POLITICAL ECONOMY RESEARCH INSTITUTE
PERI
University of Massachusetts Amherst

Comparative Advantage and Exploitation:
Wages and Unequal Exchange in a Ricardian Framework

Soumik Sarkar

April 2026

WORKINGPAPER SERIES

Number 640

POLITICAL ECONOMY RESEARCH INSTITUTE

Comparative Advantage and Exploitation: Wages and Unequal Exchange in a Ricardian Framework

A Formal Analysis of Exploitation-Driven Trade Patterns

Soumik Sarkar[1]

April 2026

[1] School of Social Sciences and Humanities, VIT-AP University, Amaravati, India.

E-mail: soumik1289@gmail.com

The author is grateful to Shouvik Chakraborty and Gerald Epstein at the University of Massachusetts Amherst for their insightful comments and support. The usual disclaimer applies.

Comparative Advantage and Exploitation: Wages and Unequal Exchange in a Ricardian Framework

A Formal Analysis of Exploitation-Driven Trade Patterns

Abstract

The paper revisits the Ricardian trade model by introducing the distinction between necessary and surplus labor from Marx, deriving a formal result that connects the class structure of production to the pattern of international specialization. The paper shows that a country can have lower absolute production costs in a good despite being technologically less efficient, provided its rate of exploitation is sufficiently higher than that of its trading partner. Under competitive money-cost pricing and homogeneous abstract labor, this condition shapes absolute cost competitiveness and, jointly with its counterpart for the second good, determines the trade pattern. Free trade may equalize commodity prices while leaving exploitation rates unequal, generating transfers of surplus value through the terms of trade. The paper thus formalizes, within a Ricardian cost-equilibrium framework, the mechanisms of unequal exchange identified by Emmanuel and extended by Roemer, while advancing both by incorporating technology differentials alongside exploitation differentials. It also highlights how, in labor-intensive export sectors such as Bangladesh's garment industry, gender-based wage suppression contributes to high exploitation rates. A Bangladesh–United States calibration illustrates that the parameter values required for the results are empirically plausible.

Keywords: unequal exchange, exploitation, comparative exploitation, comparative advantage, North–South trade, wages, labor share, wage suppression, global value chains

Notation Glossary

The following symbols are used consistently throughout the paper. Country subscripts are $i \in \{S, N\}$ (South, North) and commodity subscripts are $j \in \{X, Y\}$. Where both subscripts appear together, country comes first: a_{ij} denotes the unit labor requirement for good j in country i.

a_{ij}	Unit labor requirement: total socially necessary labor hours to produce one unit of commodity j in country i
$n_{ij},\ s_{ij}$	Necessary and surplus labor per unit of commodity j in country i, satisfying $a_{ij} = n_{ij} + s_{ij}$
ε_{ij}	Sector-level rate of exploitation: $\varepsilon_{ij} = s_{ij}/n_{ij}$ (ratio of surplus to necessary labor in sector j, country i)
ε_i	Country-level exploitation rate under the uniform-ε baseline (eq. 10): $\varepsilon_i \equiv \varepsilon_{ij}\ \forall j$; operationally $\varepsilon_i = (1 - \lambda_i)/\lambda_i$
λ_i	Labor share of value added in country i: $\lambda_i = 1/(1 + \varepsilon_i)$
w_i	Money wage rate in country i (in labor-value terms): $w_i = 1/(1 + \varepsilon_i)$
P_{ij}	Autarky price of commodity j in country i: $P_{ij} = a_{ij}/(1 + \varepsilon_i)$
p^*	International equilibrium relative price of X in terms of Y, settling in the range $P_{XS}/P_{YS} < p^* < P_{XN}/P_{YN}$ (eq. 17)
$\alpha_{\beta i}$	Unit labor requirement for the subsistence basket in country i: $\alpha_{\beta i} = b_x a_{xi} + b_y a_{yi}$; feasibility requires $\alpha_{\beta i} \leq 1$
$b = (b_x, b_y)$	Subsistence consumption basket per labor-hour (socially and historically determined)
C_{XS}, C_{XN}	Unit production costs of good X in South and North: $C_{XS} = a_{XS}/(1 + \varepsilon_S)$, $C_{XN} = a_{XN}/(1 + \varepsilon_N)$; analogously for good Y
Δ	Net surplus transfer per unit of good X exported by S: $\Delta = s_{XS} - s_{YN} \cdot p^*$; $\Delta > 0$ indicates South-to-North transfer

1 Introduction

David Ricardo's theory of comparative advantage has long influenced the analytical foundations of international trade theory, providing a framework for understanding the potential benefits of specialization and exchange (Ricardo, 1951). The main insight of the theory is that countries can benefit from trade even if one economy is less productive in all commodities, as long as relative productivities differ. In the standard Ricardian model, patterns of specialization are determined by differences in unit labor requirements between countries. However, the classical formulation of the model does not address the social and distributional relations through which production takes place (Krugman et al., 2022). Wages, in particular, are not treated as a share of the value created by labor, but rather are incorporated into technological parameters. As a result, the model implicitly assumes that workers receive the full value of their output.

One theme in classical economic thought, which continues to the present time in the mainstream economics, considers the wages, rents, profits as rewards to the factors of production received from their naturally derived participation in the production process. This way of thinking tends to present distribution as a technical outcome, detached from underlying social relations. Marx's prescient observation of the classical thought was the following: "rent, profit and wages appear to grow out of the roles that the earth, the produced means of production and labor play in the simple labor process" (Marx, 1991, p. 964). He argued instead for the necessity to connect the realm of distribution to that of production, more specifically class relations of production. During the labor process, Marx showed that performed labor time (working with the means of production) gets divided into necessary labor and surplus labor (Marx, 1991, pp. 972–973). While the equivalent of necessary labor is remunerated to workers (sometimes called direct producers), surplus labor remains unremunerated. Once this distinction is introduced, the interpretation of comparative advantage changes; production costs may depend not only on technological coefficients but also on the proportion of labor time returned to workers in the form of wages.

The literature on exploitation and international trade has developed along two distinct lines that this paper brings together. The first runs from Emmanuel (1972), who formalized unequal exchange as a consequence of international wage differentials, through Roemer (1982), who provided a rigorous Marxian treatment of exploitation, proving the Fundamental Marxian Theorem and demonstrating the correspondence between exploitation rates and class position. Roemer's framework is formally powerful but does not address technology differences across countries, treating wages as exogenously given without integrating exploitation rates into the determination of comparative advantage itself. The second line of thought runs through Shaikh (1980), who demonstrated within a multi-sector input–output framework that absolute cost advantage rather than comparative advantage governs trade once exploitation rates are incorporated. Most recently, Cogliano et al. (2024) have extended Roemer's framework to the international level, deriving conditions for the persistence of unequal exchange, though again assuming identical technologies. The present paper contributes to this literature by providing a formal proposition specifying the conditions under which exploitation-rate differentials govern absolute cost competitiveness within a Ricardian two-country framework that allows for technology differences across countries.

Despite decades of trade liberalization, large wage disparities between workers in the global North and South have not converged toward productivity levels. In many sectors, wage gaps far exceed measured productivity differences (International Labor Organization, 2023). Ricci (2019) estimates persistent surplus transfers from South to North over 1990–2019, and Hickel et al. (2021) quantifies such transfers at approximately $2.2 trillion per year. This persistence is what the theoretical mechanism formalized here helps explain. The paper's main theoretical contribution is the concept of *comparative exploitation* and the formal conditions under which it governs trade. Where Roemer (1982) proves exploitation theorems within a model of identical technologies, and Shaikh (1980) challenges the Ricardian adjustment mechanism from without, this paper works within the Ricardian cost-equilibrium framework and shows that incorporating the necessary/surplus labor distinction modifies the absolute cost conditions for specialization in a precise and formally derivable way. A country may specialize in and export a commodity not because it is technologically more efficient, but because it extracts surplus from labor at a sufficiently higher rate. Section 5 presents the formal proposition and proof under six explicitly stated assumptions. The Bangladesh–US calibration in Section 6 demonstrates that the parameter values required for the result are empirically plausible, not merely theoretically possible.

