Vilnius University Press

Contents lists available at Vilnius University Press

Organizations and Markets in Emerging Economies
2024, vol. 15, no. 1(30), pp. 109–126

ISSN 2029-4581 eISSN 2345-0037
DOI: https://doi.org/10.15388/omee.2024.15.6

How Productivity and Trade Liberalization Can Affect the Economies of Developing Nations is Illustrated by the Vietnamese Manufacturing Sectors Case

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Abstract. *This article proposes a model to examine the impact of trade liberalization on productivity growth in developing countries, exemplified by Vietnam, which is positioned at a technological distance from the frontier. Built upon the Schumpeterian framework and Total Factor Productivity (TFP) analysis, the study illustrates that free trade can directly influence the technological gap of a small developing nation by necessitating the importation of all intermediate goods from its dominant trading partner, a developed country. Moreover, trade liberalization has a negative impact on Vietnam's productivity growth, with domestic competition and trade barriers emerging as significant factors. Additionally, the research concludes that the national economic policies of Vietnam during the 2016–2020 period were ineffective, partially attributed to the failure of state-owned enterprises. As a result, international trade openness may lead to enduring adverse consequences for smaller developing countries, like Vietnam, and serves as a noteworthy example of diminishing innovation.*

Keywords: *trade liberalization, open economy macroeconomics, productivity growth, WTO, Vietnamese manufacturing*

1. Introduction

In the current era of globalization-driven economic liberalization, the relationship between trade and productivity and income is influenced by several factors. The degree and nature of trade gains for each country are diverse and contingent upon national

Received: 1/4/2023. **Accepted:** 1/3/2024

growth conditions, particularly in terms of differences in market size (Alesina et al., 2005), initial productivity levels (Devereux & Lapham, 1994), and intra-industry reallocations and aggregate industry productivity (Melitz, 2003). Aghion et al. (2013) have formulated theoretical models that conceptualize the impact of trade liberalization on productivity growth in various countries, resulting in several predictions on the effects of trade. South African manufacturing is used as an example of a less-developed country that is relatively close to the technological frontier. However, there are no empirical studies that focus on developing countries that are further away from the frontier. This research addresses this gap by examining Vietnam's case.

Vietnam is an ideal country to apply the theoretical framework discussed above. For the period prior to Vietnam's accession to the World Trade Organization (WTO) in January 2007, Chu and Kalirajan (2011) found that trade liberalization had a positive and robust impact on firm performance using balanced panel data over the period 2000 to 2003. Ha and Kiyota (2014) suggest that trade liberalization increased the productivity of entrants, survivors, and exiters simultaneously from 2006 to 2007. However, Baccini et al. (2019) reported that Vietnam's accession to the WTO led to substantial increases in productivity for private firms between 2006 and 2020, but not for state-owned enterprises. This raises questions about whether the economic opening policies of the last period have actually reduced or limited Vietnam's growth. This paper provides a more comprehensive model, based on the theoretical framework of Aghion et al. (2013), to clarify the situation in developing countries. It also compares the case of Vietnam with that of South Africa, as both represent similar yet distinct cases of countries opening their economies to test the predictions of the theoretical framework.

In summary, this study contributes to a more nuanced comprehension of the implications of trade liberalization by drawing upon the experiences of two countries that, at first glance, share some similarities in their economic trajectories. Nevertheless, it introduces a novel approach by customizing and extending the Aghion et al. (2013) trade liberalization model to accommodate the unique conditions and complexities associated with Vietnam. This Southeast Asian nation, in contrast to South Africa, presents a distinctive array of economic policies, market dynamics, and geographical considerations. Vietnam, in the post-WTO accession era, has witnessed a rapid transformation in its economic landscape. The country's transition from a centrally planned economy to a socialist-oriented market economy, coupled with its increasing integration into the global economy, has raised critical questions about the effects of trade liberalization on productivity, income distribution, and overall economic growth. Unlike South Africa, which has a historical context rooted in apartheid and a different pattern of industrialization, Vietnam's economic history and development trajectory have unfolded under distinct circumstances.

The adaptation and expansion of the Aghion et al. (2013) model allow for a more accurate assessment of the repercussions of trade liberalization in Vietnam. By considering the intricacies of Vietnam's market structure, industrial composition, and trade

policies, this study aims to provide insights that go beyond the general principles outlined in the original model. It is within this nuanced context that we endeavor to evaluate the impacts of trade openness on various facets of Vietnam's economy, ultimately shedding light on the broader implications for developing economies in the Southeast Asian region and beyond.

