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Exporting independently or entering the global market as a contract manufacturer?

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Abstract

Why do some firms in developing countries (South) choose to be contract manufacturers of multinational corporations in developed countries (North) instead of independently developing home-grown products to compete with the latter? In this paper, we provide an explanation through the lens of global value chains (GVCs). To this end, we develop an international duopoly model in which a Southern firm seeks to enter a global market dominated by a Northern conglomerate, either by having a competing product or participating in the GVC managed by the latter. We show that in a broad range of parameterizations, the North-South GVC arrangement yields a win-win solution for the firms, and hence it can justify the active involvement of Southern firms in the GVCs led by Northern conglomerates as a means to boost exports from the South, even though firms from the South have low productivity.

Key words: Global value chain; export; oligopoly; North; South.
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1. Introduction

Firms selling products in foreign markets generally face a variety of fixed costs, such as setting up distribution channels, understanding foreign regulations and consumer preferences, and doing commercials for product promotion. The new-new trade theory, which emphasizes firm heterogeneity, suggests that those fixed costs generally hinder firms to export their products to international markets so that only larger and more productive firms can enter international markets while less productive firms serve local markets. Melitz (2003) theoretically proves that high productive firms are more competitive in international markets than low productive firms, which are constrained by the fixed costs and tend to serve the domestic market. With the assumption of Bertrand completion, the model of Bernard, Eaton, Jensen and Kortum (2003) illustrates the fact that exporting plants appear to be more productive. By introducing firm heterogeneity into the model of Krugman (1980), Chaney (2008) argues that firm size matters in international trade as large firms can easily overcome the necessary fixed costs for selling products in the global market. Bernard and Jensen (1995) document the characteristics of exporters and non-exporters of US manufacturing in the period of 1976 and 1987, and find that the exporters were generally bigger, more capital intensive and paying higher wages than non-exporters. Using the firms of the United Kingdom as a sample, Greenaway and Kneller (2004) find that sunk costs play an important role in determining firms' entry into international markets and firms have to be larger and more productive for entering foreign markets.

The new generation of trade theory that incorporates firm heterogeneity implicitly assumes that, when a firm exports its product abroad, it should be responsible for all tasks from research and development, manufacturing products, marketing to final retailing. This assumption is not true for modern trade based on global value chains (GVCs).[1] To date, most of manufacturing products, for instance, Nike's shoes and Apple's iPhones, are manufactured and traded along GVCs, where

[1] Depending on their governance structure, GVCs can be classified as producer-driven and buyer-driven value chains. GVCs led by technology leaders in capital-intensive industries such as the automobile, aircraft, computer and semiconductor are producer-driven value chains. On the other hand, buyer-driven chains are typically organized by large retailers, branded marketers and branded manufacturers (Gereffi, 1999).

firms located in different countries engage in various tasks, ranging from product design, the manufacturing of components, assembly, marketing to retailing. Today's trade is not cloth-for-wine. The proliferation of GVCs has transformed trade in goods into trade in tasks (Grossman and Rossi-Hansberg, 2008). Trade based on GVCs represents a new international division of labor over the value chain of a single good, where lead firms of GVCs specialize in high-value added tasks, such as R&D, marketing and retailing, while non-lead firms, typically from developing countries, are in charge of manufacturing or assembling physical products. As a matter of fact, this new international division of labor along the same product eliminates the need for contract manufacturers - for example UNIQLO's suppliers in China - to develop brands, establish global distribution networks and use commercials to promote products. By participating in GVCs as a part supplier or assembler, firms can avoid the typical fixed costs emphasized in the new-new trade theory, and export to international markets. In other words, the so-called fixed or sunk costs are no longer necessary in the age of GVCs for the firms, which are designated contact manufactures or suppliers of multinational enterprises, to sell their products in the global market.[2]

A few cases can illustrate the new division of labor along GVCs. China has been an exclusive assembler of iPhones since Apple launched the iPhone 3G in 2007. The global popularity of iPhones due to Apple's innovation and aggressive marketing contributed more than $20 billion annually to the Chinese exports in terms of value added (Xing, 2020). The world largest chain store Walmart has about 50,000 Chinese suppliers in China and imports about $50 billion goods from them annually. The Chinese suppliers do not invest a penny in the retail network of Walmart but their products can easily reach millions of American families. Similarly, Japanese retailor UNIQLO has more than 100 suppliers in China. Those suppliers can sell their products under the UNIQLO brand to any markets as long as there is a UNIQLO store there. The popularity of "Made in China" products in the global market is largely attributed to the foreign brands attached and the global distribution networks owned by foreign multinational enterprises. Indeed, according to Nelson (2014, 2018), there has been recently a trend for retailers across the globe to offer the so-

[2] A lead firm, which manages the operation of a value chain and decides the relations between firms participating in the chain, is necessary for any meaningful GVCs. If we break down the tasks contributing to the production of a product, from supply of the raw materials used, to manufacture of the product and on to the eventual delivery of the product to targeted consumers, we can easily sketch a chain that superficially links all of the firms involved in the process. If the links along a value chain are not bonded with binding contracts, i.e., if the relations are simply defined by free market transactions as buyer-seller relations, those value chains add little in terms of promoting exports of non-lead firms.

called private labels (or store brands) which are relatively cheap products to compete with national brands. Aldi, a relatively new supermarket chain in Australia, have almost 90% of goods on shelves as store brands. Most of these private labels are sourced from developing countries, China in particular. The largest supermarket chain in Australia, Coles, also reported 32% of sales on private labels in the first half of 2021.[3]

Why do most of exporting firms in developing countries (collectively referred to as the South) choose to be contract manufacturers rather than develop their own branded products to compete with established multinational corporations of developed countries? In this paper, we explore this question, which is important for understanding value chained based international trade – the new channel that is fundamentally different with the classic cloth-for-wine trade or the trade based on product differentiations. To this end, we develop an international duopoly model in which a Southern firm seeks to enter a global market for a particular product, which has been marketed by a firm headquartered in a developed country (referred to as the North). The Southern firm could enter the market by developing a differentiated product or serving as the contract manufacturer of the Norther firm. New product development requires the Southern firm to incur a setup cost, while selling the independently developed product globally also needs huge investment in product promotion and distribution and retail networks. These investments, however, may not guarantee the Southern firms to enter the market successfully. This is a risk of developing a differentiated product to compete with the established Northern firm. In contrast, by joining the GVC of the Northern firm as the contract manufacturer and specializing in assembly or manufacturing the product designed and marketed by the Northern firm, the Southern firm can easily export to the international market without any fixed investment in R&D, marketing and distribution and retail networks, and more importantly it is a risk-free strategy of entering the international market. We focus on the interlinkages across production cost (marginal production cost, marginal marketing and distribution cost and fixed cost) differences that persist between the South and the North, the level of product substitutability and Northern product innovation capability in determining equilibrium outcomes.