Before we proceed, a clarification of the theoretical approach is necessary. This paper does not attempt to graft surplus value onto an otherwise unaltered orthodox model, nor does it attempt to integrate Marxian and Ricardian value theory into a single comprehensive framework. The Ricardian model already incorporates a labor theory of value, with prices proportional to labor time. However, it implicitly assumes that the workers are paid for their entire working hours as wages. Marx (1990) demonstrated that the working day is divided between necessary labor, which workers receive in the form of wages, and unpaid surplus labor, which capitalists appropriate. This paper replaces Ricardo's wage-value identity with that distinction. While the Ricardian logic that the countries specialize based on relative costs remains unchanged, what differs is the nature of those costs. When wages are no longer treated as equal to the total value created by workers, the distributional relations that underpin production enter the cost structure, and the trade pattern cannot be explained solely by technology.

The paper is structured as follows. Section 2 reviews the standard Ricardian model and discusses why mainstream frameworks cannot account for wage–productivity divergence. Section 3 reconstructs the framework by introducing an explicit wage–surplus division. Section 4 clarifies the model's scope, assumptions, equilibrium concept, and the institutional basis of the exploitation rate. Section 5 derives the conditions for comparative exploitation and surplus transfer, with explicit attention to the logical relationship between absolute cost competitiveness and the trade pattern. Section 6 provides an illustrative calibration using Bangladesh–US trade data. Section 7 discusses implications for development policy and extensions, and Section 8 concludes.

2 The Standard Ricardian Model and the Limits of Mainstream Trade Theory

Consider the familiar two-country, two-commodity Ricardian framework. Countries A and B produce goods X and Y using labor as the only input. Production is characterized by unit labor requirements a_{ij}, representing the hours of labor required to produce one unit of commodity j in country i. Under autarky and perfect competition, prices correspond to unit labor costs. With labor taken as the numéraire, prices in country A satisfy:

$$p_X^A = a_X^A \qquad \text{and} \qquad p_Y^A = a_Y^A, \tag{1}$$

so that $p_X^A/p_Y^A = a_X^A/a_Y^A$. The relative price of two goods equals the ratio of the labor hours needed to produce them. Country A possesses comparative advantage in commodity X when:

$$\frac{a_X^A}{a_Y^A} < \frac{a_X^B}{a_Y^B}. \tag{2}$$

When trade opens, the international relative price settles between the two autarky price ratios and each country specializes accordingly, generating the well-known gains from trade (Dornbusch et al., 1977).

The price equation $p = a$ represents the wage-value identity: the entire labor time of the worker is treated as compensated, so that labor cost and labor value coincide. What this formulation leaves unexamined is the class relation through which wages are determined. As Marx (1990, 1991) showed, the wage purchases labor-power—the worker's capacity to labor—not labor itself. Workers are compensated for reproducing that capacity, not for the full value generated during the working day (Roemer, 1982). The Ricardian model is not wrong to ground prices in labor time, what it forecloses is how that labor time divides internally between workers and capitalists— a division that Ricardo's cost equations do not address, and that only becomes visible once the wage is understood as the price of labor-power rather than of labor itself.

Mainstream trade theory offers two standard responses to large international wage differences. The first is the factor price equalization (FPE) theorem (Samuelson, 1948, 1949), which predicts that trade in goods should eventually equalize wages across countries as factors are indirectly traded. The second is the unit labor cost (ULC) framework, which interprets differences in nominal wages as reflecting differences in labor productivity—lower wages in the South are treated as corresponding to lower productivity (Feenstra, 2015; Krugman et al., 2022). However, neither framework adequately accounts for the persistent divergence between wage ratios and productivity ratios observed in global trade. In the Bangladesh–US garment sector, for example, wage ratios on the order of 30:1 coexist with productivity gaps of roughly 2–3:1 (UNCTAD, 2020; International Labor Organization, 2023). Standard FPE theory relies on assumptions such as factor mobility and identical technologies across countries, which do not hold in practice. The ULC interpretation treats wages as a technological parameter rather than as a result of distributional relations, contrary to Marx's distinction between the value created by labor and the wage paid for labor-power, and interpreting exploitation-based cost differences as productivity differences. Thus, to explain trade patterns and wage dynamics under globalization, a distinct analytical framework is needed.

The limitations of mainstream approaches are not only empirical but also structural. Both FPE and ULC share a common premise, they treat wages as derived variables, determined by technology and market clearing. This forecloses the possibility that wages are shaped through distributional processes that precede and condition market outcomes. The persistent divergence between wage and productivity ratios is therefore not an anomaly resolvable through better data or more flexible modeling within the standard framework. It is, rather, a systematic consequence of treating wages as technically derived outcomes while leaving unexamined the class relations through which the labor contract is actually constituted. This is what the present model seeks to make explicit, and why the reconstruction undertaken here cannot be achieved simply by relaxing a parameter within the standard approach.

Recent empirical work reinforces this concern. Stockhammer (2017) finds robust negative effects of globalization on wage shares in both advanced and developing economies; Riccio et al. (2024) shows that labor shares along global value chains consistently diverge between advanced and developing countries, with divergent post-2007 trends; and Heintz and Milberg (2025) document how intangible asset investments by lead firms generate persistent asymmetries in value distribution within global value chains.

Heterodox economists have long highlighted the issue. Emmanuel (1972) formalized the concept of unequal exchange, demonstrating that international wage differentials can result in surplus value transfers through trade even when labor productivity converges. Shaikh (1980) argued that once exploitation rates are incorporated, technological comparative advantage may no longer be sufficient to determine trade patterns. Roemer (1982) provided rigorous formal treatment of exploitation, proving the Fundamental Marxian Theorem and the Class-Exploitation Correspondence Principle, but did not consider the technological differences across countries. More recently, Cogliano et al. (2024) have extended Roemer's framework to the international level, proving conditions for the persistence of unequal exchange, though again assuming identical technologies across countries. Despite these contributions, most formulations of the Ricardian model continue to treat wages as equal to labor value, including standard textbook treatments (Feenstra, 2015; Krugman et al., 2022).

To clarify the contribution of this paper, it is useful to distinguish it from several related approaches in the literature. The first is ecologically unequal exchange theory, which explains unequal exchange through transfers of embodied natural resources, energy, and land rather than surplus labor (Hornborg, 1998; Dorninger et al., 2021; Hickel et al., 2022). The second is the monetary theory of value, which challenges the assumption of internationally homogeneous abstract labor (Foley, 1982; Duménil and Lévy, 2000). If higher Northern productivity causes labor there to count as multiplied simple labor on the world market, the framework here may understate cross-country exploitation differences—an extension pursued by Ricci (2019, 2021). This paper, however, maintains the assumption of homogeneous abstract labor as a simplifying device, and treats this monetary-value extension as an important avenue for future work. The third approach follows the global value chains literature, which attributes international value asymmetries to buyer power and lead-firm control over intangible assets (Gereffi and Korzeniewicz, 1994; Milberg and Winkler, 2013). Heintz and Milberg (2025) show how investments in oligopoly and oligopsony power generate persistent asymmetries in value distribution along global value chains. The GVC framework and the present model are nevertheless empirically complementary—monopsony power within global value chains is, in the terms of this model, one institutional channel through which high Southern exploitation rates are sustained.

Against this backdrop, the following sections derive a formal result specifying the conditions under which exploitation-rate differentials govern absolute cost competitiveness and thereby shape the pattern of international trade.

3 Wages, Surplus, and Exploitation: A Revised Ricardian Framework

The wage-value identity breaks down once the working day is understood as divided between necessary and surplus labor. The analysis here does not merge Ricardian and Marxian frameworks but relaxes a specific implicit assumption in the Ricardian model–that the wage equals the value created by labor by introducing the distinction between necessary and surplus labor that Ricardo's formulation leaves unexamined. Workers do not receive the full value they produce. Wages cover the cost of reproducing labor-power, while surplus labor—the remainder of the working day is appropriated by capitalists (Marx, 1990, 1991).

Let a_{ij} denote the total socially necessary labor time to produce one unit of commodity j in country i—a technologically determined parameter, independent of how the working day is divided. Let n_{ij} and

s_{ij} denote necessary and surplus labor time per unit respectively. Total unit labor time satisfies:

$$a_{ij} = n_{ij} + s_{ij}. \tag{3}$$

In simple terms, the total labor time is the sum of what workers get back (as wages) and what capital retains (as surplus).