2. Theoretical Literature

The literature on trade and growth is extensive, with abundant and contested theories about the role of trade in raising a country's income and productivity levels. Many authors agree that trade openness can lead to higher quality or a greater variety of products or a faster rate of innovation. Grossman and Helpman (1989, 1991a, 1991b) demonstrate how faster productivity growth follows trade liberalization, as successful innovators gain access to larger rents through an increase in market size. Rivera-Batiz and Romer (1991) explain how knowledge spillovers operate across borders. However, Devereux and Lapham (1994), using the Rivera-Batiz and Romer model, show that trade openness may reduce innovation levels in poorer countries with lower initial productivity levels. Young (1991) and Grossman and Helpman (1995) extend the models of trade and growth by using learning-by-doing externalities. Young (1991) suggests that opening an economy to trade can prevent learning-by-doing externalities in less developed countries, while Grossman and Helpman (1995) add that the impact of trade on growth will depend on the country's manufacturing specification and the country's trade mechanism with an international scope of learning-by-doing opportunities. Eaton and Kortum (2001) suggest that trade flows are shaped by the interaction of productivity-based comparative advantage and geographic location, and that bilateral trade follows a gravity equation. Acharya and Keller (2009) analyze the knowledge spillover effect on 14 OECD countries to confirm that the benefits from spillovers decline with geographical distance between these countries. Alesina et al. (2005) find a negative coefficient of "trade openness" and its interaction with the size of the domestic economy in the estimation that uses growth as the regressor. The early investigated effects of trade on growth primarily stem from market size and technology diffusion of a country embedded in international relations.

Another effect of trade on economic growth is a change in market competition by allowing foreign producers to compete with domestic ones. Melitz (2003) emphasized that trade liberalization leads to intra-industry relocation and an increase in productivity as less productive firms exit the market while more productive ones increase their output and start exporting. The production factor is then reallocated to more productive firms, resulting in an increase in the overall average productivity. Bustos (2011) jointly analyzed technology and exports by considering the choice of technology in a trade model with heterogeneous firms. He suggests a positive effect of trade liberalization on productivity growth, which is a negative function of distance from the techno-

logical frontier of national firms. The positive effects of trade on industry productivity through more rigid selection and market share reallocation are confirmed in many empirical articles. Pavcnik (2002), Trefler (2004), Bernard et al. (2006), Amiti and Konings (2007), Topalova and Khandelwal (2011), and Brandt et al. (2017) confirm the importance of trade liberalization for various countries, such as Chile, the United States, Canada, Indonesia, India, and China. In Vietnam, in previous years, research efforts had predominantly centered on addressing market deficiencies through institutional reforms as a focal point for enhancing output and expanding trade (Abbott et al., 2009). Baccini et al. (2019) conducted an empirical study to examine the impact of Vietnam's accession to the WTO in 2007. The results indicated that WTO accession led to lower profit-making capabilities for enterprises, despite a significant increase in productivity, particularly among private enterprises as opposed to state-owned enterprises. Furthermore, the study also highlighted that political barriers and regulations concerning accession and access to credit were key drivers behind the varying responses of state-owned enterprises to trade liberalization. However, empirical research has primarily concentrated on countries with large market sizes or developed nations, leaving a gap in the literature regarding the application of these theories to smaller developing countries, including Vietnam.

In addition to the existing literature, numerous potential effects of trade remain to be explored comprehensively. Aghion and Howit (2009) provide a synthetic framework that encompasses several potential effects of trade on productivity growth and innovation by constructing a dynamic model using Schumpeterian growth. Their model generates three predictions about the impacts of trade liberalization on growth. Firstly, they highlight that the selection effect implies a positive outcome for income and productivity growth in the final goods sector with increased openness to trade. Secondly, their model predicts that the interaction between openness and country size has a negative effect on national income and productivity growth, indicating that smaller countries could benefit proportionately more from openness than larger ones. Lastly, the effects of openness and distance from the technological frontier on income and growth are ambiguous. The impact should be positive if the distance is small, but if it is large, the effect may be reversed. Aghion et al. (2013) tested these predictions using the case of manufacturing industries in South Africa, a less developed country that is relatively close to the technological frontier, and confirmed that the direct impact of trade liberalization on productivity growth and the interaction between openness and distance from the technological frontier on growth is positive. This confirms that the direct effect of free trade on productivity growth is through interaction with competition in the domestic market. However, empirical studies on the case of a small developing country with a large technological gap have not been adequately investigated. This article aims to address this research gap by examining the economic transition of Vietnam towards a more market-oriented economy as Vietnam increased its participation in international trade and market concentration through support for state-owned enterprises between 2016 and 2020.

3. Empirical Studies

This study is based on the extended Schumpeterian framework for an opening economy as outlined by Aghion and Howitt (2009). They assume an aggregate Cobb-Douglas production function that uses as input labor and a continuum of intermediate goods, indexed by *i*, of the following form:

$$Y_t = L^{1-\alpha} \int_0^1 A_{it}^{1-\alpha} x_{it}^{\alpha} di \qquad 0<\alpha<1 \qquad (1)$$

where L is the domestic labor force, assumed constant, A_{it} is the quality of intermediate good *i* at time t, and x_{it} is the flow quantity of intermediate good *i* being produced and used at time t. Each intermediate sector includes a monopolistic manufacturer using the final good as the only input in which each unit of intermediate good is generated by one unit of the final good. In each industry, process innovation is at the center of productivity growth. Referring to equation (1), the production function determines the final output that is produced by each intermediate product.

$$Y_{it} = (A_{it}L)^{1-\alpha} x_{it}^{\alpha}$$

The economy's entire labor supply L is used in final good production. As is standard in the neoclassical model, this article refers to the product $A_{it}L$ as the effective labor supply of the economy.