[3] Source: https://www.9news.com.au/national/coles-brand-products-boom-half-yearly-supermarket-results/b7ad690c-f816-44c0-ad86-3aa8ab18e85d.

With this simple model, we can demonstrate a number of interesting results. First, there exist a broad range of parameterizations under which the Southern firm is (weakly) better off taking part in the GVC run by the Northern firm rather than independently developing a differentiated product. Under the GVC arrangement, the Southern firm signs a supply contract agreement with the Northern firm which allows it to utilize the advanced and innovative technologies owned by the Northern firm in the production process, whereas the Northern firm focuses on marketing, distribution and product innovation. Second, a greater level of product substitutability motivates the two firms to engage in GVC, provided that the starting level of product distinctiveness is high. Third, when the product is homogeneous, the setup cost of a production facility is uniform across countries and the Northern firm has significant innovation capability, the GVC arrangement will arise in equilibrium if such a setup cost is not too high. However, the Southern firm makes a positive income in equilibrium if the setup cost is sufficiently low.

The findings of the paper are useful for the debate on global value chain in which a pressing issue is how Southern firms (and, to a larger extent, Southern countries) can benefit from the global value chains traditionally run by Northern conglomerates. We argue that when new product development is not a viable option for Southern firms (to enter the global market) because of their disadvantages in technology and production capacities, entering international markets as a contract manufacturer of Northern established firms can be an effective alternative, which contributes significantly to export performance of the South. Schmitz (2007) points out that firms in developing countries face both a marketing gap and a technology gap, and that overcoming those deficiencies is very challenging in global markets. Kaplinsky (2004) observed that intangible assets such as brands and global distribution networks have turned into major hurdles for firms in developing countries, which are striving to take part in the world market. However, once firms from developing countries plug into GVCs led by MNEs, which own internationally recognized brands and global distribution networks, they can take advantage of the spillover effects the intangible assets of those MNEs and sell their products to foreign consumers. As noted in Xing (2021a), Chinese made manufacturing products, which account for more than 90% of Chinese exports, are mostly produced along the value chains led by foreign multinational companies. China's integration into global value chains has played a critical role in the country's export miracle. The spillover effects related with the brands, technology and distribution networks belonged to GVCs lead firms significantly facilitated the successful penetration of "Made in China" products into the markets of high-income countries.

To date, GVCs have functioned as a new channel for firms from developing countries to easily access international markets. GVCs based international trade stands in sharp contrast with the prediction of traditional trade theory, Melitz (2003) in particular, that only productive firms can export. Interestingly, our model and results provide an alternative explanation. Some empirical studies on the experiences of China actually show that less productive Chinese firms exported more. Lu (2010) reveals that China's exporters were typically less productive and sell less in the domestic market than non-exporters. Dai, Maitra and Yu (2016) conclude that Chinese firms engaging in processing exports were relatively low productive. Processing exports are a subsect of value chain trade. Malikov, Zhao and Kumbhakar (2020) examine Chinese firms in twenty-eight industries and find that exporters exhibited lower productivity than non-exporter. So far, the productivity puzzle revealed by those studies has not been examined theoretically in the context of GVCs.[4] Our theoretical model lends some support to these empirical findings.

The rest of the paper will proceed as follow. In the next section, Section 2, we provide an international oligopoly model with GVCs, followed by equilibrium outcomes and comparative statics in Section 3. In Section 4, we extend the basic theoretical framework to examine the roles played by product innovation. Finally, in Section 5, we discuss our results and offer some concluding remarks.

2. The model

Consider the free-trade world/global market for a consumer product.[5] The product is initially produced by a firm from a developed country (referred to as the North in what follows), firm N. The production process takes place in the North. With its established position in the marketplace, firm N's fixed cost, or set up cost, is assumed to be sunk. Firm N's marginal cost consists of two

[4] See also the recent work by Meng, Ye and Wei (2020) on the 'smiling curves' in the context of GVCs focusing on the labour market of China and the United States, where they document the different benefits of GVCs attributed to different groups of labour in these two largest economies.

[5] In the extension to the model, we will consider the case in which there are M countries which together form markets for the product in question. The market size of these countries ranges from γ_1 to γ_M. Then, due to the spillover effects of advertising across countries, firm i's advertising cost is $x_i = f(M)$, where $f'(M) > 0$ and $f''(M)<0$. The advertising cost is an increasing function of M, but the marginal cost of advertising decreases, reflecting a positive spillover effect of the advertisement across countries.

components: the marginal cost associated with production, c_{NP}, and the marginal cost associated with marketing, distribution and retailing activities, c_{NM}.

The marginal cost of manufacturing the product is lower in the South due to a lower level of development.[6] Firm N could therefore undertake foreign direct investment (FDI) in the South or outsource manufacturing task to the Southern firm. Taking advantage of this, a local firm in the South, firm S, considers entering the global market through one of the two options. The first option is to independently develop a differentiated and compete directly with firm N in the world market. The other option is to join the value chain of firm N by serving as a designated contract manufacturer of firm N. In this paper, we will focus on this new, unexplored setting of value chain and abstract away from FDI arrangement. In fact, there is a vast literature on FDI by Northern firms in the South which may lead to spillover effects which enhance Southern firms' capabilities. Interested readers can refer to Ghosh, Morita and Nguyen (2018) and Morita and Nguyen (2021) for recent theoretical insights as well as useful surveys of this literature.

If firm S chooses the first option, it incurs a positive fixed, or setup, cost, f. This setup cost includes R&D and product design, which are necessary for new entrants. Firm S's marginal cost also consists of two components: the marginal cost of manufacturing the product, c_{SP}, and the marginal cost associated with marketing, distribution and retail activities in the global market, c_{SM}. Assume that $c_{SP} < c_{NP}$ but $c_{SM} > c_{NM}$; i.e., firm S has a lower marginal cost of production but larger marginal cost of marketing and distribution activities. These assumptions simplify the number of cases to be considered and it is rather consistent with what often observed in reality. In general, it is more difficult and costly for a new firm to ask distributors/retailers to carry its products than the established firms whose brands have been recognized by consumers. For instance, it is much easier for Nike to ask foreign retailors to sell Nike shoes than for a Chinese shoemaker, whose shoe brand is unknown to international customers. For expositional reason, define c_{ij} as the marginal cost of firm i (=N, S) associated with the activity j (=production, marketing and distribution),

[6] This is a phenomenon that has been observed in many places around the world, especially in Asian developing countries such as China, Vietnam, Indonesia and Thailand which are home to the supply of global supply of most consumer products ranging from clothing and footwears to advanced technological items such as mobile phones and laptops (Xing, 2016). These locations are famous for their low labour costs and living standards which make them attractive for multinational companies (MNCs).

