the best way of fitting a profit function for our panel analysis.

$$\Pi_{it} = \alpha + \beta_1 LC_{it} + \beta_2 RMC_{it} + \beta_3 KC_{it} + V_{it} \dots \dots \dots (4)$$

Positive and negative wage shocks can have different roles on firm profitability [27], [28]. That is why this study segregates the positive and negative wage shocks to find their asymmetric role in firm profitability. Equation (5) is the final functional form of this study that serves the objective of this study,

$$\Pi_{it} = \alpha + \beta_{1a} LC_{it}^+ + \beta_{1b} LC_{it}^- + \beta_2 RMC_{it} + \beta_3 KC_{it} + V_{it} \dots \dots \dots (5)$$

The classic procedure assumes that the effects of omitted variables are independent of

independent variables and are independently identically distributed. Thus, conditioning on all observations is a random variation of a representative firm [68].

### 3.3. Hypothesis Development

This research study is aimed at investigating empirically the relationship between Firm profitability with business costs such as labor costs, raw material costs and capital costs involved in Bangladesh ready-made garments (RMG) industry. Available literature shows that input costs are strongest determinants of firm-level performance, particularly in the production of export-oriented goods that are labor intensive such as the RMG [69]. But due to the institutional inflexibilities, constraints on adjustment as well as behavioural responses of the workers and firm it is likely that the character of this relationship would vary across a time scale and in a non-linear manner. In theory, the neoclassical cost model that causes a compression of the profit margin due to fixed output prices and low rates of adjustment may explain the nefarious short-term effect of the rising cost of labor. Conversely, by the mechanism of the efficiency wage theory and endogenous growth theory, higher wages can in the long run enhance efficiency of the workers and the business so as to boost profitability [70], [71]. In the same fashion, since firms in developing countries often have no local supply chains, difficulty in creating any hedging mechanism, or lack access to low-cost capital, the rising prices in raw materials and capital are expected to progressively reduce profitability as time goes on [72]. Based on previous literature and discussion this study formulates the following four hypotheses,

$H_1 =$  In long run rising labor costs affect firm's profitability negatively

$H_2 =$  labor costs affect firm's profitability asymmetrically

$H_3 =$  Rising Raw material costs affect firm's profitability negatively

$H_4 =$  Rising capital costs affect firm's profitability negatively

### 3.4. Econometric Models Specification

#### 3.4.1. Cross-sectional Dependence Test

The research examined cross-sectional dependency (CSD) before assessing different design estimation techniques. When first-generation approaches are favoured for subsequent exploration, CSD's existence may lead to inappropriate and biased prediction findings. In this study, the research used [73], [74] for CSD. The CSD test statistic is given below in Equation (5)

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T \hat{\rho}_{ij}^2 - 1) \dots\dots\dots$$

Here,  $\hat{\rho}_{ij}$  denotes the sampling enumerate of the residuals pairwise connection, N is the panel data's cross-section term, and T is its time series term.

#### 3.4.2. Unit Root Test

The research used both first and second-generation-unit root tests. To test for a unit root in the group of panel series, the IPS and LLC tests panel unit root tests are used. These tests were proposed by [75] and [76], respectively. The baseline framework of these two tests is an ADF regression for

panel data and is specified as follows in Equation (6).

$$\Delta y_{it} = \gamma_i y_{i,t-1} + \sum_{j=1}^p \varphi_j \Delta y_{i,t-1} + \varepsilon_{it}, \text{ where } \gamma_i = \rho_i - 1 \dots\dots\dots (6)$$

However, they are regarded as first-generation unit root tests because the IPS and LLC tests do not consider the cross-section dependency issue that could arise due to macroeconomic linkages, unexplained residual independence, and unobserved common factors. To determine whether the variables in the model for this study have any cross-sectional dependence, second-generation unit root tests are run. The Cross-Sectionally Augmented IPS (CIPS) by [77] examines the unit root test addressing the matter of cross-sectional association. CIPS is a 2nd generation unit root test that is strong in testing the CD and the dissimilarity of the slope. This method's experimental version is depicted as follows:

$$\Delta y_{it} = \alpha_i + \beta_i \bar{y}_{it-1} + \gamma_i y_{t-1} + \sum_{j=0}^k \delta_{ij} \Delta \bar{y}_{it-1} + \sum_{j=0}^k \theta_{ij} \Delta y_{it-1} + \varepsilon_{it} \dots\dots\dots (7)$$