The price of intermediate goods is assumed to be 1. Each intermediate product is produced by a monopolist, and its price equals its marginal product in the final sector. If the final good monopolist maximizes profits, there will be an equilibrium quantity, an equilibrium price, and an equilibrium profit for each sector:

$x_{it} = \alpha^{2/(1-\alpha)} A_{it}L$ and $p_{it} = 1/\alpha$ and $\Pi_{it} = \delta A_{it}L$, where $\delta = (1-\alpha)\,\alpha^{(1+\alpha)/(1-\alpha)}$

This article assumes that there is a leading entrepreneur with the possibility of innovating in that industry at a specific point. Assumedly, this innovation would increase the productivity level to $A_{i,t} = \gamma A_{i,t-1}$ where $\gamma > 1$ is a productivity parameter for each successful innovation. Otherwise, productivity will remain at the same level for the company. The cost of innovation of the final good is $c_{it} = (1-\tau)\varphi(\mu)A_{i,t-1}$, where τ represents the national policies encouraging innovation and φ is a standard convex cost function of the innovation probability μ. We assume $\varphi'(\mu)>0$, $\varphi''(\mu)>0$ and $\varphi(0) = 0$.

Thus, the expected profit of the local entrepreneur is:

$V_{it} = E[\pi_{it}] - c_{it} = \delta L A_{i,t} - (1-\tau)\,\varphi(\mu)A_{i,t-1} = \mu\,\delta L \gamma A_{i,t-1} + (1-\mu)\,\delta L A_{i,t-1} -$

$(1-\tau)\,\varphi(\mu)A_{i,t-1}$, where $E[\pi_{it}]$ is the expected revenue of each innovation.

Taking the first-order condition to maximize V_{it}, by choice of the innovation probability μ, the entrepreneur chooses the probability μ in the closed economy, which solves the research arbitrage equation:

$$(1-\tau)\varphi'(\mu)/\delta = L(\gamma-1) \quad (2)$$

The marginal innovation probability $\varphi'(\mu)$ is increasing in the population size, the government's innovation policy, and the productivity parameters of sector *i*. While the population size of a nation and the productivity parameters of the sectors are quite stable, the government's innovation policy is very flexible. Thus, if the innovation environment is favorable enough, the solution μ will be unique and strictly positive. This means that the country will grow in the closed economy as the government employs policies that actively encourage innovation.

This was the case of a closed country in which all goods are produced domestically. In the following sections, this article employs the theoretical framework of Aghion and Howitt (2009) to describe how the research arbitrage equation changes if the economy is opened and begins to compete with others in the face of unilateral or bilateral trade liberalization.

With unilateral trade liberalization, the host country will lower tariff barriers to competition from foreign imports for intermediate inputs whereas the others do not. The competitive production of the sole final good continues to be characterized by equation (1).

It is assumed that the market sizes of the home and the foreign country are identical. This means the distance from the technology frontier of the home country in the sector *i* is M_{it}. This implies that $M_{it} = A_{it}/\hat{A}_{it}$

The demand for intermediate inputs from domestic producers continues to directly reflect the marginal productivity of intermediate inputs

$$p_{it} = \alpha(A_{it}L)^{1-\alpha}x_{it}^{\alpha-1}$$

After unilateral trade liberalization, the producers of imported intermediate monopolists are protected with a lowered tariff of χ units of the final good per unit of the intermediate inputs acquired. The demand for foreign intermediate inputs reflects the marginal productivity net of import:

$$p_{it}^{*} = \alpha(A_{it}^{*}L)^{1-\alpha}x_{it}^{\alpha-1}/(1+\chi)$$

The final goods production then employs the intermediate goods with the highest productivity net of taxes, so that:

$$Y_t = L^{1-\alpha}\int_0^1 \hat{A}_{it}^{1-\alpha}x_{it}^{\alpha}di,\ 0<\alpha<1 \text{ where } \hat{A}_{it} = \max\{A_{it}, A_{it}^{*}/(1+\chi)^{1/(1-\alpha)}\}$$

The wedge between national and international productivity lies in the operation of taxes. Therefore, the productivity of the final goods sector and the labor income will be directly raised by unilateral liberalization, while the direct competition of intermediate goods overseas will result in the monopolist's profit producing intermediate input. The substitution of domestic goods leads to decreases in aggregate profits by reducing prof-

its of the intermediate input producing monopolist when the substitution of domestic goods has no compensation through increasing profits of the expanding market size for the in-country monopolist. To summarize, unilateral trade liberalization negatively affects the monopoly profits.