In contrast, if firm S chooses the second option, it will be integrated with the value chain run by firm N. To simplify the analysis, we consider an arrangement between firms N and S such that firm S manufactures the product designed by firm N, while firm N is responsible for marketing the product in the global market. Thus, the arrangement effectively 'merges' firm S and firm N, with the former specializing in manufacturing task and the latter in product design, marketing, distribution and retailing. The merge combines the comparative advantage of the firms together. The production of the good under the GVC arrangement will therefore have marginal cost associated with production, c_{SP}, and marginal cost associated with marketing and distribution activities, c_{NM}. The fixed cost required for GVC production is assumed to be F, where $F > f$ holds.[7] Let $\Delta f = F - f$ where $\Delta f > 0$.

In line with the licensing literature and to fit our model with reality as much as possible, we consider two scenarios associated with the GVC arrangement. In the first scenario, firm N offers firm S a lumpsum to motivate firm S to join its GVC on a take-it-or-leave-it basis. If firm S rejects the offer, the two firms proceed with a competition game, but if firm S accepts the offer, it will produce exclusively for firm N and effectively become a foreign affiliate for firm N. This is like a fixed fee licensing scheme; however, here, once the GVC arrangement occurs the two firms no longer compete in the marketplace as in the case of fixed fee licensing. In the second scenario, firm N offers firm S a per-unit price for any output to be produced, subject to minimum volume to be imposed by firm N and exclusive distribution and retailing. This is similar to a royalty licensing scheme, yet with no subsequent competition due to the nature of GVC.

In the first scenario (GVC with a lumpsum payment), we investigate a three-stage game. In stage 1, firm N offers a GVC contract with the lumpsum payment, R, to firm S. Upon this, in stage 2, production takes place and consumers make their purchasing decision. Notice that the game has two stage-1 subgames: one in which firm S chooses to produce a competing product with that of firm N (competition subgame) and one in which firm S chooses to be a contract manufacturer of firm N (GVC subgame). Depending on product offering, the collective utility function of consumers who purchase product i (produced by firm i) follows a quasi-concave function:

[7] One possible reason is that the setup cost of production in the South for the GVC must meet firm N's strict requirements. The N's production technology, including not only manufacturing technology, but also include production know-how, and supply chains, etc, is usually more advanced than that of the South and thus requires more investment.

$U_i(q_i, q_j) = \alpha(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j) + Y$, where Y is a positive constant and γ is a parameter capturing the degree of substitutability between firm N's and firm S's product. This utility function has been adopted in several papers in the economics literature (for a recent paper, see Bond and Saggi, 2018) and it offers tractability to model solutions and simplification of the analysis. Note, the implied inverse demand function can be found based on the envelop theorem: $P_i = \alpha - q_i - \gamma q_j$. For simplicity we normalize the market size to 1, that is $\alpha = 1$.

In the second scenario (GVC with per-unit price), we consider a two-stage game. In stage 1, firm S sets the (wholesale) price to firm N. In stage 2, firm N chooses sales volume, which is directed to firm S for production. All other elements of the model remain exactly the same as with the first scenario.

In the next section, we use the backward induction technique to solve for solutions to the model mentioned above. Our focus is to identify conditions in which firms N and S implement GVC agreement. We then explore comparative statics concerning the parameters of interest: c_{NP}, c_{NM}, c_{SP} and c_{SM}. Results will help us understand better the dynamics of GVCs. Finally, as an extension of the model, in Section 4, we will accommodate firm S's innovation capability. This is relevant with settings in which firm S has a technological backwardness but not too far behind from that of firm N. We will show how the interplay between marginal cost differences, the set-up cost of production in the South, and firm S's innovative capability determines equilibrium outcomes. In particular, we will show that a GVC arrangement is still possible in this alternative model.

3. Analysis

Competition

Let us start with the competition subgame. In the last stage, firm N chooses the quantity level q_N and firm S chooses the quantity level q_S to maximize their respective profits:

$$\pi_N = (1 - q_N - \gamma q_S - c_{NP} - c_{NM})q_N, \tag{1}$$

$$\pi_S = (1 - q_S - \gamma q_N - c_{SP} - c_{SM})q_S - f. \tag{2}$$

Cournot solutions are given by $q_N^C = \frac{2-2c_{NP}-2c_{NM}-\gamma(1-c_{SP}-c_{SM})}{4-\gamma^2}$ and $q_S^C = \frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}$. For q_N^C and q_S^C to be positive, it is required that $2-2c_{NP}-2c_{NM}-\gamma(1-c_{SP}-c_{SM})>0$ and $2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})>0$ hold, which we assume to be the case.

Firm N's equilibrium profit, π_N^C, and firm S's equilibrium profit, π_N^C, in the competition subgame can be computed, allowing comparative statics analysis. Note, as is usually stated in the Cournot oligopoly literature, when both $q_N^C > 0$ and $q_S^C > 0$ hold, $\pi_N^C = (q_N^C)^2$ and $\pi_S^C = (q_S^C)^2 - f$.

<u>Lemma 1:</u>

There exists a threshold positive value $\hat{f}$ such that $\pi_S^C > (\leq) 0 \leftrightarrow f < (\geq) \hat{f}$.

Proof. From the equilibrium outcome: $\pi_S^C = \left(\frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}\right)^2 - f > (\leq) 0 \leftrightarrow f < (\geq) \left(\frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}\right)^2 \equiv \hat{f}$. ■

Lemma 1 provides the condition for firm S to make a strictly positive profit in the equilibrium of the competition subgame. Basically, the condition is such that the fixed cost of production for firm S is relatively small. This is expected as the fixed cost does not enter the equations for equilibrium quantity for both firms N and S, and firm S's profit declines as its fixed cost increases.

<u>Proposition 1:</u>

In the equilibrium of the competition subgame, the following hold:

(i) $\partial\pi_S^C/\partial c_{SP} < 0$, $\partial\pi_S^C/\partial c_{SM} < 0$, $\partial\pi_S^C/\partial c_{NP} > 0$, $\partial\pi_S^C/\partial c_{NM} > 0$ and $\partial\pi_S^C/\partial f < 0$;

(ii) $\partial\pi_N^C/\partial c_{SP} > 0$, $\partial\pi_N^C/\partial c_{SM} > 0$, $\partial\pi_N^C/\partial c_{NP} < 0$, $\partial\pi_N^C/\partial c_{NM} < 0$ and $\partial\pi_N^C/\partial f > 0$.