The rate of exploitation in sector j of country i is:

$$\varepsilon_{ij} = \frac{s_{ij}}{n_{ij}}. \tag{4}$$

This is Marx's rate of surplus value—the ratio of unpaid to paid labor (Marx, 1990). When $\varepsilon_{ij} = 0$, workers receive the full value they create, when $\varepsilon_{ij} > 0$, part of the working day takes the form of surplus labor appropriated by capital. Exploitation rates may differ not only across countries but also across sectors within countries, reflecting differences in unionization, capital intensity, skill requirements, or the gendered organization of work (Elson and Pearson, 1981; Seguino, 2000; Basu et al., 2024).

Since $s_{ij} = \varepsilon_{ij} n_{ij}$, substituting into equation (3) gives $a_{ij} = n_{ij}(1 + \varepsilon_{ij})$, from which:

$$n_{ij} = \frac{a_{ij}}{1 + \varepsilon_{ij}}, \tag{5}$$

$$s_{ij} = \frac{\varepsilon_{ij}\, a_{ij}}{1 + \varepsilon_{ij}}. \tag{6}$$

For a given unit labor requirement, a higher exploitation rate implies a smaller share of labor time returns to workers and a larger share is retained by capital.

Now, workers must consume in order to reproduce their labor-power. Let $b = (b_x, b_y)$ denote the subsistence consumption basket required per labor-hour worked. The subsistence basket is socially determined, shaped by the combined effects of biological needs and historical and moral elements that define the average means of subsistence required by workers (Marx, 1990; Chakrabarti and Cullenberg, 2003; Chakrabarti et al., 2008), and here assumed to be uniform across sectors within a country. The working day is normalized to one unit of labor time. In country i, the money wage must enable workers to purchase this bundle. Under competitive conditions, prices equal unit labor costs: $P_{ij} = w_{ij}\, a_{ij}$. With labor mobile across sectors, wages equalize: $w_{ix} = w_{iy} = w_i$. Defining the unit labor requirement for the subsistence bundle as:

$$\alpha_{\beta i} = b_x a_{xi} + b_y a_{yi}, \tag{7}$$

the wage–subsistence condition requires $\alpha_{\beta i} \leq 1$, the labor time required to produce subsistence must not exceed the working day. This is a feasibility restriction, not a wage-determination equation. Wages are not determined by subsistence level but by the rate of exploitation, which is shaped by institutional conditions (discussed in Section 4). Given ε_i, the share of the working day returned to workers—and hence the wage expressed in labor-value terms—is:

$$w_i = \frac{1}{1+\varepsilon_i}. \tag{8}$$

In other words, if the exploitation rate doubles, workers' wage share halves. Autarky prices therefore equal $P_{ij} = a_{ij}/(1+\varepsilon_i)$, which is formalized as equation (12) below. Relative prices in country i are:

$$\frac{P_{xi}}{P_{yi}} = \frac{a_{xi}/(1+\varepsilon_{xi})}{a_{yi}/(1+\varepsilon_{yi})} = \frac{a_{xi}}{a_{yi}} \cdot \frac{1+\varepsilon_{yi}}{1+\varepsilon_{xi}}. \tag{9}$$

Relative prices depend not only on technology but also on the ratio of exploitation rates across sectors. Labor mobility is assumed to equalize exploitation rates within each country, though not across countries. While sector-level rates do vary empirically, this simplification allows each country to be characterized by a single exploitation rate for analytical tractability. The baseline specification therefore assumes:

$$\varepsilon_{xi} = \varepsilon_{yi} = \varepsilon_i. \tag{10}$$

Section 7 discusses how sector-specific rates affect the results. With equation (10), relative prices simplify to the standard Ricardian result:

$$\frac{P_{xi}}{P_{yi}} = \frac{a_{xi}}{a_{yi}}. \tag{11}$$

Remark 1 (Sector-specific exploitation rates)**.** *When exploitation rates vary by sector within a country—so that* $\varepsilon_{xi} \neq \varepsilon_{yi}$*—the relative price simplification in equation (11) no longer holds, and the trade pattern depends on the interaction of technology ratios and within-country sectoral exploitation-rate ratios. Proposition 1 continues to hold for each absolute cost comparison separately, but the recovery of the standard comparative advantage condition no longer follows because the exploitation terms no longer cancel. The baseline uniform-*ε_i *specification is a deliberate simplification that preserves the core mechanism in its cleanest form; relaxing it would require more disaggregated data and institutional analysis.*

But absolute prices and wages differ from Ricardo. The wage rate is $w_i = 1/(1+\varepsilon_i)$, and absolute prices are:

$$P_{ij} = \frac{a_{ij}}{1+\varepsilon_i}. \tag{12}$$

Countries with identical technologies but different exploitation rates have different absolute price levels. Higher exploitation depresses both wages and prices. The subsistence feasibility condition requires $\alpha_{\beta i} \leq 1$: the labor time required to produce subsistence must not exceed one hour. If technology is sufficiently productive ($\alpha_{\beta i} < 1$), surplus extraction is feasible; if technology is backward ($\alpha_{\beta i} > 1$), workers cannot reproduce themselves.

4 Model Specification and Equilibrium

Before we proceed to the analysis, it is important to state what the model assumes, what it determines endogenously, and how equilibrium is reached. The proposition derived in Section 5 rests on six assumptions, and the result does not hold if any of them is violated.

A1 (Pure labor model): Labor is the only factor of production, there is no constant capital. This is the standard Ricardian simplification. It implies that, with no organic composition of capital (OCC) differences, exploitation rates and wages are the only distributional parameters affecting costs. When constant capital is introduced and profit rates equalize across sectors (producing prices of production), the simple relationship $P = a \cdot w$ breaks down. OCC differences affect prices and exploitation rates become one distributional determinant among several. The current model therefore cannot address the debates around OCC-driven unequal exchange emphasized by Carchedi and Roberts (2021) and Ricci (2021)—an important limitation noted in Section 7.

A2 (Competitive money-cost pricing): Prices equal unit money labor costs: $P_{ij} = w_i \cdot a_{ij}$. This is the key pricing rule that makes exploitation rates relevant to relative prices and trade. If instead pure labor-value pricing were assumed (P_{ij} proportional to a_{ij} alone), then exploitation rates would be irrelevant to prices, and the proposition would not hold. The money-cost pricing rule reflects competitive conditions under which capitalists set prices to recover costs including wages, and competition drives profits to zero (Shaikh, 1980).

A3 (Exogenous exploitation rates): ε_i is determined by institutional and political conditions outside the model—class struggle, labor law, union organization, the reserve army of labor, following Emmanuel's (1972) treatment of wages as the "independent variable" in international trade. If exploitation rates were endogenous (determined jointly with prices and trade patterns), the analysis would require a richer model of institutional dynamics. This is addressed directly in the subsection below.

A4 (Internationally homogeneous abstract labor): One hour of abstract labor in country S creates the same monetary value V as one hour in country N: $V_S = V_N = V$. This is the most restrictive assumption. Marx's discussion of money in Chapter 3 of Volume I of *Capital* suggests that, on the world market, labor of different countries is reduced to a common measure through exchange. However, if more productive labor counts as "multiplied" simple labor (Marx, 1990), the condition $V_S = V_N$ may not hold. A country with higher social productivity of labor would have hours that count as more abstract labor on the world market. This would require a richer international value theory—an extension identified in Section 7.

A5 (Factor mobility within, immobility across, countries): Labor is mobile within each country, resulting in a single wage w_i, but cannot move across borders. International capital mobility is likewise excluded. Both are standard Ricardian restrictions.

A6 (Constant returns, free trade, homogeneous goods, balanced trade): Standard Ricardian conditions. The balanced trade assumption is particularly important and is discussed further below.

4.1 Scope and Endogenous Variables

The endogenous variables are: the money wage w_i (equation 8), absolute commodity prices P_{ij} (equation 12), the pattern of specialization (governed by condition 16 and its counterpart for good Y), and the direction and magnitude of surplus transfer (condition 18). The model holds constant the unit labor requirements a_{ij} (technologically determined, fixed in the short run), the subsistence basket b (historically and socially determined), and the number of sectors (two). It does not model consumer preferences explicitly; the international relative price p^* settles in the range consistent with comparative advantage theory (Dornbusch et al., 1977).