In formula (7), k denotes the mentioned variables, and  $\bar{y}_{it}$  denotes the mean of the cross-sections. Hence, the CIPS is obtained using the CADF test statistic in the abovementioned formula.

$$CIPS = N^{-1} \sum_{i=1}^N CADF_i \dots\dots\dots (8)$$

Here, Equation (8) represents  $CADF_i$  as the cross-section term, and the average value of CADF calculates CIPS. The null hypothesis affirms unit roots; by comparison, no unit roots are stated in the alternative hypotheses.

### 3.4.3. Slope Homogeneity Test

Additionally, this analysis employed [78] to test the slope dissimilarity in equations (9) and (10). This test statistic's formula is seen as follows:

$$\Delta = (N)^{\frac{1}{2}} (2k)^{-\frac{1}{2}} \left( \frac{1}{N} \tilde{S} - k \right) \dots\dots\dots (9)$$

$$\Delta^{adj} = (N)^{\frac{1}{2}} \left( \frac{2k(T-k-1)}{T+1} \right)^{-\frac{1}{2}} \left( \frac{1}{N} \tilde{S} - 2k \right) \dots\dots\dots (10)$$

Where  $\Delta$  denotes the delta title,  $\Delta^{adj}$  denotes the adjusted delta title,  $\tilde{S}$  is Swamy's test statistic, N is the panel data's cross-section term, T is its time series term, and 'k' is the number of variables. In opposition to the alternative hypothesis, the null hypothesis favors the homogeneous slope.

### 3.4.4. Cointegration Test

The [79], [80] panel cointegration tests are used in the next phase of the study to look for evidence of long-run cointegration between profit and the independent variables once the order of integration has been confirmed. Based on the panel-data model for an I(1) dependent variable y, the Pedroni test compares the cointegration alternative to the null hypothesis of no cointegration. Equation (11) shows the Pedroni cointegration test formula,

$$y_{it} = x^{it} \beta_i + z'_{it} \tau_i + e_{it} \dots\dots\dots (11)$$

In the presence of cross-sectional dependency Pedroni cointegration test can be biased. Westerlund cointegration can solve this limitation by accommodating cross-sectional dependency

problems. Equation 12 is the CSD-adjusted formula of Westerlund cointegration.

$$\Delta y_{it} = \alpha_i + \sum_{j=1}^p \beta_{ij} \Delta y_{i,t-j} + \sum_{j=0}^q \gamma_{ij} \Delta x_{i,t-j} + \varphi_i (y_{i,t-1} - \theta_i x_{i,t-1}) + \varepsilon_{it} \dots \dots \dots \quad (12)$$

### 3.4.5. Panel Nonlinear ARDL

Reaction of firm differ based on situation. Firm may react differently to rising labor cost and falling labor cost. Because firms respond quickly to wage rises (e.g., by cutting staff), while labor contract rigidities may cause adaptations to wage decreases to take longer [27], [81]. Because it distinguishes between the short-term and long-term effects of wage shocks and permits dynamic asymmetry, the nonlinear PMG ARDL model is suitable in this scenario. In labor intensive businesses like RMG, relying on traditional linear models is frequently unreasonable, which implies that cost increases and decreases have the same proportionate influence on profitability [27], [28]. Asymmetric adjustment dynamics are incorporated into nonlinear PMG ARDL to overcome this restriction. To assess profitability responses, the model allows us to evaluate whether companies respond to positive wage shocks more quickly than negative ones [28]. This approach adds to the body of research by illuminating intricate cost-profit relationships in the industrial sectors of developing nations. This allows policymakers to create focused interventions that take into account asymmetric impacts and time horizons that are frequently disregarded in conventional econometric analysis.

The study wants to determine the impact of wage shock on firms' profitability, and the nonlinear autoregressive distributed lag model is the best fit for this purpose. NARDL, introduced by [82], which is an extension of [74], [83], can elucidate linear and nonlinear dependency and express the symmetric and asymmetric relationships among variables. Above all, this method has several other advantages. First, along with a small sample size, this method allows stationary variables at the level and the first Difference [84], [85], [86]. Second, this method is applicable even when there is an endogeneity problem with some variables [85]. Third, this method helps estimate both the short-run and long-run impact of the independent variable on the dependent variable by adjusting the autocorrelation and heteroskedasticity problems of the data.