Proof: The proof follows from equilibrium outcomes presented above where it is noted that:

$\pi_N^C = \left(\frac{2-2c_{NP}-2c_{NM}-\gamma(1-c_{SP}-c_{SM})}{4-\gamma^2}\right)^2$ *and* $\pi_S^C = \left(\frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}\right)^2 - f$. ■

Proposition 1 provides some comparative statics results in the equilibrium of the competition subgame. It says that firm N's profitability decreases if one of its cost components increases, whereas it increases if one of firm S's cost components increases. Similarly, firm S's profitability decreases for any increases in its production/fixed costs but increases if firm N's cost rises. These are expected results, which are also in line with the Cournot oligopoly literature.

<u>Proposition 2:</u>

There exist positive threshold values γ_1 and γ_2 such that in the equilibrium of the competition subgame:

(i) If $c_{NP} + c_{NM} \geq c_{SP} + c_{SM}$ then $\partial \pi_N^C / \partial \gamma \leq 0$. Furthermore, $\partial \pi_N^C / \partial \gamma > 0 \leftrightarrow \gamma_1 < \gamma \leq 1$ and $\partial \pi_S^C / \partial \gamma \leq 0$ otherwise, where γ_1 solves $\partial \pi_S^C / \partial \gamma = 0$ for all $\gamma < 1$;

(ii) If $c_{NP} + c_{NM} < c_{SP} + c_{SM}$ then $\partial \pi_S^C / \partial \gamma \leq 0$. Furthermore, $\partial \pi_N^C / \partial \gamma > 0 \leftrightarrow \gamma_2 < \gamma \leq 1$ and $\partial \pi_S^C / \partial \gamma \leq 0$ otherwise, where γ_2 solves $\partial \pi_N^C / \partial \gamma = 0$ for all $\gamma < 1$.

Proof. From the equilibrium outcome we find:

$$\frac{\partial \pi_N^C}{\partial \gamma} = -\frac{(2-2c_{NS}-2c_{NM}-\gamma(1-c_{SP}-c_{SM}))((1-c_{SP}-c_{SM})\gamma^2-4(1-c_{NP}-c_{NM})\gamma+4(1-c_{SP}-c_{SM}))}{(4-\gamma^2)^3}, \text{ and}$$

$$\frac{\partial \pi_S^C}{\partial \gamma} = -\frac{(2-2c_{PS}-2c_{PM}-\gamma(1-c_{NP}-c_{NM}))((1-c_{NP}-c_{NM})\gamma^2-4(1-c_{SP}-c_{SM})\gamma+4(1-c_{NP}-c_{NM}))}{(4-\gamma^2)^3}.$$

As such, whenever $c_{NP} + c_{NM} \geq c_{SP} + c_{SM}$, $\partial \pi_N^C / \partial \gamma \leq 0$ holds for all γ. Then, $\partial \pi_S^C / \partial \gamma > 0$ if $\gamma_1 < \gamma < y_1{}'$ and $\partial \pi_S^C / \partial \gamma < 0$ otherwise, where γ_1 and $\gamma_1'(> \gamma_1)$ solve $\partial \pi_S^C / \partial \gamma = 0$. In contrast, whenever $c_{NP} + c_{NM} < c_{SP} + c_{SM}$, $\partial \pi_S^C / \partial \gamma \leq 0$ holds for all γ. Then, $\partial \pi_N^C / \partial \gamma > 0$ if $\gamma_2 < \gamma < y_2{}'$ and $\partial \pi_S^C / \partial \gamma \leq 0$ otherwise, where γ_2 and $\gamma_2'(> \gamma_2)$ solve $\partial \pi_N^C / \partial \gamma = 0$. The proof completes by noticing that both $y_1' > 0$ and $y_2' > 0$ hold. ■

Proposition 2 says that whenever the "effective marginal cost" (i.e., the sum of marginal production cost and marginal marketing and distribution cost) of a firm is larger than its competitor, the firm's profitability decreases as the degree of product differentiation increases. In other words, the firm with a marginal cost disadvantage prefers to have its product less distinct from its competitor. In contrast, the firm with a marginal cost advantage finds its profitability enhanced as the degree of product differentiation increases, provided that the initial level of such product substitutability is high enough.

GVC with lumpsum payment

We now turn to examine the GVC subgame where the two firms, N and S, effectively 'merge' through a lumpsum payment arrangement offered by firm N to firm S. The firms can then utilize in the production and distribution their best technologies. That is, the marginal cost of production will now consist of firm S's marginal cost associated with production, c_{SP}, and firm N's marginal cost associated with marketing and distribution activities, c_{NM}.

Firm N's and firm S's profit are respectively given by:

$$\pi_N = (1 - q_N - c_{SP} - c_{NM})q_N - R - F \,, \tag{3}$$

$$\pi_S = R, \tag{4}$$

where *R* is the lumpsum payment firm N makes to firm S (for not being its competitor). For the GVC arrangement to arise as an equilibrium outcome, the following conditions must be concurrently satisfied in equilibrium:

$$R \geq \pi_S^C \geq 0, \tag{5}$$

$$\pi_N^{GVC} \geq \pi_N^C \,. \tag{6}$$

If conditions (5) and (6) are not satisfied at the same time, the equilibrium of the game is a competition equilibrium in which firms N and S compete in the global market. To simplify the discussion, we make a tie-breaking assumption that whenever $q_S^C = 0$, $R = 0$ holds and firm N chooses GVC over competition.[8]

Cournot solutions for the GVC subgame is given by $q_N^{GVC} = \frac{1-c_{SP}-c_{NM}}{2}$. To fit the model with reality we will assume that $1 - c_{SP} - c_{NM} > 0$ holds. This allows us to compute firm N's

[8] Indeed, firm N just needs to make a slightly positive amount to firm S to enable the arrangement which does not damage its profitability.

equilibrium profit, $\pi_N^{GVC} = \left(\frac{1-c_{SP}-c_{NM}}{2}\right)^2 - \left(\frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}\right)^2 - \Delta f$, as well as firm S's equilibrium profit, $\pi_S^{GVC}(= R \equiv \pi_S^C)$. Note, here we assume $R \equiv \pi_S^C$ for simplification. In reality, firm N can realistically enforce this (GVC with lumpsum payment) by setting $R = \pi_S^C + \epsilon$, where ϵ is positive and small, to motivate firm S to participate in its GVC.