4.2 Equilibrium Concept and Adjustment Mechanism

The model's equilibrium is a competitive cost equilibrium similar to the standard Ricardian setup. Under autarky, equilibrium requires prices to equal unit labor costs (equations 1 and 12). Producers earn zero profit, prices are determined on the supply side, and no agent has an incentive to change decisions. When trade opens, countries observe absolute production costs in both sectors. If a country has a lower absolute cost in a good, it is competitive in that market and will specialize in producing it, the other country exits that sector and specializes in the good where it holds a cost advantage. What adjusts in this model is the pattern of production and specialization, not wages, which are again determined by the rate of exploitation. The key results hold for all p^* in the admissible range (17) and are not sensitive to where exactly p^* settles.

This is a partial equilibrium framework for analyzing trade patterns and distributional consequences. It does not solve for the full general equilibrium of prices, wages, and consumption simultaneously—a limitation of most analytical Ricardian models—but it is sufficient to establish the structural conditions under which comparative exploitation and surplus transfers arise.

4.3 The Exploitation Rate: Exogenous but not Arbitrary

The exploitation rate ε_i is the model's key exogenous parameter, and it is important to address the concern that treating it as exogenous makes the model tautological. There are two points that distinguish this treatment from circularity.

First, ε_i is determined independently, not derived from trade patterns but proxied by the labor share of value added, an observable quantity from national accounts and productivity data. The exploitation rate is written as $\varepsilon_i = (1 - \lambda_i)/\lambda_i$, where λ_i denotes the labor share of value added in sector i. Cross-country labor shares are systematically documented in the Extended Penn World Tables (EPWT 7.0), developed by Marquetti and collaborators (Extended Penn World Tables, 2022), and in the companion cross-country profit rate decompositions by Basu et al. (2025). For Bangladesh garment manufacturing, labor shares in the range 0.22–0.28 imply $\varepsilon_{BD} \approx 2.6$–$3.5$; for US electronics assembly, shares of 0.63–0.70 imply $\varepsilon_{US} \approx 0.43$–$0.59$. These provide independent empirical benchmarks for the calibration in Section 6, drawn from data rather than from the model's predictions.

Second, the institutional determinants of cross-country variation in exploitation rates are well established. Exploitation rates tend to be persistently higher where union density is low and collective bargaining rights are legally constrained; where the reserve army of labor is large—through surplus rural labor or export-processing zone competition—giving capital bargaining power over wage-setting; where global value chain competition creates credible threats of relocation that discipline national wage claims; and where labor legislation is weakly enforced (Elson and Pearson, 1981; Seguino, 2000). Bangladesh's garment sector exemplifies all four conditions–union rights in export-processing zones are formally restricted, rural migrants supply a large reserve labor force, international buyers exercise persistent price-reduction pressure, and minimum wage enforcement is notoriously weak (Fair Labor Association, 2024; Cornell Global Labor Institute, 2025). These conditions produce a high and durable exploitation rate that is not reducible to productivity. The international variation in ε_i is therefore the product of specific, identifiable institutional and political-economic configurations, not an assumption made to support the paper's conclusions.

5 Comparative Exploitation and Surplus Transfers under Free Trade

5.1 From Autarky Prices to Trade Patterns

The autarky framework established in Section 3 yields relative prices determined solely by technology when exploitation rates are uniform within countries (equation 11). But absolute prices and wages differ across countries according to their exploitation rates. These differences become determinative once trade opens. Before deriving the trade conditions, it is important to understand the relationship between absolute cost competitiveness and trade patterns, which has not always been clearly defined in existing heterodox literature.

In the standard Ricardian two-country, two-good model, the pattern of trade is determined by comparative advantage: country S exports X if and only if $a_{XS}/a_{YS} < a_{XN}/a_{YN}$. This condition is independent of the wage level, because each country's single wage cancels out of the relative cost ratio. The introduction of exploitation-rate differentials changes the situation. With $w_S \neq w_N$, the absolute cost in each good differs across countries, and the trade pattern now depends on absolute cost comparisons in each good. Under balanced trade and perfect competition, country S exports X if and only if it has lower absolute cost in X *and* higher absolute cost in Y:

$$C_{XS} < C_{XN} \quad \Longleftrightarrow \quad \frac{a_{XS}}{1+\varepsilon_S} < \frac{a_{XN}}{1+\varepsilon_N}, \tag{13}$$

$$C_{YS} > C_{YN} \quad \Longleftrightarrow \quad \frac{a_{YS}}{1+\varepsilon_S} > \frac{a_{YN}}{1+\varepsilon_N}. \tag{14}$$

Together, conditions (13) and (14) determine the trade pattern. Dividing (13) by (14) recovers the standard comparative advantage condition $a_{XS}/a_{YS} < a_{XN}/a_{YN}$ only when $\varepsilon_S = \varepsilon_N$. When exploitation rates differ, the conditions are more restrictive, they jointly determine both which good is exported and whether absolute cost competitiveness is achievable given the exploitation differential.

Remark 2. *Under balanced trade and competitive pricing (Assumptions A1–A6), the trade pattern is governed jointly by conditions (13) and (14), not by (13) alone. Proposition 1 below characterizes the conditions under which (13) holds despite technological inferiority in good X; the symmetric condition (14) must be jointly satisfied for S to export X under balanced trade.*

5.2 The Comparative Exploitation Condition

The equilibrium trade pattern under balanced trade (Assumption A6) requires that each country specializes completely in the good in which it holds an absolute cost advantage: country S produces only X and country N produces only Y. The competitive cost equilibrium ensures that no producer in the importing country can undercut the exporter's price based on international trade terms. The international price p^* settles in the range between the two autarky relative prices (formalized in equation 17 below). The conditions governing this equilibrium, equations (13) and (14), are the foundation for the following proposition.

Consider two countries, North (N) and South (S), producing goods X and Y with unit labor requirements a_{XN}, a_{YN}, a_{XS}, a_{YS}. Suppose S is technologically inferior in good X: $a_{XS} > a_{XN}$. From equation (12), absolute production costs are:

$$C_{iJ} = w_J \cdot a_{iJ} = \frac{a_{iJ}}{1+\varepsilon_J}, \tag{15}$$

where the subscript $J \in \{N, S\}$ denotes the country and i the good. Country S has lower absolute cost in X despite $a_{XS} > a_{XN}$ if and only if:

$$\frac{a_{XS}}{1+\varepsilon_S} < \frac{a_{XN}}{1+\varepsilon_N}.$$

Rearranging:

$$\frac{a_{XS}}{a_{XN}} < \frac{1+\varepsilon_S}{1+\varepsilon_N}. \tag{16}$$

The left-hand side is a technological ratio—it measures how much more labor S requires per unit of X than N. The right-hand side is a distributional ratio—it measures how intensely S exploits its workers relative to N. South has lower absolute cost in X whenever its exploitation advantage exceeds its technological disadvantage.