To apply NARDL, the paper divided the exogenous fluctuating variable labor cost into two partial sums.  $\Delta LC_{i,t}^+$  is the positive partial sum  $\Delta$ , and  $LC_{i,t}^-$  is the negative partial sum. The positive partial sum of Equation (13) will capture upward fluctuation, and the negative partial sum of Equation (14) will capture downward fluctuation of labor costs. The main aim of this model is that positive and negative shocks of labor costs have different impacts on the profitability of RMG firms.

$$LC_{i,t}^+ = \sum_{j=1}^t \Delta LC_{i,t}^+ = \sum_{j=1}^t \max(\Delta LC_{i,t}^+, 0) \dots \dots \dots \quad (13)$$

$$LC_{i,t}^- = \sum_{j=1}^t \Delta LC_{i,t}^- = \sum_{j=1}^t \min(\Delta LC_{i,t}^-, 0) \dots \dots \dots \quad (14)$$

This study's nonlinear panel ARDL model includes short- and long-term asymmetric interactions. Equation (15) displays the study's estimated model.

$$\Delta \Pi_{it} = \alpha + \beta_1 \Pi_{it} + \beta_{2i}^+ LC_{i,t-1}^+ + \beta_{3i}^- LC_{i,t-1}^- + \beta_4 RMC_{i,t-1} + \beta_5 OC_{i,t-1} + \sum_{j=1}^{p=1} \delta_{1ij} \Delta P_{i,t-j} + \sum_{j=1}^{p=2} (\delta_{2ij}^+ LC_{i,t-j}^+ + \delta_{2ij}^- LC_{i,t-j}^-) + \sum_{j=1}^{p=3} \delta_{3ij} \Delta RMC_{i,t-j} + \sum_{j=1}^{p=4} \delta_{4ij} \Delta OC_{i,t-j} + V_{it} \dots \dots \dots \quad (15)$$

The coefficients  $\beta_{2i}^+$  and  $\beta_{3i}^-$  are used to evaluate the long-term asymmetric reaction of the gross profit ( $\Pi$ ) to positive and negative shocks on labor cost (LC), whereas  $\delta_{2ij}^+$  and  $\delta_{2ij}^-$  are used to estimate the short-term asymmetric response.

$$\Delta\Pi_{it} = \tau_i + \sum_{j=1}^{p=1} \delta_{1ij} \Delta\Pi_{i,t-j} + \sum_{j=1}^{p=2} (\delta_{2ij}^+ LC_{i,t-j}^+ + \delta_{2ij}^- LC_{i,t-j}^-) + \sum_{j=1}^{p=3} \delta_{3ij} \Delta RM C_{i,t-j} + \sum_{j=1}^{p=4} \delta_{4ij} \Delta OC_{i,t-j} + \theta_i ect'_{i,t} + V_{it} \dots \dots \dots \quad (16)$$

In Equation (16)  $ect'_{i,t}$  stands for the asymmetric error correction term, and  $\theta_i$  represents the speed at which the system reaches long-term equilibrium following a shock.

Cross-sectional dependency (CSD) occurs when economic shocks which include global cotton price fluctuations and energy cost changes affect every firm operating within the sector. When cross-sectional dependency is neglected in panel analysis, they generate biased findings [87]. The presence of CSD does not undermine the validity of PMG ARDL estimation when further robustness testing is conducted with Driscoll-Kraay standard errors (DKSE), Common Correlated Effects Mean Group (CCEMG), and Generalized Method of Moments (GMM) methodologies [88], [89], [90]. The analysis used CCEMG and GMM test formulations to verify that CSD did not impact our findings. The valid application of PMG remains possible according to the cointegration test results from [91], [92], despite the presence of CSD. Figure 2 shows how the objective of this study can be accomplished by the chosen research design.