However, there remains more ambiguity as to the effect of unilateral trade on innovation and research. The sector *i* below presents the expected profits of the intermediate inputs producing monopolist in two countries:

$$V_{it} = E[\pi_{it}] - c_{it} = E[\pi_{it}] - (1-\tau)\ \varphi(\mu_A)\hat{A}_{i,t-1}$$

$$V^*_{it} = E[\pi^*_{it}] - c^*_{it} = E[\pi^*_{it}] - (1-\tau^*)\varphi(\mu^*_A)\hat{A}_{i,t-1}$$

The monopolist's innovation in every sector of a country mainly prioritizes maintaining the domestic market share. The reason is that the technological distance between the leading monopolist and the following monopolist must be larger than the trade barrier at the market of the following monopolist if the leading monopolist would like to enter the foreign market. Then, we must assume that the innovation of the monopolist under the unilateral trade liberalization is sufficiently large in comparison with the trade barriers of two countries. Then, possible situations for the revenue of domestic monopolies in unilateral trade liberalization can be:

- The domestic monopolist is currently leading with a technological distance that is larger than the trade barrier at the market of the foreign monopolist.
- The domestic monopolists cannot enter the foreign market, and the foreign monopolist has a similar situation because the trade barriers of two countries are relatively higher than their technological distances.
- The foreign monopolist is currently leading with a technological distance exceeding the trade barrier at the domestic market.

There are three possible cases with the expected revenues of the intermediate input producing monopolist in the sector *i* in the home country with a trade barrier:

- $E[\pi_{it}] = \mu_1\ \delta(L + L^*)\ \gamma\hat{A}_{i,t-1} + (1-\mu_1)\ \delta(L+(1-\mu^*_1)\ L^*)\hat{A}_{i,t-1}$ if the monopolist in the home country is superior in regard to the technology of the two countries.
- $E[\pi_{it}] = \mu_2\ \delta(L + (1-\mu^*_2)\ L^*)\gamma\hat{A}_{i,t-1} + (1-\mu_2)\ \delta L(1-\mu^*_2)\hat{A}_{i,t-1}$ if the monopolist in the home country is lagging behind the foreign country in regard to technology, but still retains the home market by the protection of the tariff in the unilateral liberalization.
- $E[\pi_{it}] = (1-\mu^*_3)\ \delta\ \mu_3 L\hat{A}_{i,t-1}$ if the monopolist in the home country is lagging behind the foreign country regarding technology, but loses the home market even though there is a tariff in the unilateral liberalization.

Taking the first-order condition for an interior of the profit maximum of the monopolist in the home country in each case, there are three possibilities in the long term under unilateral trade liberalization:

Case 1. $\hat{A}_{it} = A_{it} > A^*_{it}/(1+\chi)^{1/(1-\alpha)}$, where the condition is $(1+\chi^*)^{1/(1-\alpha)} = \Omega^*_{it} < A_{it} / A^*_{it}$

Unilateral liberalization of imports does not change the optimal level of research spending as the monopolist is a technology leader. The reason is that the dominance in the local market is guaranteed for the home country as it is technologically superior without the trade barriers. Hence, liberalization generates neither a scale effect of capturing foreign markets nor an escape entry effect. In this case, the direct and indirect effects of trade barriers do not occur.

The research arbitrage equation is still used as in Case 1, where the sector *i* in the home country in the bilateral trade liberalization is the lead:

$$(1-\tau)\,\varphi'(\mu_1)/\delta = (L+L^*)(\gamma-1)+\mu_1^* L^* \qquad (3)$$

$$(1-\tau^*)\varphi'(\mu_1^*)/\delta = (1-\mu_1)\,L^*$$

In Case 1, the foreign country will catch up with the home country in the long term. The productivity growth in the opening home country is always greater than that in the closed economy due to the scale effect. The first part of innovation motivation in the home country will be based on the domestic competition and the domestic market size. The home monopolists' innovation activity is encouraged by the possibility of gaining control of the foreign market as the foreign economy imposes trade barriers.

In the case of a small developing country like Vietnam, reducing trade barriers (such as lowering import tariffs and eliminating trade restrictions) can have a positive impact on productivity growth (Le & Nguyen, 2019). When a country lowers trade barriers, domestic businesses can access international markets more easily, creating new opportunities for Vietnam's exports of goods and services. Lowering trade barriers also facilitates domestic businesses' participation in global supply chains, making it easier for them to engage in international trade. This can enhance production efficiency and boost competitiveness in international markets. Additionally, market openness and reduced trade barriers can make Vietnam a more attractive destination for foreign investors.

If the foreign economy has a huge trade barrier to protect the foreign intermediate market from the home country, Case 1 will be transformed to Case 2 with the change in roles of the home and host countries.

Case 2. $A^*_{it} = A_{it}\,\gamma^m > \hat{A}_{it} = A_{it} > A^*_{it}/(1+\chi)^{1/(1-\alpha)} = A_{it}\,\gamma^m/(1+\chi)^{1/(1-\alpha)}$

where the condition is $(1+\chi^*)^{1/(1-\alpha)} = \Omega^*_{it} > A_{it} / A^*_{it} > 1/(1+\chi)^{1/(1-\alpha)} = \Omega_{it}$

In this case, the technological distance between the home country and the world technology frontier is less pronounced. The aim of trade barriers in this case is to nurture the domestic monopolists to catch up with the foreign monopolists. South Africa provides a good example of this type of case (see Aghion et al., 2013).