This condition makes explicit that absolute cost competitiveness is determined by the interaction of two ratios: a *technological ratio* (a_{XS}/a_{XN}) and a *distributional ratio* ($(1+\varepsilon_S)/(1+\varepsilon_N)$). Standard Ricardian theory considers only the first; this paper shows the second operates independently and may dominate. The condition is falsifiable. For given technology parameters, it predicts a threshold exploitation differential below which comparative exploitation does not hold. We can formalize this result as:

Proposition 1 (**Comparative Exploitation**). *Under Assumptions A1–A6, country S may have lower absolute production cost in good X despite being technologically inferior ($a_{XS} > a_{XN}$) if and only if its exploitation rate sufficiently exceeds its trading partner's, i.e. $(1+\varepsilon_S)/(1+\varepsilon_N) > a_{XS}/a_{XN}$. When condition (16) holds jointly with its counterpart for good Y—namely $a_{YS}/(1+\varepsilon_S) > a_{YN}/(1+\varepsilon_N)$—country S will export good X and import good Y under free trade. Under these conditions, the pattern of international specialization is partially determined by the intensity of surplus extraction rather than by technological efficiency alone.*

Proof. From A2 (**competitive money-cost pricing**), $C_{iJ} = a_{iJ}/(1+\varepsilon_J)$. From A4 (internationally homogeneous abstract labor), the monetary value created per hour is the same in both countries, so the wage rates $w_J = 1/(1+\varepsilon_J)$ are directly comparable. The inequality $C_{XS} < C_{XN}$ holds if and only if $a_{XS}/(1+\varepsilon_S) < a_{XN}/(1+\varepsilon_N)$, which rearranges to $a_{XS}/a_{XN} < (1+\varepsilon_S)/(1+\varepsilon_N)$, which is precisely condition (16). That this condition can hold even when $a_{XS} > a_{XN}$ follows from the fact that $(1+\varepsilon_S)/(1+\varepsilon_N) > 1$ when $\varepsilon_S > \varepsilon_N$, and this ratio can exceed $a_{XS}/a_{XN} > 1$ when the exploitation differential is sufficiently large. The joint condition with (14) is necessary for the trade pattern to assign X to S and Y to N under balanced trade. □

Remark 3 (**Scope of the result**). *Proposition 1 characterizes* absolute cost competitiveness *in good X. Under balanced trade (A6), the trade pattern requires both conditions (13) and (14) to hold jointly.*

When both hold, the standard comparative advantage condition follows as a necessary condition. To see this, divide condition (13) by (14): $[a_{XS}/(1+\varepsilon_S)]/[a_{YS}/(1+\varepsilon_S)] < [a_{XN}/(1+\varepsilon_N)]/[a_{YN}/(1+\varepsilon_N)]$, *which simplifies to* $a_{XS}/a_{YS} < a_{XN}/a_{YN}$ *—the standard comparative advantage condition. The* $(1+\varepsilon)$ *terms cancel, showing that standard comparative advantage is a necessary but not sufficient condition when exploitation rates differ. The sufficient condition for the trade pattern now incorporates exploitation differentials: even when* S *is technologically inferior in* X *(violating pure comparative advantage in the sense of* $a_{XS} > a_{XN}$*), it may still export* X *if condition (16) holds jointly with the* Y*-counterpart. When trade is not balanced, as when capital flows finance persistent deficits, condition (16) alone may be sufficient to sustain exports even without the* Y *counterpart, a scenario closer to Shaikh's absolute advantage framework.*

5.3 Surplus Transfers under Free Trade

The international price that emerges under free trade lies between the two autarky price ratios. Denote the international relative price as $p^* = P_X^*/P_Y^*$, where:

$$\frac{P_{XS}}{P_{YS}} < p^* < \frac{P_{XN}}{P_{YN}}. \tag{17}$$

At this price, S specializes in X, N in Y. But the gains from trade are asymmetric in their class character. When S exports one unit of X, it exports a_{XS} labor hours, decomposed as:

$$n_{XS} = \frac{a_{XS}}{1+\varepsilon_S} \quad \text{(necessary labor)}, \qquad s_{XS} = \frac{\varepsilon_S\, a_{XS}}{1+\varepsilon_S} \quad \text{(surplus labor)}.$$

In exchange, S imports p^* units of Y from N. The surplus labor embodied in these imports is:

$$s_{YN} \cdot p^* = \frac{\varepsilon_N\, a_{YN}}{1+\varepsilon_N} \cdot p^*.$$

A net surplus transfer from S to N occurs when the surplus labor embodied in S's exports exceeds the surplus labor embodied in its imports:

$$\frac{\varepsilon_S\, a_{XS}}{1+\varepsilon_S} > \frac{\varepsilon_N\, a_{YN}}{1+\varepsilon_N} \cdot p^*. \tag{18}$$

In other words, S exports goods containing proportionally more unpaid labor than the goods it imports. The price mechanism equalizes commodity values on the surface while concealing this asymmetric flow of surplus labor underneath.

Proposition 2 (**Surplus Transfer under Free Trade**). *Under Assumptions A1–A6, when countries trade at equalized commodity prices but have different exploitation rates, the country with higher exploita-*

tion may systematically transfer surplus value to the country with lower exploitation through the terms of trade. The magnitude of transfer per unit of X exported by S is $\Delta = s_{XS} - s_{YN} \cdot p^*$. A positive net transfer ($\Delta > 0$) occurs if and only if condition (18) holds. This result holds for all values of p^* in the admissible range (17).

This formalizes, in Ricardian terms, Emmanuel's original insight into unequal exchange. When free trade equalizes commodity prices but does not affect exploitation rates, the price mechanism serves as a conduit for asymmetric flows of surplus labor from high-exploitation to low-exploitation economies. The gains from trade are real—consumption possibilities expand for both countries—but they are not shared symmetrically. Under the conditions of Proposition 2, Southern export growth may reflect the intensification of domestic exploitation rather than technological advancement, while Northern consumption is partially supported by Southern surplus labor. None of this can be seen by the standard Ricardian model, which treats wages as equal to the total value created by workers.

6 A Theoretical Calibration: Bangladesh–US Trade in Garments and Electronics

Sections 3 and 5 present a theoretical framework that suggests comparative advantage can be influenced by both technological parameters and class relations. This section uses parameters derived from current Bangladesh-US trade data to provide a theoretical calibration rather than an empirical test. By theoretical calibration we mean the selection of parameter values from independent empirical sources—labor shares, productivity estimates, wage data—and their use to verify that the qualitative predictions of the model are consistent with observable orders of magnitude, without claiming the parameters are direct measurements or that the exercise constitutes structural estimation. The purpose is to illustrate the mechanics of comparative exploitation and surplus transfer, to demonstrate that the parameter values required for the theoretical results are empirically plausible, and to explore the sensitivity of the results to reasonable variations in parameter choices. The limitations of this approach, and what a rigorous empirical test would require, are discussed in Section 7. The calibration uses two sectors: garments (good X, labor-intensive) and electronics (good Y, capital-intensive).

6.1 Parameter Calibration

Exploitation rates. From equation (8), the exploitation rate is written as $\varepsilon_i = (1 - \lambda_i)/\lambda_i$, where λ_i denotes the share of compensation in value added. This enables us to connect the model's theoretical parameter to an observable national accounts variable, providing independent empirical support for the calibration following the methodology of Basu et al. (2025).

Drawing on the Extended Penn World Tables (EPWT 7.0, Extended Penn World Tables 2022), Asian Productivity Organization (2020) labor productivity estimates, and Fair Labor Association (2024) wage data, we set labor shares $\lambda_{BD} = 0.25$ and $\lambda_{US} = 0.67$ as benchmark values. The EPWT 7.0 reports labor compensation as a share of value added across manufacturing sectors. For Bangladesh garment manufacturing, the labor share is approximately 0.22–0.28, centered on 0.25, consistent with Asian Productivity Organization (2020). For US electronics assembly (NAICS 334), the share is approximately 0.63–0.70, centered on 0.67, consistent with BEA industry accounts. The labor share is mapped directly to $\lambda_i = 1/(1 + \varepsilon_i)$, so that the labor share equals the fraction of the working day returned to workers as wages—the key theoretical assumption connecting the data to the model. Alternative calibrations within the ranges $\lambda_{BD} \in [0.20, 0.30]$ and $\lambda_{US} \in [0.60, 0.70]$ leave the qualitative results unchanged (see Appendix A for the sensitivity table). These imply:

$$\varepsilon_{BD} = 3.00, \qquad \varepsilon_{US} = 0.50.$$

The value $\varepsilon_{US} = 0.50$ is rounded from the exact figure of 0.4925 implied by $\lambda_{US} = 0.67$; it equals 0.50 exactly when $\lambda_{US} = 2/3$. All subsequent calculations use the rounded value, and the paper is internally consistent throughout. Bangladesh workers receive 25 per cent of the value they create; the US ratio is 67 per cent. The exploitation differential is $\varepsilon_{BD}/\varepsilon_{US} = 6.0$.