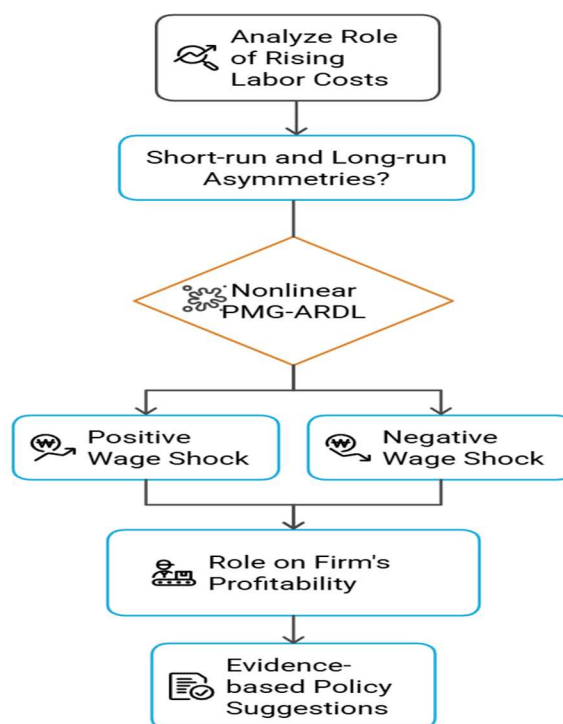


Figure 2. Objectives of the study and research design.

#### 4. Empirical Results

In the presence of multicollinearity, econometric analysis may provide false estimation. To get appropriate findings there should not be a linear relationship among the selected variables. Table 3 shows the multicollinearity test result of this study. The variance inflating factor (VIF) of all chosen variables is less than five and the mean VIF is also less than five indicating that there is no multicollinearity problem in this study. Along with this most of the variable tolerance factors are close to one reflect that this study that the study doesn't suffer from a multicollinearity problem.

**Table 3.** Multicollinearity test.

Variable	VIF	1/VIF
$\Pi$	3.47	0.288
LC <sup>+</sup>	2.51	0.399
LC <sup>-</sup>	1.07	0.931
RMC	1.16	0.865
KC	2.78	0.359
Mean VIF	2.198	

Table 4 represents Pesaran cross-sectional dependency test results. The findings reveal that businesses with identical positive or negative wage bill shocks prefer to cluster together because favourable and adverse labor cost variables exhibit significant statistical cross-sectional dependency and strong positive spatial autocorrelation coefficients. However, with lower mean values and weaker dependence, gross profit, raw materials, and capital costs indicate weaker consistent spatial trends.

**Table 4.** Cross-sectional dependency test.

Variable	CD-test	p-value	average joint T	mean $\rho$	mean abs( $\rho$ )
$\Pi$	-0.96	0.337	12.00	-0.03	0.35
LC <sup>+</sup>	25.887	0.000	12.00	0.92	0.92
LC <sup>-</sup>	14.692	0.000	12.00	0.52	0.52
RMC	2.54	0.011	12.00	0.09	0.41
KC	-0.762	0.446	12.00	-0.03	0.33

Table 5 shows Levin-Lin-Chu, Im-Pesaran-Shin, and CIPS unit root tests that demonstrate different levels of stationarity for the variables. Findings show that gross profit raw material costs, favourable labor costs, and capital costs show signs of non-stationarity at the level, but they are stationary at 1st Difference. On the contrary, negative labor costs make a potential stationarity claim based on statistically insignificant data at level.

Table 6 shows the slope heterogeneity test of [78]. The Slope Heterogeneity analysis determines whether the variable's slope coefficients are homogenous or consistent across various groups or conditions. A more significant p-value in your situation means that there is not enough data to rule out the null hypothesis (H0), which suggests the relationship between the slope coefficients is homogeneous. This shows no significant variations across groups or situations in the slopes of the parameters "Delta" and "adj."

The results of the Pedroni and Westerlund cointegration analysis in Table 7 provide conclusive proof of a long-term link between the studied variables. Extremely low p-values across contexts are produced by the Modified Phillips-Perron and Phillips-Perron statistics, indicating strong

cointegration. This finding is further supported by the Augmented Dickey-Fuller test, particularly when considering the lack of a trend. These findings reveal a solid and lasting relationship between the variables, indicating that they move in tandem throughout time. Similarly, the variance ratio of the Westerlund cointegration test significant at a 1% significance level, indicates that there are long-term cointegrations among the selected variables.