The corresponding research arbitrage equation would be:

$$(1 - \tau)\, \varphi'(\mu_2)/\delta = (\gamma - 1)L + (1 - \mu_2^*)\, \gamma L^* + \mu_2^* L \qquad (4)$$

Compared with equation (2), the productivity growth under the impact of unilateral liberalization is slower than that of bilateral liberalization, but still higher than that in a closed economy. The first part of the right-hand side of equation (4) presents the motivation for innovation by domestic market competition to maintain the home market. The second part of the right-hand side of equation (7) shows the failure of foreign innovation as a condition for domestic monopolists to maintain the domestic market. However, the distance of the home country from the world technology frontier will increase in the long term if the foreign nation size is large. Domestic competition prior to trade liberalization can exert pressure on monopolistic entities and foster innovation among domestic firms, as they strive to enhance their products and production processes to compete in the domestic market (Geng & Kali, 2021). This can lead to improvements in product quality and labor productivity. Furthermore, domestic competition can create incentives to enhance production efficiency, as businesses must operate more effectively to maintain or increase their market share in the domestic market.

Case 3. $A_{it}^* > \hat{A}_{it} = A_{it}^*/(1+\chi)^{1/(1-\alpha)} = A_{it}\, \gamma^m/(1+\chi)^{1/(1-\alpha)} > A_{it}$

where the condition is $A_{it} / A_{it}^* < 1/ (1+\chi)^{1/(1-\alpha)} = \Omega_{it}$

The distance to the world technology frontier in the sector *i* is too great. The corresponding research arbitrage equation is:

$$(1-\tau)\, \varphi'(\mu_3)/\delta = (1 - \mu_3^*)\, L \qquad (5)$$

Compared with equation (2), the innovation rate of the domestic monopolist under trade liberalization will be lower than that in the closed economy if the foreign country's innovation rate (μ^*_3) is sufficiently large. Obviously, the lower trade barrier in this case reduces the nation's innovation or productivity growth in the long term. Besides, the productivity growth of the final good increases mainly because domestic production is provided with imported and better intermediate goods. Thus, there is a trade-off between a productivity growth of the final goods and a reduction in the innovation motivation of the intermediate goods sector.

The theory gives predictions including selection effects of openness on income, scale effects of openness and size on income, and an ambiguous effect from the interactions of openness and distance from the technology frontier on growth. However, the study will focus on the ambiguous effect.

To investigate this ambiguous effect, arguments about how trade can reduce or enhance growth in one country are required. Furthermore, Case 3 of a country having a further distance from the technology frontier is applied for the arguments as the do-

mestic monopolist with a closer distance is being protected by a trade barrier from the foreign goods requires confirmation (Aghion et al., 2013). Along a similar line, this article argues that if that national market size (L) is small, the country's innovation probability (μ3) under the trade liberalization might be zero as all monopolies will reside in the foreign country. In such a case, all monopolies would remain forever in the foreign country. The first result in this case would be a decline in national income. Particularly, the home country's GDP under trade liberalization may be lower than if it had never opened to trade. Baccini et al. (2017) argue that when trade liberalization occurs, domestic monopolistic businesses may face challenges in competing with foreign goods and services, thereby limiting their ability to capitalize on new opportunities in the international market. As a result, productivity growth in the country can be constrained, or even decline, due to a decrease in national income and a lack of innovation incentives. Significant disparities in technological capabilities between the two nations can lead to an imbalance in competition between the domestic and foreign markets. When domestic market competition is excessively low, and foreign entities possess superior technological capabilities, the domestic nation may encounter difficulties in sustaining productivity and economic growth (Martin et al., 2022).

While many studies of larger and more developed countries record the positive impacts of trade liberalization on growth (Trefler, 2004), it should also be considered that this is likely the result of advantageously having the leading monopolist in manufacturing sectors (Bernard et al., 2006; Acharya & Keller, 2009). Therefore, a more concentrated comparison of two countries whose manufacturing sectors are lagging behind becomes necessary.

From the theoretical analysis, we formulate three research questions about the productivity growth in an opening economy:

Research question 1: *What is the impact of a lower trade barrier on productivity growth in the case of a small developing country?*

Research question 2: *How does domestic competition in the face of trade liberalization influence productivity growth in the case of Vietnamese manufacturing?*

Research question 3: *What is the difference in productivity growth between two countries whose manufacturing sectors are both lagging behind and also have considerable differences in technological capacity between them?*

4. Methodology

To answer Research Question 1, this study examines the productivity dynamics in the Vietnamese manufacturing sector for the period between 2016 and 2020 using the two-digit ISIC-level data. The innovation of each monopolist will be measured by the