Wages: Wage data are drawn from the Fair Labor Association's 2024 Bangladesh Wage Trends Report and the US Bureau of Labor Statistics' May 2023 Occupational Employment and Wage Statistics. Bangladesh garment workers earn a minimum wage of BDT 12,500 per month, equivalent to roughly 0.60–0.65 USD per regular hour; the calibration uses 0.65 USD/hour (Fair Labor Association, 2024). BLS OEWS (May 2023) reports a national mean wage of 21.03 USD/hour for electronics assemblers (SOC 51-2028) (Bureau of Labor Statistics, 2023); we use 21 USD/hour. The ratio of approximately 32:1 compares Bangladesh's legal sector minimum with the US mean—a methodologically asymmetric comparison. Alternative choices move the ratio within a 25–35:1 band but do not change the order of magnitude relative to the 2–3:1 productivity gap, which is the central observation requiring explanation.

Technology: ILO data on employment, wages, and productivity trends in the Asian garment sector (International Labor Organization, 2022) and UNCTAD productivity estimates (UNCTAD, 2020) suggest that labor productivity in garment manufacturing differs far less dramatically than wages. Bangladeshi garment workers require approximately 2–3 times more labor hours per unit than advanced-economy producers. For the calibration:

$$a_{XBD} = 2.0 \text{ hrs/unit}, \quad a_{XUS} = 1.0 \text{ hrs/unit}, \quad a_{YBD} = 5.0 \text{ hrs/unit}, \quad a_{YUS} = 1.0 \text{ hrs/unit}.$$

These represent a stylized calibration consistent with the evidence that Bangladeshi apparel productivity is roughly 2–3 times lower than leading producers, and that electronics manufacturing involves substantially greater capital intensity in which Bangladesh is more severely disadvantaged.

6.2 Calibration Summary

Table 1 summarizes the parameter values and verifies both conditions of Proposition 1.

Table 1: Parameter values and comparative exploitation check (theoretical calibration)

Parameter	**Bangladesh**	**United States**
Labor share: $\lambda_i = 1/(1+\varepsilon_i)$	0.25	0.67
Exploitation rate: ε_i	3.00	0.50
Unit labor req., garments: a_{Xi} (hrs/unit)	2.00	1.00
Unit labor req., electronics: a_{Yi} (hrs/unit)	5.00	1.00
Technology ratio in garments: a_{XBD}/a_{XUS}	2.00	
Exploitation ratio: $(1+\varepsilon_{BD})/(1+\varepsilon_{US})$	2.67	
Condition (16) holds? (BD absolute cost advantage in garments)	**Yes** (2.00 $<$ 2.67)	
Technology ratio in electronics: a_{YBD}/a_{YUS}	5.00	
Symmetric condition (14) holds? (US absolute cost advantage in electronics)	**Yes** (5.00 $>$ 2.67)	

Note: All parameters are theoretical calibration values consistent with the empirical evidence cited; they do not constitute direct measurements. Exploitation rates are derived from labor shares following Basu et al. (2025) and Extended Penn World Tables (2022). Unit labor requirements are stylized values consistent with ILO 2022 and UNCTAD 2020 productivity estimates.

6.3 Results

Bangladesh has standard Ricardian comparative advantage in garments: $a_{XBD}/a_{YBD} = 0.40 < a_{XUS}/a_{YUS} = 1.00$. Both conditions of Proposition 1 hold:

$$\underbrace{\frac{a_{XBD}}{a_{XUS}}}_{\text{tech. ratio}} = 2.00 < \underbrace{\frac{1+\varepsilon_{BD}}{1+\varepsilon_{US}}}_{\text{exploit. ratio}} = \frac{4.0}{1.5} = 2.67, \qquad \underbrace{\frac{a_{YBD}}{a_{YUS}}}_{\text{tech. ratio}} = 5.00 > \underbrace{\frac{1+\varepsilon_{BD}}{1+\varepsilon_{US}}}_{\text{exploit. ratio}} = 2.67.$$

Bangladesh has lower absolute cost in garments; the US has lower absolute cost in electronics. Both specialize accordingly. Bangladesh's technological disadvantage in garments (factor 2.00) is outweighed by its exploitation advantage (factor 2.67), while its technological disadvantage in electronics (factor 5.00) exceeds the exploitation advantage, leaving the US cost-competitive in electronics even under the exploitation differential.

The condition barely holds for garments, indicating that Bangladesh's garment exports rest on a combination of modest relative technological efficiency and substantial wage suppression. Were the garment productivity gap to widen toward 2.67 without a corresponding change in wages, exploitation-based absolute cost advantage would cease to hold—a concrete, falsifiable implication of the model.

Under autarky, relative prices equal relative labor requirements: $P_{XBD}/P_{YBD} = 0.40$, $P_{XUS}/P_{YUS} = 1.00$. The international price ratio p^* settles in (0.40, 1.00); assume $p^* = 0.6$. Bangladesh specializes in garments, the US in electronics. When Bangladesh exports one unit of garments, it exports $a_{XBD} = 2.0$ labor hours, of which:

$$n_{XBD} = \frac{2.0}{4.0} = 0.5 \text{ hrs (necessary)}, \qquad s_{XBD} = 3.0 \times 0.5 = 1.5 \text{ hrs (surplus)}.$$

In exchange, Bangladesh imports $p^* = 0.6$ units of electronics embodying surplus labor $s_{YUS} \cdot p^* = (0.5/1.5) \times 0.6 = 0.2$ hrs. The net surplus transfer per unit of garments exported is $\Delta = 1.5 - 0.2 = 1.3$ surplus hours—1.3 hours of surplus labor flow through the price mechanism per garment exported. The surplus transfer condition (18) holds: $1.5 > 0.2$.

These results are illustrative of the theoretical mechanism, not causal estimates. The mapping from labor share to exploitation rate and from stylized unit labor requirements to sector comparability involves simplifications that a rigorous empirical test would need to address. What the calibration establishes is that the parameter values required for Propositions 1 and 2 to hold are consistent with plausible readings of the available data—the theoretical results are not dependent on implausible or extreme parameter choices. The falsifiable threshold prediction ($a_{XBD}/a_{XUS} < 2.67$) likewise can be empirically analyzed with better sector-level data.

7 Theoretical Implications and Extensions

The model formalizes a specific mechanism of unequal exchange—systematic surplus transfers arising from international exploitation-rate differentials under equalized commodity prices. It extends the work of Emmanuel (1972) and Roemer (1982). The paper derives the trade pattern from both technological and class parameters simultaneously, providing a formal proposition under six explicitly stated assumptions that characterizes the precise conditions under which exploitation-rate differentials govern absolute cost competitiveness. Cogliano et al. (2024) likewise derived conditions for international exploitation dynamics but, by assuming identical technologies, could not address the interaction between technology and exploitation differentials that is the central concern here. The present result is therefore complementary to Cogliano et al. but distinct, operating within a Ricardian cost-equilibrium framework with heterogeneous technologies.

Shaikh (1980) demonstrated within a multi-sector input–output framework that once exploitation rates are incorporated, absolute cost advantage—not comparative advantage—determines trade patterns, because Ricardo's adjustment mechanism (based on the quantity theory of money) fails under capitalist competition. The present model takes a different approach. It works *within* the Ricardian relative-price framework and demonstrates that exploitation differentials modify the absolute cost conditions governing the trade pattern, deriving this from an explicit competitive cost equilibrium rather than from an alternative adjustment mechanism. Where Shaikh challenges the Ricardian framework from without, this paper reconstructs it from within. As Machado and Trigg (2021) argue in their Pasinetti pure-labor approach, wage disparities create absolute advantage structures even in labor-only models, and absolute advantages are critical for realizing comparative advantage gains—a result consistent with the paper's findings. The two approaches are therefore complementary. Shaikh's framework captures the monetary dynamics of competitive rivalry between firms, whereas the present model highlights how exploitation differentials reshape the cost conditions for specialization in a cost-equilibrium setting.

The analysis also addresses recent quantitative work on unequal exchange. Ricci (2019) constructs a disaggregated monetary model encompassing absolute rent (intraindustry exchange due to wage/productivity differences) and differential rent (interindustry exchange due to organic composition differences), finding persistent South-to-North value transfers over 1990–2019. Ricci's framework is more general than the present model in two aspects. it incorporates organic composition of capital (OCC) differences across sectors, and it allows national labor values to differ through a monetary expression of labor time—precisely the extension that relaxing A1 and A4 would require. The present paper offers a distinct but complementary mechanism: the pure-labor cost-equilibrium channel through which exploitation differentials alone shape the trade pattern, independently of OCC effects. Carchedi and Roberts (2021) argue that absolute advantage explains why countries trade, while exploitation-rate and OCC differentials explain distributional outcomes. This paper formalizes the first part of that claim within a pure-labor framework, with incorporating OCC left as an avenue for future work. These results have direct implications for debates on labor standards, global value chains, and industrial policy. If comparative advantage reflects exploitation rates as well as technology, policies aimed at raising wages face a trade-off with export competitiveness—but this trade-off is neither fixed nor inevitable.