**Table 5.** Unit root test.

Variable	Levin-Lin-Chu		Im-Pesaran-Shin		CIPS	
	At level	At 1 <sup>st</sup> Difference	At level	At 1 <sup>st</sup> Difference	At level	At 1 <sup>st</sup> Difference
$\Pi$	-0.9041	-3.6642***	-0.8592	-1.7658**	-2.014	-2.754***
$LC^+$	0.6543	-3.8923***	3.6720	-5.2237***	-2.037	-4.323 ***
$LC^-$	-1.4441**	....	2.5014**	....	-2.408**	....
$RMC$	-0.1535	-4.1574***	-0.4573	-4.7197***	-2.252	-5.813***
$KC$	-1.1440	-7.8864***	-0.7054	-4.3825***	-2.508	-3.840***

Note: \*, \*\*, \*\*\* denote the rejection of the null hypothesis of no unit root at 1%, 5%, and 10%, respectively. Ho: All panels contain unit roots. # Normality of the Z-t-tilde-bar requires at least six observations per panel with balanced data and no time trend.

**Table 6.** Slope Heterogeneity Test.

	Delta	p-value
	1.068	0.285
adj.	1.511	0.131

Note: Ho: slope coefficients are homogenous.

**Table 7.** Pedroni and Westerlund test for cointegration.

	Without Trend		With Trend	
	Statistic	p-value	Statistic	p-value
Modified Phillips-Perron t	3.8165	0.0001	4.7285	0.0000
Phillips-Perron t	-4.7080	0.0000	-3.2245	0.0006
Augmented Dickey-Fuller t	-2.3439	0.0095	-1.4704	0.0707
Westerlund Test				
Variance Ratio	3.824***			

\*\*\*, \*\*, \* respectively refers to statistical significance at 1%, 5%, and 10% level.

Table 8 shows the result of panel nonlinear ARDL's PMG and MG models. The MG model is rejected, and the PMG model's prediction is accepted because the p-value from the Hausman test is

more significant than the 5% significance level. According to the PMG model results, all four variables are statistically insignificant in the short run but significant in the long run. In the long run, positive wage bill shock is statistically significant, with a p-value of 0.005 and a coefficient of 0.685. The negative wage bill shock coefficient is 1.265, with a significant p-value of 0.000. Raw material and capital costs are statistically significant at a 1% significance level with positive coefficients of 0.132 and 1.131, respectively. The short-run and long-run asymmetries test are also shown in Table 8. The chi-squared test indicates the possible long-run asymmetries in the panel dataset. However, the outcome is significant at a significance level of 0.10 rather than the standard significance level of 0.05. The panel dataset indicates short-run asymmetry according to the chi-squared test. Short-run asymmetries are likely to exist since the outcome is considered statistically significant.

**Table 8.** Panel nonlinear ARDL estimation results.

Variable	Pool Mean Group				Mean Group			
	Coef.	Std. Err	z	P> z	Coef.	Std. Err	z	P> z
D.Π								
Long Run Results								
<i>LC</i> <sup>+</sup>	0.6851282	0.2441684	2.81	0.005	1.981612	2.250317	0.88	0.379
<i>LC</i> <sup>-</sup>	1.265771	0.1942681	6.52	0.000	2.285356	2.648791	0.86	0.388
<i>RMC</i>	-0.1321395	0.032759	4.03	0.000	-1.130487	1.144979	-0.99	0.323
<i>KC</i>	-1.131436	0.2267462	4.99	0.000	0.5016648	2.225763	0.23	0.822
Short Run Results								
ECT	-0.3933942	0.1176718	3.34	0.001	-0.818697	0.1031031	7.94	0.000
$\Delta LC$ <sup>+</sup>	-0.1652839	0.9272545	-4.27	0.000	-2.3931	2.221056	-1.08	0.281
$\Delta LC$ <sup>-</sup>	1.556908	1.696137	2.61	0.009	5.471963	2.517868	2.17	0.030
$\Delta RMC$	0.1231664	0.1032032	1.19	0.233	-.0188922	0.2833299	-0.67	0.505
$\Delta OC$	0.7046595	0.4311898	1.63	0.102	0.0753253	0.9187799	0.08	0.935
_cons	6.61e+08	2.78e+08	2.37	0.018	9.16e+09	5.76e+09	1.59	0.112
Hausman Test			chi2(4) =0.10, Prob>chi2 =0.9914					
Long Run Asymmetries			Chi2(1) = 3.17, Prob > chi2 = 0.0750					
Short Run Asymmetries			Chi2(1) = 3.18, Prob > chi2 = 0.0749					