Proposition 3:

In the equilibrium of the GVC subgame with lumpsum payment, $\partial\pi_S^{GVC}/\partial c_{SM} > 0$, $\partial\pi_N^{GVC}/\partial c_{NP} < 0$, $\partial\pi_S^{GVC}/\partial c_{NM} < 0$, $\partial\pi_S^{GVC}/\partial F < 0$, and $\partial\pi_S^{GVC}/\partial f > 0$ hold. Furthermore, $\partial\pi_N^{GVC}/\partial c_{SP} \geq 0$ if $c_{NP} + c_{NM} < c_{SP} + c_{SM}$, or if $c_{NP} + c_{NM} \geq c_{SP} + c_{SM}$ and $\gamma < \gamma_2$, and , $\partial\pi_N^{GVC}/\partial c_{SP} < 0$ otherwise.

Proof: The proof for $\partial\pi_N^{GVC}/\partial c_{NP} < 0$, $\partial\pi_S^{GVC}/\partial c_{NM} < 0$, $\partial\pi_S^{GVC}/\partial F < 0$, and $\partial\pi_S^{GVC}/\partial f > 0$ *follows from equilibrium outcomes presented above where it is noted that:* $\pi_N^{GVC} = \left(\frac{1-c_{SP}-c_{NM}}{2}\right)^2 - \left(\frac{2-2c_{SP}-2c_{SM}-\gamma(1-c_{NP}-c_{NM})}{4-\gamma^2}\right)^2 - \Delta f$. *Meanwhile:*

$$\frac{\partial\pi_N^{GVC}}{\partial c_{SP}} = 2\frac{((1-c_{NP}-c_{NM})\gamma^2 - 4(1-c_{SP}-c_{SM})\gamma + 4(1-c_{NP}-c_{NM}))}{(4-\gamma^2)^2}$$

so that together with the proof of Proposition 2, we obtain the results for $\partial\pi_N^{GVC}/\partial c_{SP}$. ■

Firm N's choice between competition and GVC depends on how much profit it can extract from the GVC arrangement after the lumpsum payment to firm S. Proposition 3 tells us that an increase in c_{SM} or a reduction in c_{NP} both help to motivate firm N to choose GVC over competition. This is expected given that c_{SM} and c_{NP} are not part of firm N's technology choice under GVC but they impact firm N's performance under competition. In contrast, c_{NM} negatively impacts firm N's profitability under GVC but positively impacts firm S's profit under competition which both work to reduce firm N's incentive for GVC. The most interesting result of Proposition 3 is related to how a change in c_{SP} influences firm N's production choice in the equilibrium of the entire game. If firm N has an advantage in marginal cost under competition, Proposition 3 says that an increase in c_{SP} motivates firm N to choose GVC, whereas if firm N has a disadvantage in marginal cost under competition, an increase in c_{SP} only produce the similar effect on firm N's production choice if the degree of product substitutability is relatively low. The intuition behind both cases can be explained as follows. Firm S's profitability is low under competition if it does not possess a marginal cost advantage, or if two products (produced by firm N and firm S) are not distinct from each other. This yields a low lumpsum payment under GVC that firm N must make to firm S, which in turn guarantees a greater profitability for firm N under GVC.

Finally, let us examine how the marketing and distribution cost, which is the strength of firm N, drives the production choice decision by firm N. In particular we focus on the roles played by c_{NM} and c_{SM} (notice that $c_{NM} < c_{SM}$ holds). In Figure 1, we demonstrate an example which shows the benefits from GVC for firm N, where we perform several simulations of the model to contrast firm N's profitability under GVC with that under competition.

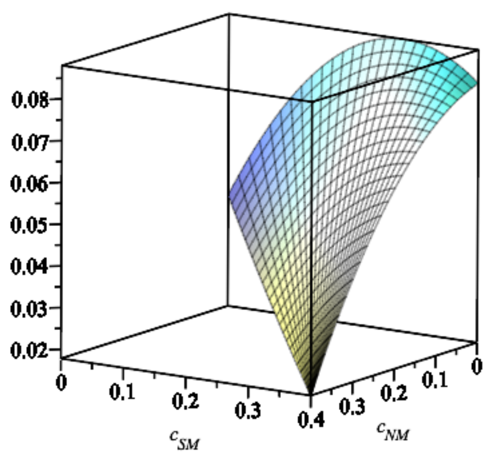

Figure 1: $\pi_N^{GVC} - \pi_N^{C}$ when $c_{SP} = 0$, $c_{NP} = 0.1$, $\gamma = 1$ and $\Delta f = 0$.

As can be seen, parameterizations exist in which firm N is strictly better off by choosing the GVC in equilibrium. Given the shifting role played by Δf, it follows that the qualifying condition is given by a low enough level of Δf. When this is satisfied, the GVC provides the optimal solution for both firms N and S.

GVC with per-unit price

We consider next the GVC subgame where firm N makes a per-unit price to firm S's product and serves as an exclusive distributor for the latter. The marginal cost of production will now include the marginal cost associated with production, c_{SP}, and the marginal cost associated with marketing and distribution activities, c_{NM}, which, like the GVC with lumpsum payment, are the best cost configurations by firms N and S. Yet, the key difference is that the two processes, production and marketing and distribution, are now handled by the two firms distinctively under GVC with per-unit price, rather than centrally by firm N as was the case of the GVC with lumpsum payment.

Firm N's and firm S's profit are respectively given by:

$$\pi_N = (1 - q_M c_{NM} - p)q_M, \tag{7}$$

$$\pi_S = (p - c_{SP})q_M - F\ , \tag{8}$$

where q_M is firm N's output choice (which is now produced by firm S in the South and p is the per-unit price firm N pays firm S. As before, the conditions (participation constraints) for GVC arrangements are:

$$\pi_S^{GVC2} \geq \pi_S^C \geq 0, \tag{9}$$

$$\pi_N^{GVC2} \geq \pi_N^C\ , \tag{10}$$

In stage 1, firm S sets the (wholesale) price, p on its product to firm N. In stage 2, firm N chooses sales volume, q_M, which will be directed back to firm S for production. Cournot solutions for the GVC subgame with per-unit price is given by $q_M^{GVC2} = \frac{1-c_{SP}-c_{NM}}{4}$, and the optimal price is $p^{GVC2} = \frac{1-c_{NM}+c_{SP}}{2}$. Thus, $\pi_N^{GVC2} = \left(\frac{1-c_{NM}-c_{SP}}{4}\right)^2$ and $\pi_S^{GVC2} = 2\left(\frac{1-c_{NM}-c_{SP}}{4}\right)^2 - f$.