Minimum wage politics: Proposition 1 directly illuminates the political economy of minimum wage resistance in export-dependent economies. If ε_{BD} falls such that $(1+\varepsilon_{BD})/(1+\varepsilon_{US})$ drops below a_{XBD}/a_{XUS}, Bangladesh would lose its cost advantage in garments. The model shows, however, that this trade-off is not fixed: wage increases accompanied by productivity improvements can maintain the condition, since exploitation and technology enter as substitutes in condition (16).

Gender, labor, and the composition of exploitation: The uniform exploitation rate assumed in the baseline specification (equation 10) does not capture an important empirical dimension—in Bangladesh's garment industry, where women constitute roughly 85 percent of the workforce, the exploitation rate is not gender-neutral in its determination or incidence (Elson and Pearson, 1981; Seguino, 2000). Gender-based wage suppression, driven by occupational segregation, unequal bargaining power, and social norms associated with women's work, contributes to elevated country-level exploitation rates in labor-intensive export sectors. Seguino (2000) shows that gender wage inequality has functioned as a growth strategy in semi-industrialized export economies, precisely by enabling the cost competitiveness that Proposition 1 argues. Folbre (1994) conceptualizes gender as a "structure of constraint" that shapes labor market bargaining power independently of individual productivity, directly relevant to why the exploitation rate in Bangladesh's garment sector cannot be explained by technology alone. Folbre's analysis of the care economy (England and Folbre, 1999; Folbre, 2001) shows that the systematic undervaluation of feminized labor—whether in social reproduction or in export manufacturing—reflects institutionalized norms that depress women's reservation wages and constrain collective bargaining. These structures of constraint operate as a pre-market mechanism that keeps necessary labor low relative to surplus labor in female-dominated sectors, amplifying the exploitation differential that Proposition 1 identifies as the source of Bangladesh's cost competitiveness. The gap between the technology ratio $a_{XBD}/a_{XUS} = 2.00$ and the exploitation ratio $(1+\varepsilon_{BD})/(1+\varepsilon_{US}) = 2.67$ in the calibration of Section 6 is not simply a macroeconomic fact; it is partially constituted by gendered labor market institutions that consistently undervalue women's skills, efforts, and productivity (Folbre, 1994; England and Folbre, 1999; Seguino, 2000).

The model here does not disaggregate exploitation by gender, sector, or skill. A richer specification incorporating sector- and gender-specific exploitation rates would require moving beyond the uniform-ε_i assumption, an extension consistent with Assumption A3 (institutional determination of exploitation)

(Berik, 2000; Kabeer, 2004; Folbre, 1994). The present framework nonetheless provides the formal cost-equilibrium structure within which such disaggregation could be developed.

Global value chains and the limits of convergence: The model clarifies why GVC integration has not produced the wage convergence that factor price equalization theory predicts (Samuelson, 1948, 1949). If comparative advantage itself depends on exploitation differentials, trade reinforces rather than erodes wage gaps. Low wages are not a transitional condition but the source of competitive advantage. Stockhammer (2017) and Riccio et al. (2024) document precisely this pattern of persistent labor share divergence under GVC integration. The implication is that labor standards reforms operating only at the national level face the structural trap identified in Proposition 1.

Industrial policy and structural transformation: To escape this trap, structural transformation is necessary, not just another wage policy. In condition (16), the goal should be to reduce the technology ratio on the left side through productivity gains, rather than relying on a high exploitation ratio on the right. That is, the aim is to build competitiveness that rests on what workers can produce rather than on how little they are paid.

8 Conclusion

The paper reconstructs Ricardian trade theory by incorporating the class relations of production. By distinguishing between necessary and surplus labor and treating the exploitation rate as an institutional parameter along with technological coefficients, it shows that the pattern of international specialization reflects not only differences in efficiency but also differences in the appropriation of surplus. The concept of comparative exploitation is introduced to capture this mechanism, where a country may exhibit lower absolute production costs in a commodity despite technological inferiority, provided its exploitation rate exceeds that of its trading partner. When this condition holds jointly across goods, the technologically inferior country exports under free trade. If commodity prices equalize while exploitation rates do not, the terms of trade generate transfers of surplus value from high-exploitation to low-exploitation economies. Calibration based on Bangladesh–United States trade indicates that wage differentials of approximately 32:1 far exceed productivity gaps of 2–3:1. Both model conditions are satisfied under plausible parameter values, and the framework yields a falsifiable threshold prediction that can be tested with more detailed sector-level data.

Finally, the paper argues that the question of who gains from trade cannot be answered by looking at technology alone. Once the class relations of production are written into the cost structure, the distribution of gains from trade depends on how the working day is divided between labor and capital in each country, not only on how productively that working day is organized. Trade liberalization does not close a gap that has its roots in differential rates of exploitation. What matters, alongside technological upgrading, is the balance of institutional conditions that sets the exploitation rate in the first place.

References

Asian Productivity Organization (2020). *APO Productivity Databook 2020*. Asian Productivity Organization, Tokyo.

Basu, D., Huato, J., Jauregui, J. L., and Wasner, E. (2025). World Profit Rates, 1960–2019. *Review of Political Economy*, 37(1):92–107.

Basu, D., Haas, C., and Moraitis, T. (2024). Intensification of Labor and the Rate and Form of Exploitation. *Review of Radical Political Economics*, 56(1):26–50.

Bureau of Economic Analysis, US Department of Commerce (2023). *GDP by Industry: Value Added, Gross Output, and Intermediate Inputs (NAICS 334, Computer and Electronic Products)*. BEA, Washington, DC. Available at: `https://www.bea.gov/data/gdp/gdp-industry`.

Berik, G. (2000). Mature Export-Led Growth and Gender Wage Inequality in Taiwan. *Feminist Economics*, 6(3):1–26.

Bureau of Labor Statistics, US Department of Labor (2023). *Occupational Employment and Wage Statistics, May 2023*. US Department of Labor, Washington, DC.

Carchedi, G. and Roberts, M. (2021). The Economics of Modern Imperialism. *Historical Materialism*, 29(4):23–59.

Chakrabarti, A. and Cullenberg, S. (2003). *Transition and Development in India*. Routledge, New York.

Chakrabarti, A., Cullenberg, S., and Dhar, A. (2008). Rethinking Poverty beyond Non-surplus Theories: Class and Ethical Dimensions of Poverty Eradication. *Rethinking Marxism*, 20(4):673–687.

Cogliano, J. F., Veneziani, R., and Yoshihara, N. (2024). The Dynamics of International Exploitation. *Environment and Planning A: Economy and Space*, 56(5):1420–1446.

Judd, J., Wakamo, B., and Kuruvilla, S. (2025). *Waiting Game: Minimum Wage-Setting in Bangladesh's Apparel Industry*. Policy Brief. Cornell University ILR School Global Labor Institute, Ithaca, NY. Available at: `https://www.ilr.cornell.edu/global-labor-institute`.

Dornbusch, R., Fischer, S., and Samuelson, P. A. (1977). Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods. *American Economic Review*, 67(5):823–839.

Dorninger, C., Hornborg, A., Abson, D. J., von Wehrden, H., Mehrabi, Z., Ostergard, H., Pauliuk, S., Sousa-Poza, A., and Fischer-Kowalski, M. (2021). Global patterns of ecologically unequal exchange: Implications for sustainability in the 21st century. *Ecological Economics*, 179:106824.

Duménil, G. and Lévy, D. (2000). The Conservation of Value: A Rejoinder to Alan Freeman. *Review of Radical Political Economics*, 32(1):119–146.

Elson, D. and Pearson, R. (1981). 'Nimble Fingers Make Cheap Workers': An Analysis of Women's Employment in Third World Export Manufacturing. *Feminist Review*, 7(1):87–107.