Table 9 demonstrates the findings of the robustness test by GMM, CCEMG, and DKSE approaches. Most of the findings are similar to the PMG ARDL results. According to GMM and DKSE positive wage shock and negative wage shock variables positively influence profitability but raw

materials cost and capital costs have a negative role on the profitability of firms. However, according to GMM, raw materials cost is statistically insignificant and has no role in firm profitability. This finding of GMM is similar to CCEMG. However, in the CCEMG approach positive wage shock shows a negative role in firm profitability which is significant at the 10% level.

**Table 9.** Robustness tests.

Variable	GMM	CCEMG	DKSE
$LC^+$	1.125***	-0.813*	1.112**
$LC^-$	0.615***	0.482***	1.008***
$RMC$	-0.652	-0.861	-0.568**
$KC$	-0.861***	-1.251***	-1.256***
_cons	5.21e+06***	6.56e+06***	5.18e+09

\*\*\*, \*\*, \* respectively refers to statistical significance at 1%, 5%, and 10% level.

## 5. Discussion

According to the nonlinear PMG-ARDL findings of this study, a one-unit positive wage shock will decrease profit by 0.16 units in the short run. This observation conforms to the classical cost theory in the sense of input costs, especially the price of labor being considered as quasi-fixed and firms not being able to adjust output quickly or price in response to cost variations in the short-run production setting. Any abrupt increase in wage is therefore directly reduced in profit margins. In the short run, firms cannot absorb positive shocks in wages and higher wages usually cannot improve labor productivity. It can only happen slowly because productivity takes time to grow [93]. Additionally, the global clothing value chain limits the price-setting power of the Bangladesh RMG enterprises to offset higher costs of labor, because price is often determined by the foreign buyers, which causes a direct profit margin loss. This finding is justified by empirical analysis of [94] and [95] who argue that since the price agreements by the foreign buyers are tight, labor-intensive industries in low-wage countries remain highly vulnerable to increasing labor costs. Similarly, [69] find that higher wages in the Bangladesh garment sector mean lower profit margins among the companies that cannot adjust fast enough to restructuring their production processes.

However, in the long run, according to our estimated result, a 1-unit positive shock in the wage bill may lead to a 0.69-unit increase in gross profit. In the long run, wage impact on firms' profitability is positive. This suggests that although temporary shocks might cause disruptions, businesses eventually adjust by increasing efficiency, making the most use of their workforce, and using greater compensation to boost employee engagement and lower attrition. This is in line with the Efficiency Wage Theory, which states that more effort by employees can produce greater effort as well as reduced shirking and improved retention, which in turn improves productivity and, ultimately, profitability due to higher wages.

[70] support this argument by holding that the increase in production and morale by fair pay has raised equity. [71] further states that companies can invest a little more on training or hire more

of the talented people, as well, provided that they offer them higher compensations. This would promote learning-by-DOing as well as innovation. Such an outcome is not surprising considering that a study by [96] has shown that continuous growth of wages positively affects the quality and efficiency of manufacturing of operations in China. Labor productivity contributes to gross profit [97]. [98] found a similar result and stated that wages have a significant positive relationship with employee work motivation in the RMG sector of Bangladesh. With higher wages, workers' nutrition intake is higher, and higher wages also allow workers to get better health facilities [99]. Additionally, [99] argues that the enterprises that operate in the RMG industry of Bangladesh can achieve a higher level of global competitiveness due to the moderate increase in wages combined with productivity improvements.

However, for adverse shocks in wages, the impact on firm profitability is always positive, either in the short or long run. The reduction of labor wage instantly reduces the firm's total cost, and, as a result, in the short run, it affects profitability positively. In the short run, a 1 unit fall in labor cost led to a 1.56 unit increase in firms' profitability. Moreover, in the long run, a one-unit negative shock in the wage bill will lead to a 1.3-unit increase in gross profit. This is because, in the long run, the firm can mobilize the money accumulated due to reduced wages, improved infrastructure, improved technology, buying more raw materials, etc. Which always has a positive impact on firms' profitability. According to our estimation, a 1 unit increase in raw material consumption led to a 0.13 unit increase in gross profit because whenever a firm uses more raw material, it produces more. Moreover, more production usually leads to higher profitability in the short and long run. One unit increase in capital costs led to a 1.13 unit increase in gross profit.