<u>Proposition 4:</u>

In the equilibrium of the GVC subgame with per-unit price, $\partial\pi_N^{GVC2}/\,\partial c_{SP} < 0$, $\partial\pi_N^{GVC2}/\,\partial c_{NM} < 0$, $\partial\pi_S^{GVC2}/\,\partial c_{SP} < 0$, $\partial\pi_S^{GVC2}/\,\partial c_{NM} < 0$, and $\partial\pi_S^{GVC2}/\,\partial f < 0$ hold.

Proof: The proof follows directly from equilibrium outcomes presented above. ■

In the GVC with per-unit price, both firms N and S become better off when firm S's marginal cost associated with production, c_{SP}, or firm N's marginal cost associated with marketing and distribution activities, c_{NM}, decreases. This is an expected result because improvement in cost-reducing technology brings about production efficiency, regardless of which production process that is utilized.

Thus far, we have assumed that the GVC with per-unit price is welcome by both firms N and S and thus both the wholesale price and output level are endogenously set. It is important for us to capture the difference in profit each of these firms can generate as compared with that in the case of competition. Define:

$$\Delta\pi_{\mathrm{N}} = \pi_N^{GVC2} - \pi_N^C, \tag{11}$$

$$\Delta\pi_{\mathrm{S}} = \pi_S^{GVC2} - \pi_S^C, \tag{12}$$

then it follows that for $\Delta\pi_{\mathrm{N}} \geq 0$ to hold, it is required that c_{NP} is sufficiently large. This is because as firm N's marginal cost of production increases, its profit under competition declines whereas its profit under GVC is unaffected. Large c_{NP} is consistent with the fact that assembling/manufacturing costs of products are generally much higher in the North because of its higher labor cost. Similarly, for $\Delta\pi_{\mathrm{S}} \geq 0$ to hold, it is required that c_{SM} is sufficiently large.[9] Large c_{SM} is also consistent with the fact that firms in the South typically lack of internationally recognized brands and little experiences in marketing products in the global market.

How do $\Delta\pi_{\mathrm{N}}$ and $\Delta\pi_{\mathrm{S}}$ respond to a change in c_{NM} and c_{SP}? If this question can be answered, similar to the case of GVC with lumpsum payment, we can draw up some important conclusions with respect to the implications of GVC on firms' profitability. We find:

Proposition 5:

There exist positive thresholds c_1 and c_2 with the following properties:

(i) $\partial\Delta\pi_{\mathrm{N}}/\partial c_{NM} > (=) < 0 \leftrightarrow c_{NM} < (=) > c_1$,

[9] Indeed, one can easily find that $\partial\Delta\pi_{\mathrm{N}}/\partial c_{NP} > 0$ and $\partial\Delta\pi_{\mathrm{N}}/\partial c_{SM} > 0$ hold.

(ii) $\partial \Delta \pi_{\mathrm{N}} / \partial c_{SP} < 0$,

(iii) $\partial \Delta \pi_{\mathrm{S}} / \partial c_{NM} < 0$, and

(iv) $\partial \Delta \pi_{\mathrm{S}} / \partial c_{SP} > (=) < 0 \leftrightarrow c_{NM} > (=) < c_2$,

where $c_1 > c_2$ holds in a range of parameterizations.

Proof: The proof for Proposition 5(ii)-(iii) comes directly from Proposition 1 and Proposition 4. Furthermore, one can easily compute: $\partial \Delta \pi_{\mathrm{N}} / \partial c_{NM} = \frac{23-64c_{NP}-55c_{NM}+41c_{SP}+31c_{SM}}{72} > (=,<) 0 \leftrightarrow c_{NM} < (=) > \frac{23-64c_{NP}+41c_{SP}+31c_{SM}}{55} \equiv c_1$, *and* $\partial \Delta \pi_{\mathrm{S}} / \partial c_{NP} = \frac{7+16c_{NP}+25c_{NM}-23c_{SP}-32c_{SM}}{36} > (=,<) 0 \leftrightarrow c_{NM} > (=) < \max\left(\frac{-7-16c_{NP}+23c_{SP}+32c_{SM}}{55}, 0\right) \equiv c_2$. ■

Proposition 5 tells us that an increase in firm N's marginal cost associated with marketing and distribution activities, c_{NM}, gives firm S less incentive for participating in the GVC run by firm N, whereas an increase in firm S's marginal cost associated with production, c_{SP}, does the same thing to firm N. In contrast, effects of a firm's own marginal cost rise on its desire for GVC is not straightforward. For sufficiently high level of c_{NM} , where firm N has an advantage, an increase in c_{SP} increases firm S's incentive for accepting the GVC arrangement. In contrast, an increase in c_{NM} provides firm S with stronger motivation for GVC but does so to firm N if c_{NM} is not too high.

Moving from competition to GVC, there are two major benefits for both firms N and S. First, they combine their best expertise, so that both production efficiency and distribution efficiency can improve. Second, there is no competition between them in the marketplace, so that together they can enjoy some sort of monopoly power. The drawback of integrating into an GVC for these firms, however, is that they must share the combined profits somehow. Then, whether the former (positive) effect of efficiency improvement or the latter (negative) effect of profit sharing dominates will determine what happen arise as an equilibrium outcome.

In Figures 2-3 below, we further illustrate our results with some simulations. As can be seen, the combination of c_{NM} and c_{SP} turn out to be important with regard to whether firm N and firm S can make a larger profit level under the GVC with per-unit price comparing to competition.

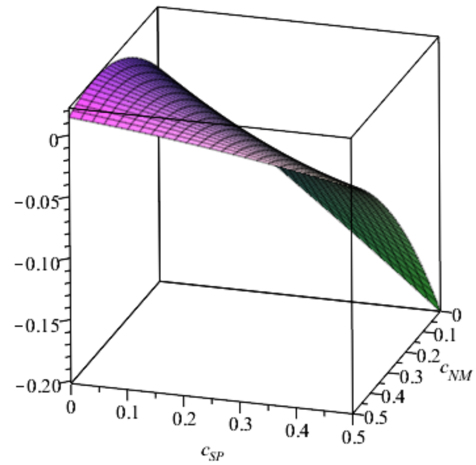

Figure 2: $\Delta\pi_{\mathrm{N}} = \pi_N^{GVC2} - \pi_N^C$ when $c_{NP} = 0$ and $c_{SM} = 0.1$.