Emmanuel, A. (1972). *Unequal Exchange: A Study of the Imperialism of Trade*. Monthly Review Press, New York.

Marquetti, A., Morrone, H., and Miebach, A. (2022). *Extended Penn World Tables 7.0*. PUCRS/University of Massachusetts Amherst. Available at: `https://people.umass.edu/dbasu/Data/`.

Fair Labor Association (2024). *Bangladesh Wage Trends Report: Minimum Wage Analysis in the Ready-Made Garment Sector*. Fair Labor Association, Washington, DC.

Feenstra, R. C. (2015). *Advanced International Trade: Theory and Evidence*. 2nd edition. Princeton University Press, Princeton.

Foley, D. K. (1982). The Value of Money, the Value of Labor Power, and the Marxian Transformation Problem. *Review of Radical Political Economics*, 14(2):37–47.

England, P. and Folbre, N. (1999). The Cost of Caring. *Annals of the American Academy of Political and Social Science*, 561:39–51.

Folbre, N. (1994). *Who Pays for the Kids? Gender and the Structures of Constraint*. Routledge, New York.

Folbre, N. (2001). *The Invisible Heart: Economics and Family Values*. New Press, New York.

Gereffi, G. and Korzeniewicz, M. (1994). *Commodity Chains and Global Capitalism*. Praeger, Westport, CT.

Heintz, J. and Milberg, W. (2025). Investing in Power: Unequal Exchange in Global Value Chains. PERI Working Paper No. 635. Political Economy Research Institute, University of Massachusetts Amherst.

Hickel, J., Sullivan, D., and Zoomkawala, H. (2021). Plunder in the Post-Colonial Era: Quantifying Drain from the Global South through Unequal Exchange, 1960–2018. *New Political Economy*, 26(6):1030–1047.

Hickel, J., Dorninger, C., Wieland, H., and Suwandi, I. (2022). Imperialist Appropriation in the World Economy: Drain from the Global South through Unequal Exchange, 1990–2015. *Global Environmental Change*, 73:102467.

International Labor Organization (2022). *Employment, Wages and Productivity Trends in the Asian Garment Sector*. ILO, Bangkok.

International Labor Organization (2023). *Global Wage Report 2022–23: The Impact of Inflation and COVID-19 on Wages and Purchasing Power*. ILO, Geneva.

Hornborg, A. (1998). Towards an Ecological Theory of Unequal Exchange: Articulating World System Theory and Ecological Economics. *Ecological Economics*, 25(1):127–136.

Kabeer, N. (2004). Globalisation, Labor Standards, and Women's Rights: Dilemmas of Collective (In)Action in an Interdependent World. *Feminist Economics*, 10(1):3–35.

Krugman, P. R., Obstfeld, M., and Melitz, M. J. (2022). *International Trade: Theory and Policy*. 12th edition. Pearson, London.

Machado, D. and Trigg, A. (2021). On Absolute and Comparative Advantage in International Trade: A Pasinetti Pure Labor Approach. *Structural Change and Economic Dynamics*, 59:375–383.

Marx, K. (1990). *Capital: A Critique of Political Economy. Vol. 1.* Penguin, London.

Marx, K. (1991). *Capital: A Critique of Political Economy. Vol. 3.* Penguin, London.

Milberg, W. and Winkler, D. (2013). *Outsourcing Economics: Global Value Chains in Capitalist Development.* Cambridge University Press, Cambridge.

Ricardo, D. (1951 [1817]). *On the Principles of Political Economy and Taxation.* Vol. 1 of *The Works and Correspondence of David Ricardo*, edited by Piero Sraffa. Cambridge University Press, Cambridge.

Ricci, A. (2019). Unequal Exchange in the Age of Globalization. *Review of Radical Political Economics*, 51(2):225–245.

Ricci, A. (2021). *Value and Unequal Exchange in International Trade: The Geography of Global Capitalist Exploitation.* Routledge, London.

Riccio, F., Cresti, L., and Virgillito, M. E. (2024). The Labor Share along Global Value Chains: Perspectives and Evidence from Sectoral Interdependence. *Review of World Economics*, 160(4):1241–1283.

Roemer, J. E. (1982). *A General Theory of Exploitation and Class*. Harvard University Press, Cambridge, MA.

Samuelson, P. A. (1948). International Trade and the Equalization of Factor Prices. *Economic Journal*, 58(230):163–184.

Samuelson, P. A. (1949). International Factor-Price Equalization Once Again. *Economic Journal*, 59(234):181–197.

Seguino, S. (2000). Gender Inequality and Economic Growth: A Cross-Country Analysis. *World Development*, 28(7):1211–1230.

Shaikh, A. (1980). Foreign Trade and the Law of Value: Part II. *Science & Society*, 44(1):27–57.

Stockhammer, E. (2017). Determinants of the Wage Share: A Panel Analysis of Advanced and Developing Economies. *British Journal of Industrial Relations*, 55(1):3–33.

United Nations Conference on Trade and Development (2020). *Trade and Development Report 2020: From Global Pandemic to Prosperity for All: Avoiding Another Lost Decade*. UNCTAD, Geneva.

A Data Sources and Sensitivity Analysis

A.1 Data Sources

Table 2 summarizes the primary data sources used in the calibration of Section 6, the variables they supply, and the specific values adopted as benchmarks.

Table 2: Data sources for the Bangladesh–US calibration

Source	**Variable**	**Value used**
EPWT 7.0 (Extended Penn World Tables, 2022)	Labor share, BD garments (λ_{BD})	0.22–0.28; benchmark 0.25
BEA industry accounts, NAICS 334 (Bureau of Economic Analysis, 2023)	Labor share, US electronics (λ_{US})	0.63–0.70; benchmark 0.67
ILO (International Labor Organization, 2022); APO (Asian Productivity Organization, 2020)	Unit labor requirement, BD garments (a_{XBD}); $a_{XUS} = 1.0$ hrs/unit stylized	2.0 and 1.0 hrs/unit (BD sourced; US stylized)
UNCTAD TDR (UNCTAD, 2020); ILO (International Labor Organization, 2022)	Unit labor requirement, BD electronics (a_{YBD}); $a_{YUS} = 1.0$ hrs/unit stylized	5.0 and 1.0 hrs/unit (BD sourced; US stylized)
FLA Wage Trends Report (Fair Labor Association, 2024)	Bangladesh garment wage	USD 0.65/hr
BLS OEWS May 2023 (Bureau of Labor Statistics, 2023)	US electronics assembler wage (SOC 51-2028)	USD 21.00/hr

A.2 Sensitivity of Key Conditions to Labor Share Variation

The exploitation rate $\varepsilon_i = (1 - \lambda_i)/\lambda_i$ and the exploitation ratio $(1 + \varepsilon_{BD})/(1 + \varepsilon_{US})$ depend on the chosen labor shares. Table 3 reports the exploitation ratio and the status of Proposition 1 (condition 16: technology ratio in garments = 2.00) across the full empirically plausible range.

Table 3: Sensitivity of Proposition 1 to labor share variation

λ_{BD}	λ_{US}	ε_{BD}	ε_{US}	$(1 + \varepsilon_{BD})/(1 + \varepsilon_{US})$	Condition holds?
0.20	0.60	4.00	0.67	3.00	Yes (3.00 > 2.00)
0.20	0.70	4.00	0.43	3.50	Yes
0.25	**0.67**	**3.00**	**0.50**	**2.67**	**Yes (benchmark)**
0.25	0.60	3.00	0.67	2.40	Yes
0.30	0.67	2.33	0.50	2.22	Yes
0.30	0.60	2.33	0.67	2.00	Borderline (= 2.00)
0.30	0.70	2.33	0.43	2.33	Yes

Note: The technology ratio in garments is fixed at $a_{XBD}/a_{XUS} = 2.00$ throughout. The condition fails only if the exploitation ratio falls below 2.00—requiring Bangladesh's labor share to exceed 0.30 simultaneously with the US labor share falling to 0.60, the least favorable combination in the plausible range. The benchmark row (bold) corresponds to the values used in Section 6. The borderline case ($\lambda_{BD} = 0.30$, $\lambda_{US} = 0.60$) illustrates the falsifiable threshold: a widening productivity gap or a compression of the exploitation differential could eliminate Bangladesh's cost advantage.