TFP growth. Hence, the first specification test for the effect of the direct protection measure on productivity growth is:

$$\Delta A_{it} = a_0 + a_1 P_{i,t} + a_2 P_{i,t} M_{it} + \beta_t + \alpha_i + u_{it} \quad (6)$$

where $P_{i,t}$ denotes the trade barriers existing in industry i at time t and is measured by the nominal rate of protection (NRP) or the effective rate of protection (ERP). Obviously, this given measure is the opposite measurement for the economic openness, whereas ΔA_{it} is a measure of the TFP growth in industry i in year t. As shown in the theoretical framework, the indirect effect of trade liberalization on the distance to the frontier is investigated along with the direct impact of trade liberalization. Specifically, the study uses the term $P_{i,t} M_{it}$ as an interaction term to capture the relationship between openness and technological innovation, and to represent the indirect effect with M_{it} denoting the distance from the technological frontier. Finally, β_t and α_i are the fixed effects of time and industry. The specification test of this study on Vietnam is identical to that in the South African case (Aghion et al., 2013). Thus, this study predicts that the coefficient a_1 is positive and the coefficient a_2 is negative as these coefficients in the South Afican case (Aghion et al., 2013).

The second specification will be used to answer Research Question 2 to show the influence of domestic competition on productivity growth, which differs according to the economic structure of each country. This study employs the Hirschman-Herfindahl Index that measures the market concentration of a certain industry (i.e., a commonly accepted measure for domestic competition), its interaction with the technological distance, and the trade protection measure in the second specification.

$$\Delta A_{it} = a_0 + a_1 P_{i,t} + a_2 M_{it} P_{it} + a_3 He_{it} + a_4 He_{it} P_{it} + a_5 He_{it} M_{it} + \beta_t + \alpha_i + u_{it} \quad (7)$$

where He_{it} is the Hirschman-Herfindahl Index of industry i at time t in Vietnam. Once again, the specification in the study in Vietnam is identical to that of South Africa (Aghion & Howitt, 2013). This study predicts $a_3 < 0$, meaning that lower market concentration improves productivity growth, preventing the escape competition effect. Unlike the case of South Africa, this study does not conclude specifically about the interaction between the Hirschman-Herfindahl Index and the trade protection, and the interaction between the Hirschman-Herfindahl Index and the technological distance.
The baseline estimations are accompanied by a series of robustness checks. The possible endogeneity of protection rate measures cannot be completely ignored since sectors with low rates of productivity growth may lobby to receive protection. Henceforth, the study employs the systems GMM estimation technique for the two specifications.

To empirically test the theoretical predictions, this study examines the direct and indirect effects of trade liberalization on productivity growth using two types of trade protection variables, ERP and NRP, as specified in equation (6) and reported in Table

1. Furthermore, this study compares the estimated results of the Vietnamese case with the South African case presented by Aghion et al. (2013) to examine the difference between Case 2 and Case 3 in the theoretical framework. To accomplish this, the study employs identical estimation techniques consistently used by Aghion et al. (2013), including the within estimator, the fixed effect combined with year effect, and the systems GMM methodology, and uses the two-step estimator with lower-order lags as instruments in estimation. However, this study cannot compare the second specification for the domestic competition element between Vietnam and South Africa as the estimations controlling for the impact of product market competition in Aghion and Howitt (2013) are too basic. Aghion et al. (2013) only utilize panel data models with industry effects without exploring endogeneity and time effects using other estimation methods.

5. Results and Discussion

5.1 Testing the Direct and Indirect Effect of Trade Protection on Productivity Growth

The present study reports the results of estimating the impact of trade protection on TFP growth, as specified in equation (6), according to the extended Schumpeterian framework for an opening economy proposed by Aghion and Howitt (2009). The estimation results are presented in Table 1, which reports the results using different estimation techniques to assess their robustness. Specifically, the within estimator, the fixed effect combined with year effect, and the systems GMM methodology are employed to estimate equation (6) for both ERP and NRP. Columns (1) to (3) use ERP, while columns (4) to (6) use NRP. Column (1) reports the results with industry fixed effects using the within estimator, while columns (2) and (5) include year fixed effects. Columns (3) and (6) present the results under the systems GMM methodology. It is worth noting that the estimate with the industry effect is based on 72 observations, while the balanced panel dataset comprises 90 observations. This difference is due to the use of lagged variables of technological distance and trade protection rate in the estimations.

The study analyzes the impact of trade protection on productivity growth using an extended Schumpeterian framework, following the model outlined by Aghion and Howitt (2009). The study first examines the direct and indirect effects of trade liberalization on productivity growth, using ERP and NRP as trade protection variables, in accordance with equation (6). The estimations are carried out using the within estimator, the fixed effect combined with year effect, and the systems GMM methodology. The number of observations in columns (1), (2), (5), and (6) is 72 for the 18 industries in Vietnam, with a decrease in observations from 72 to 54 in columns (3) and (6) when applying the GMM estimation methodology.

The results in Table 1 confirm a positive and robust direct impact of trade protection on productivity growth, both for ERP and NRP, independent of the applied estimation

method. An economically significant marginal product is observed, as a 1-percentage point decrease in effective protection reduces TFP growth by 0.319 to 0.397 percentage points, while a decrease in nominal protection reduces TFP growth by 0.536 to 0.791 percentage points.