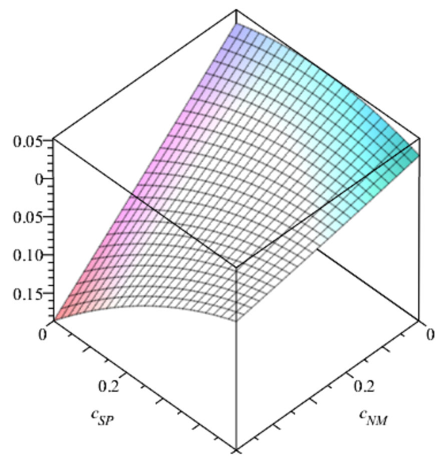

Figure 3: $\Delta\pi_{\mathrm{S}} = \pi_S^{GVC2} - \pi_S^C$ when $c_{NP} = 0$ and $c_{SM} = 0.1$.

4. A model with product innovation

Finally, we extend the model to consider the roles played by product innovation. To this end, we consider an augmented version of the model introduced in Section 2. Assume now that firm N incurs a constant and positive marginal cost of production, c_N, but it can make an investment to improve its production efficiency, i.e., reduce its marginal cost.[10] Specifically, by spending lx_N^2 on

[10] Thus, technology development cost enters our model similar to a research and development (R&D) cost applicable to process innovation, which lowers a producing firm's per-unit cost of production (see, for example Zigic, 1998, 2000, Naghavi, 2007, Saggi

technology innovation, firm N's marginal cost reduces from c_N to $c_N - x_N$, where l is a positive constant reflecting the technological innovation efficiency of firm N. A higher l means that the efficiency of technology innovation of firm N becomes less effective. Firm S's constant marginal cost, c_S, is lower than that of firm N; that is $c_S < c_N$, and it does not have innovation capability to reduce such marginal cost.

We investigate a three-stage game. In stage 1, firm N offers a supply contract, with the value of R attached, to firm S on a take-it-or-leave-it basis. Upon this, in stage 2, firm N chooses its technology development spending level, x_N. Finally, in the last stage, the firm(s) sets their output level and consumers make their purchasing decision. Notice that similar to the baseline model, the game has two stage-1 subgames: competition subgame and GVC subgame with lumpsum payment. To simplify things further we will focus on the case of homogeneous goods produced by the firms in question. The collective utility function of consumers who purchase the product produced by firm i follows a quasi-concave function: $U_i(q_i, q_j) = \alpha(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2) + Y$, where Y is a positive constant.

For simplicity, assume that the 'merged' firm has the same fixed cost as that of the Southern firm, f, and it is run/controlled by firm N. Let c denote the marginal cost difference between firms N and S, i.e., $c = c_N - c_S$ and normalize $\alpha - c_S$ to 1 (see Naghavi, 2007, for a similar approach).

Let us start with the competition subgame. In the last stage, firm N chooses the quantity level q_N and firm S chooses quantity level q_S to maximize their respective profits:

$$\pi_N = (\alpha - q_N - q_S - (c_N - x_N))q_N - lx_N^2, \tag{13}$$

$$\pi_S = (\alpha - q_S - q_N - c_S)q_S - f. \tag{14}$$

Without the loss of generality, and recall that $c = c_S - c_N$, $\alpha - c_S = 1$, firm N's and firm S's profit equation can be rewritten respectively as:

2002, Bond and Saggi 2018). In an extension to the model, we will examine the roles played by advertising spending is an expansion of the market size, which generates some complexity with regard to the analysis of our model which we leave for future research.

$$\pi_N = (1 - q_N - q_S - (c - x_N))q_N - lx_N^2, \tag{15}$$

$$\pi_S = (1 - q_S - q_N)q_S - x_S - f. \tag{16}$$

Cournot solutions are given by $q_N^C = \frac{1-2c+x_N}{3}$ and $q_S^C = \frac{1+c-x_N}{3}$. Substitute these into (13) and solve for firm N's stage 2 optimal technology innovation investment level, we obtain $x_N^C = \frac{2-4c}{9l-4}$. As such, $q_N^C = \frac{3l(1-2c)}{9l-4}$ and $q_S^C = \frac{3l(c+1)-2}{9l-4}$. For q_N^C to be positive, it is required that $c < 1/2$ and $l > 4/9$ hold, which we assume to be satisfied. Notice, then, that $3l(c+1) - 2 > 0$ is the condition for q_S^C to be positive, which we will examine in what follows.

Firm N's equilibrium profit, π_N^C, and firm S's equilibrium profit, π_N^C in the competition subgame can easily be computed, allowing comparative statics as well as welfare analysis. Express $\pi_N^C = (q_N^C)^2 - lx_N^2$ and $\pi_S^C = (q_S^C)^2 - f$. We have:

Lemma 2:

Suppose $3l(c+1) - 2 > 0$. There exists a threshold positive value $\hat{f}(l,c)$ such that $\pi_S^C > (\leq) 0 \leftrightarrow f < (\geq) \hat{f}(l,c)$.

Proof. Notice that $\pi_S^C = \left(\frac{3l(c+1)-2}{9l-4}\right)^2 - f > (\leq) 0 \leftrightarrow f < (\geq) \left(\frac{3l(c+1)-2}{9l-4}\right)^2 \equiv \hat{f}(l,c)$. ■

Lemma 2 provides a condition for firm S to make a positive profit in the equilibrium of the competition subgame. Basically, the condition is such that the fixed cost of production for firm S is relatively small. This is expected as the fixed cost does not enter the equations for equilibrium quantity for both firms N and S and firm S's profit declines as its fixed cost increases.

We now turn to the GVC subgame. Firm N's and firm S's profit are respectively given by:

$$\pi_N = (1 - q_N - q_S + x_N)q_N - lx_N - R, \tag{17}$$

$$\pi_S = R, \tag{18}$$

where R is the lumpsum payment made by firm N to firm S. For the GVC arrangement to arise as an equilibrium outcome, the following conditions must be concurrently satisfied:

$$R \geq \pi_S^C \geq 0, \tag{19}$$

$$\pi_N^{GVC} - R \geq \pi_N^C. \tag{20}$$

If conditions (19) and (20) are not satisfied at the same time, the equilibrium of the game is a competition equilibrium in which firms N and S compete in the global market. To simplify the discussion, we make a tie-breaking assumption that whenever $q_S^C = 0$, $R = 0$ holds and firm N chooses GVC over competition.

Cournot solutions for the GVC subgame is given by $q_N^{GVC} = \frac{1+x_N}{2}$, which yields stage-2 optimal technology investment level by firm N, $x_N^{GVc} = \frac{1}{4l-1}$. This allows us to compute firm N's equilibrium profit, π_N^{GVC}, as well as firm S's equilibrium profit, π_N^{GVC}.