So, it is clear that although a positive shock in wages has a positive impact on profitability in the long run, in the short run a positive shock in wages leads to a decrease in firms' profitability. The same findings were stated by [16] when analysing firms' profitability. After 2010, the growth of RMG decreased sharply because the number of new firm entries was deficient. New firms enter into a market when the profit margin of that market is high. Similarly, [16] found that the net entry rate falls due to the introduction of minimum wage. However, as RMG's profitability is decreasing, new firms are not interested in entering this market. This problem reduces the growth of RMG and the international competitiveness of Bangladeshi RMGs because, due to higher costs, Bangladeshi RMGs are increasing their product price, and other competitors are offering them at lower prices. A similar conclusion was found [100].

Furthermore, the findings reveal that in the long run, increases in raw materials and capital costs lead to decreased profits. Higher costs for raw materials and capital costs result in a greater total cost. If firms are unable to adjust prices, this will ultimately lead to a decline in profit [101], [102]. Conversely, short-run results indicate that both of these variables positively contribute to profitability. Higher costs of raw materials and capital costs correlate with increased production levels. Due to the large scale of production, firms benefit from economies of scale, resulting in higher profits [103]. However, according to this study, the impact of raw materials and capital costs on a firm's profitability is statistically insignificant. Table 10 showing how the objectives and hypothesis of this study has been accomplished.

The results of the current research are highly practical and have important implications for policymakers, RMG stakeholders, and the economy of Bangladesh. The fact that positive wage shocks lower the profitability of firms in short run and hinder expansion within a sector but rise profitability

over the long term, coupled with the negative impact of increasing raw material prices, points to the necessity of well-thought-out interventions. On the government side, the study can be used to develop durable wage policies that will cater to the welfare of workers without affecting the competitiveness of firms. Policies should shift toward productivity-linked wage structures, training, and skills development to enhance workers' abilities instead of relying on ad hoc wage increases. Additionally, the government can subsidize backward linkage industries (i.e., local textiles, cotton cultivation) to minimize reliance on imported raw materials, thereby reducing external cost shocks. The existence of long-run asymmetry in wage impacts also encourages firms to implement strategic labor management techniques, including performance-based salaries and staff retention benefits, rather than universal salary recommendations. In the case of the Bangladeshi economy, which thrives on a significant percentage of RMG exports, the findings help identify weaknesses in the cost structure of the sector. Reforms based on this study can be implemented at both policy and industry levels to sustain export competitiveness, attract foreign investment, and create sustainable employment, thereby ensuring long-term economic stability and growth.

**Table 10.** Decision on hypothesis.

Null Hypothesis	Decision	Remarks
$H_1$	Rejected	In long run increasing labor costs rise firm profitability.
$H_2$	Accepted	Labor costs have asymmetric role on firm profitability.
$H_3$	Accepted	Rising raw material costs negatively affect firm profitability.
$H_4$	Accepted	Rising capital costs negatively affect firm profitability.

## 6. Conclusion

The research applied a panel nonlinear PMG-ARDL, GMM, CCEMG, DKSE approaches to estimate the correlation between positive wage shocks, negative wage shocks, raw material costs, capital costs with firms' profitability. Findings states that in the short run firm are facing negative consequences from rising labor cost. This necessitates the needs of policy reform for easy and cheap supply of labor to RMG. However, in the long run positive shock on labor cost is beneficial to firms as it helps to rise profit by improving labor productivity. Since there is substantial evidence that any positive shock in wages led to a rise in business profitability in the long run, it would be unfair to place all the responsibility on the minimum wage law for the short-run adverse impact of it on RMG sector growth. This highlights the importance of efficiency wag for labor. Long-term and short-term asymmetry of wage shock on profit is discovered in the estimation result. It means firm response differently to the wage shocks. In the long run a positive wage shock rise less profit for firm than a negative wage shock. Wage shock's adverse impact on firms' profitability discourages new firms from entering the market. Because of this adverse impact, the growth of Bangladesh's RMG sector is decreasing gradually. Along with the decreasing growth of this sector, rising labor costs also reduce Bangladeshi RMG's competitiveness in the international market. Thus, rising labor cost is emerging as the most critical threat to Bangladesh's RMG industry. Bangladesh's comparative advantage for labor will vanish unless Bangladeshi policymakers take immediate action. As a result, RMG, the most critical pillar of Bangladesh's GDP, will fly from Bangladesh to another country or countries that