Table 1

The Direct and Indirect Effect of Trade Protection on Productivity Growth

	(1)	(2)	(3)	(4)	(5)	(6)
Trade barriers	ERP	ERP	ERP	NRP	NRP	NRP
P	0.00397*	0.00382*	0.00319***	0.00791**	0.00739*	0.00536***
	(0.00194)	(0.00202)	(0.000329)	(0.00326)	(0.00387)	(0.00123)
M(-1) x P(-1)	-0.156**	-0.142**	-0.140***	-0.297***	-0.283***	-0.279***
	(0.0543)	(0.0591)	(0.00695)	(0.0658)	(0.0759)	(0.00624)
Constant	0.175***	0.185***		0.191***	0.203***	
	(0.0146)	(0.0340)		(0.0169)	(0.0391)	
Observations	72	72	54	72	72	54
R-squared	0.087	0.101		0.122	0.135	
Number of Industries	18	18	18	18	18	18
Industry FE	Yes	Yes		Yes	Yes	
Year FE	No	Yes		No	Yes	
GMM			System 2-step			System 2-step
Wald (joint)	6058.28***	1.7e+06***	113.20***	2279.73***	4.7e+05***	37.68***

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The study also finds a significant indirect impact of trade liberalization, which is conditional on the distance from the technological frontier and applies to the case of Vietnamese manufacturing sectors. For a 1 percentage point decrease in trade protection, each percentage point increase in distance from the technological frontier lowers productivity growth between 0.14 and 0.297 percentage points under the TFP growth measure.

The study allows for endogenous trade protection by employing the dynamic GMM estimator and controls for endogenous heterogeneity across industry groups beyond the time-invariant industry heterogeneity controlled by fixed effects. The results are robust to the possibility of endogeneity of the trade protection measure under systems GMM, maintaining the positive and statistically significant impact of trade protection on productivity growth. Finally, the study concludes that industries with a closer distance to the boundary benefit more from trade protection than those with further distances.

The outcomes of the estimations based on equation (7) are presented in Table 2. The first three columns of the table demonstrate the impact of productivity growth on the effective rate of protection, while the last three columns show the same relationship using the nominal rate of protection. The results provide evidence that the effect of trade protection on productivity growth remains robust even when incorporating controls for domestic competition. Specifically, the magnitude of the coefficient for both the direct and indirect effects undergoes minimal changes.

Table 2

General Effect of Trade Protection when also Controlling for Domestic Competition

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Trade barriers	ERP	ERP	ERP	NRP	NRP	NRP
P	0.00380**	0.00466**	0.00369***	0.0105*	0.0115**	0.00997***
	(0.00144)	(0.00167)	(0.000302)	(0.00513)	(0.00463)	(0.000859)
M(-1) x P(-1)	-0.196***	-0.166***	-0.194***	-0.330***	-0.290***	-0.325***
	(0.0464)	(0.0360)	(0.0268)	(0.0718)	(0.0630)	(0.0452)
He(-1)	-15.75***	-21.00***	-15.95***	-16.47***	-21.36***	-17.06***
	(5.393)	(3.326)	(1.192)	(5.128)	(3.125)	(1.180)
He(-1) x M(-1)	-22.01***	-11.17**	-29.74***	-17.84***	-8.398*	-30.31***
	(6.099)	(5.204)	(6.274)	(5.587)	(4.084)	(6.898)
He(-1) x P(-2)	0.0322***	0.0332***	0.0373***	0.0369	0.0519**	0.0526***
	(0.00815)	(0.00838)	(0.00490)	(0.0228)	(0.0216)	(0.0101)
Constant	0.629***	0.774***		0.626***	0.767***	
	(0.129)	(0.0853)		(0.120)	(0.0737)	
Observations	72	72	54	72	72	54
R-squared	0.376	0.449		0.404	0.472	
Number of Industries	18	18	18	18	18	18
Industry FE	Yes	Yes		Yes	Yes	
Year FE	No	Yes		No	Yes	
GMM			System 2-step			System 2-step

Moreover, the adverse effect of concentration on firm productivity growth is evident. Specifically, a 0.001-unit decrease in the Hirschman-Herfindahl Index leads to a 0.015-0.021 percentage point increase in productivity growth for Vietnamese manufacturing sectors. The findings reveal that the interaction effects between the market concentration index and both the trade barrier and technological distance remain significant and align in direction with the coefficient of the individual interaction variables. Indeed, the interaction coefficient of market concentration with technology distance is

negative, while that of market concentration with trade barriers is positive. This demonstrates that the trade barrier and technological distance are the primary determinants of productivity growth as per the theoretical framework. Furthermore, if this argument is used to explain the estimated outcomes while controlling for product market competition in the case of South Africa (Aghion et al., 2013), it remains applicable to the Vietnamese case.

Using the estimation results of the Vietnamese manufacturing sectors in the previous section, this study will now compare them to those for the South African manufacturing sectors in Aghion et al. (2013).

Table 3

The Direct and Indirect Effects of Trade Protection on Productivity Growth

	The direct impact P		**The indirect impact P(-1) x M(-1)**	
Models	Vietnam	South Africa	Vietnam	South Africa
Model using ERP with industry fixed effect	0.00397*	-0.0004*	-0.156**	-0.0009*
	(0.00194)	(5.6e-005)	(0.0543)	(0.0003)
Model using ERP with industry fixed effect and year effect	0.00382*	-0.0002*	-0.142**	-0.001**
	(0.00202)	(4.8e-005)	(0.0591)	(0.0003)
Model using ERP under the system GMM methodology	0.00319***	-0.00014*	-0.140***	-0.0013*
	(0.000329)	(6.8 e-005)	(0.00695)	(0.0005)
Model using NRP with industry fixed effect	0.00791**	-0.0021*	-0.297***	-0.0013**
	(0.00326)	(0.0007)	(0.0658)	(0.0007)
Model using NRP with industry fixed effect and year effect	0.00739*	-0.002*	-0.283***	-0.002
	(0.00387)	(0.0007)	(0.0759)	(0.002)
Model using NRP under the system GMM methodology	0.00536***	-0.0030*	-0.279***	0.0010
	(0.00123)	(0.0004)	(0.00624)	(0.0007)

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3 presents a comparison of the direct effects of a lower trade barrier on productivity growth between South Africa and Vietnam. The results reveal two major differences. Firstly, a decrease in the trade barrier has a positive effect on productivity growth in South Africa, whereas it has a negative effect in Vietnam. Secondly, the magnitude of the effect is higher in Vietnam than in South Africa for an identical reduction in trade barriers. Specifically, a 1 percentage point reduction in trade barriers, measured using both NRP and ERP, would result in productivity growth in South Africa increasing by 0.2 to 0.3 percentage points and 0.02 to 0.04 percentage points, respectively. However, in Vietnam, this reduction leads to productivity growth increasing by 0.53 to 0.79 percentage points and 0.31 to 0.39 percentage points when measuring trade protection using NRP and ERP, respectively. The difference in the impact of trade liberalization on the two countries can be attributed to the competition from foreign goods,

which have a higher quality and discourage domestic innovation. Additionally, the foreign monopolist is more incentivized to innovate, contributing to further technological advancements.

The indirect effects of the trade barrier and technological distance on productivity growth in Vietnam and South Africa are also compared. Although the direction of the indirect effects is the same for both countries, the magnitudes differ significantly. Specifically, a one percentage point decrease in the technology gap increases South Africa's TFP growth by 0.009 to 0.013 percentage points in models using ERP and NRP. However, Vietnamese productivity growth under the indirect effects with a one percentage point decrease increases by 1.40 to 1.56 percentage points for models using ERP, or 2.79 to 2.97 percentage points for models using NRP, significantly higher than that of South Africa. The differences in the coefficients can be attributed to the technological distance and import of intermediate goods. The Vietnamese manufacturing sectors rely heavily on imported goods to produce the final product, and thus a reduction in technological distance does not necessarily lead to an increase in productivity growth if the sectors cannot compete with imported goods. In contrast, South African manufacturing sectors were not impacted by foreign goods, and thus a reduction in technological distance leads to an increase in productivity growth. Therefore, the impact of technological distance on productivity growth is not as important for South Africa compared to Vietnam. The key differences between the two countries lie in the impact of trade barriers and the magnitude of the effect of technological distance from the frontier.

6. Conclusions

This study provides evidence and findings regarding how the process of trade liberalization influences or affects productivity. Trade liberalization typically involves reducing trade barriers, such as tariffs and import restrictions, to encourage more open and free trade between countries. The study aims to show how this policy change, i.e., trade liberalization, has a direct or indirect effect on the productivity levels of businesses or industries. The empirical findings confirm the predictions made for the Vietnamese manufacturing sector using the GMM estimation method. The study employs fixed and year effects to account for manufacturing heterogeneity and controls for the influence of product market competition. The findings are robust even when endogeneity of trade protection measures is allowed for.

Although theoretical and empirical studies have established the impact of trade liberalization on productivity growth, some conclusions in this study contrast with those of other prominent studies. The empirical evidence presented in this paper suggests that unilateral trade liberalization directly reduces productivity growth and innovation in production in a country that is far away from the technology frontier. Most previous studies have worked with data from multiple countries without accounting for differ-

ences in their structure and situation. This paper provides new findings based on the case of Vietnam.

The study identifies a range of new findings drawn from the Vietnamese manufacturing sector. Firstly, free trade can directly impact the technological gap of a small developing country due to the importation of all intermediate goods from the leading monopolist of the developed country. This reduces the technological distance in only some key manufacturing sectors in which the country specializes, with other sectors experiencing minimal or no changes. Secondly, domestic competition plays a significant role in productivity growth, and its interaction with trade barriers and technology distance is vital to force monopolists in manufacturing sectors to innovate. Thirdly, the impact of unilateral trade liberalization on productivity growth varies depending on the technology distance of each economy.

One limitation of this study is that it cannot compare the impact of domestic competition between Vietnam and South Africa due to differences in the measurement of domestic competition. The study suggests that South African producers were gaining market share in the domestic market, while Vietnamese producers were losing market share to foreign exporters.

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