is/are having a cheap labor advantage. Along with this, Bangladesh also needs to be concerned about rising raw material costs for the smooth growth of this sector. Because in the long run continues rise of raw material cost has negative consequences on firm profitability.

## **7. Policy Recommendations**

A multifaceted policy approach is essential to ensure the long-term sustainability and profitability of Bangladesh's RMG industry while protecting the rights and well-being of its labor force. First and foremost, it is advised to implement a structured wage progression system that explicitly connects pay increases to employees' skill development and productivity gains in order to lessen the negative effects of short-term wage shocks on business profitability. This system would minimize sudden salary increases that put a strain on business finances while encouraging ongoing workforce development, which would eventually allow for sustainable wage growth. To promote this approach, the government should work with industry associations to facilitate certification and vocational training programs.

As in the long run higher wage help firms to get positive profit a revenue sharing system that allows a set percentage of business profits to employee benefit programs should be established It will strike a balance between labor protection and business profitability. This initiative would promote social security and boost employee morale by funding vital services like medical care, schooling, and pension benefits. By bringing businesses and employees together, this strategy guarantees that financial advantages result in noticeable enhancements to worker welfare.

There is still abandoned labor and disguised unemployment in Bangladesh's agriculture sector [104]; the government needs to take proper steps to transfer and utilize those unemployed workers in the RMG sector. Decentralization of RMG can be another solution because there are still a lot of unemployed workers available in rural areas [105]. According to Weber's theory of localization, decentralization from a high labor-cost area to a low labor-cost area may help improve profit margins.

Workers who migrate to cities for RMG from rural areas live in slums that impede their productivity. Life in slums is extremely challenging, which discourages workers from entering the RMG sector and also diminishes the productivity of those who live in slums. Housing initiatives that provide proper living conditions could effectively attract labors to join RMGs and enhance the productivity of the current workforce.

As rising raw material costs negatively affect a firm's profitability, the authorities should establish a stabilization fund to protect RMG companies from fluctuating raw material prices. In order to ensure more predictable and consistent input prices, this fund might function through specific support or price hedging methods during times of notable price changes. The capacity of businesses to plan and control production costs without sacrificing competitiveness would be improved by such a strategy.

Sooner or later, the comparative advantage of Bangladesh's cheap labor will vanish, so Bangladesh needs to prepare its RMG to absorb this shock by implementing different cost-effective methods. Diversifying products, technology improvement could serve as viable solutions in this regard. Additionally, Bangladesh needs to identify alternative sources of income beyond RMG to shield its economy from any negative impacts arising from shocks in the RMG sector. However, Bangladesh should not rely solely on RMG for export earnings; rather, it should focus on producing and exporting a broader range of products.

## 8. Limitations and Future Research Guidelines

Although this study will serve as a benchmark for future research on the threats of RMG in Bangladesh, it has some unavoidable limitations. First, out of three thousand firms, this study was able to include only fifty. Second, this study covers just twelve years of data, which may raise questions about the reliability of its findings. Future research with a larger sample and extended timeframe could yield better estimates and more reliable results. Additionally, qualitative research may also aid in understanding the diverse impacts of rising wages and raw material costs on firm profitability, worker welfare, and worker productivity.

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## Appendix A

### List of Abbreviations:

Abbreviations	Details
ARDL	Autoregressive Distributed Lag
CIPS	Cross-Sectionally Augmented IPS
CSD	Cross-Sectional Dependency
GDP	Gross Domestic Product
LC	labor Cost
RMC	Raw material Cost
KC	Capital Cost
MG	Mean Group
NARDL	Nonlinear ARDL
PMG	Pool Mean Group
RMG	Ready-made Garments

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