<u>Proposition 6:</u>

Suppose $3l(c+1) - 2 > 0$. In the equilibrium of the competition subgame with innovation, $\partial \pi_N^C / \partial c < 0$, $\partial \pi_S^C / \partial c > 0$, $\partial x_N^C / \partial c < 0$, $\partial \pi_N^C / \partial f = 0$, $\partial \pi_S^C / \partial f < 0$, $\partial x_N^C / \partial f = 0$, $\partial \pi_N^C / \partial l < 0$, $\partial \pi_S^C / \partial l > 0$, and $\partial x_N^C / \partial l < 0$ hold.

Proof: The proof follows from equilibrium outcomes presented above. ■

Proposition 6 provides comparative statics results in equilibrium. It says that firm N's profitability decreases if the production cost advantage of the South increases. Firm S, however, benefits if such cost difference rises. These are expected results, which are also in line with the Cournot oligopoly literature. Similarly, since firm S incurs a fixed cost of production but not firm N, it follows that a higher fixed cost facing firm S reduces its profitability while having no effects on firm N's performance (as well as firm N's technological innovation level).

Interestingly results from Proposition 6 are those concerning firm N' technological innovation level following a change in either the production cost advantage of the South or the technology innovation efficiency parameter, as well as how both firms' profitability is impacted by the technology innovation efficiency level. Specifically, firm N reduces its investment in technology if the technology innovation efficiency parameter increases. The increase in l hurts firm N by reducing its competitiveness (i.e., raising the effective marginal cost) but benefits firm S. This result can be explained as follows. A higher level of technological inefficiency increases the marginal cost of production for firm N, all else equal, so that it will need to cut down its technology innovation level to maintain its performance. Then, a higher level of technology inefficiency hurts firm N and benefits firm S in equilibrium.

<u>Proposition 7:</u>

In the equilibrium of the game with innovation:

(i) Suppose $3l(c+1)-2>0$ and $f<\hat{f}(l,c)$. Then, $\pi_N^{GVC}>\pi_N^C$ holds.

(ii) Suppose $3l(c+1)-2\leq 0$ or $f\geq\hat{f}(l,c)$. Then, there exists a threshold value $\bar{f}(l,c)$ such that $\pi_N^{GVC}>\pi_N^C$ if and only if $f<\bar{f}(l,c)$ and $\pi_N^{GVC}\leq\pi_N^C$ holds otherwise, where $\bar{f}(l,c)>\hat{f}(l,c)$ holds in a range of parameterizations.

Proof: Proposition 7(i) follows from the above. Proposition 7(ii) follows from comparing the merged firm's profit under GVC with firm N's monopoly profit (when firm S does not emerge). Then, routine calculations yield $\bar{f}(l,c)=\frac{lc(2-c)}{4l-1}$ *, so that* $\bar{f}(l,c)-\hat{f}(l,c)=\frac{l(117l^2-81l+16)c^2-2l(45l^2-39l+10)c+36l^3-57l^2+28l-4}{(4l-1)(9l-4)^2}$*, which is quadratic in* c *for any given level of* l *(see Figures 4 and 5 below) so that this difference is positive for sufficiently large* c*.* ■

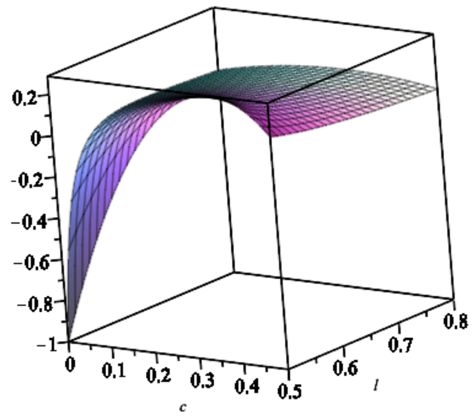

Figure 4: $\bar{f}(l,c) - \hat{f}(l,c)$.

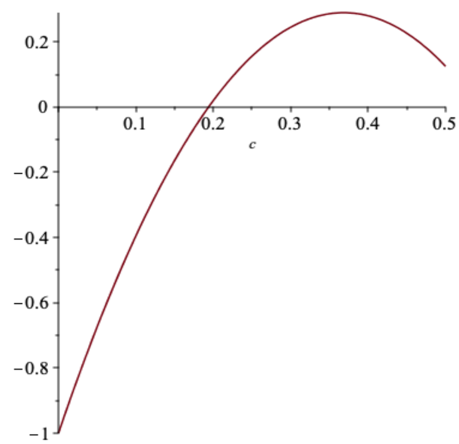

Figure 5: $\bar{f}(l,c) - \hat{f}(l,c)$ when $l = 0.5$.

Proposition 7 tells us that, the interplay between the marginal cost difference, c (which is firm S's marginal cost advantage), fixed cost of setting up a new production in the South, f, and firm N's technological innovation efficiency play a crucial role in driving the behaviour of firms N and S with regard to whether or not to set up their own production facility or to serve the market via participating in the GVC (managed by firm N). Specifically, in the case in which firm S produces a positive output (and makes a positive profit) under competition - which happens when its marginal cost advantage is relatively large and its fixed cost is relatively small - an equilibrium switch from competition to GVC would enhance firm N's performance as Proposition 7(i) informs us. The reason behind this finding is as follows. Under the GVC, firms N and S effectively combine their best expertise: firm S's low marginal cost and firm N's technological capability. More importantly, when both firms share same brand, design and distribution and retail network, the economies of scale rise sharply. In turn, the merged firm, run by firm N, will become a monopolist in the marketplace and as such it makes a larger profit comparing to the combined profits of the two firms under competition. To enable the GVC arrangement, then, firm N needs to transfer the rent to firm S such that the amount is not less than firm S's profit under competition.[11]

Let us turn to Proposition 7(ii). In this case, firm S's production cost advantage (marginal cost or fixed cost) is insufficient so that it would end up making a loss under competition unless it reduces its output to zero. Then, from firm N's perspective, it can serve the market as a monopolist under competition. The GVC arrangement will then differ to that in the presence of competition in not only c and l but also the fixed cost of setting up a new production in the South, f. We know that in absence of such a fixed cost, the GVC arrangement overshadows competition in the sense that firm N makes a larger profit under GVC in the equilibrium. However, the inclusion of the fixed cost may change this conclusion. If such fixed cost is rather large, firm N might as well make a negative profit after even the modest royalty payment to firm S (which is assumed to be at the minimum possible level, 0, in this case). Hence, the GVC will arise as an equilibrium outcome if and only if such fixed cost is less than a threshold value.

Comparing between Propositions (6) and (7) yield an important finding: for a given combination of c and l, the equilibrium outcome of the entire game will depend on the size of f, as below:

<u>Proposition 8:</u>

Suppose that $\bar{f}(l,c) - \hat{f}(l,c) \geq 0$ holds. Then in the equilibrium of the game with innovation:

(i) If $f < \hat{f}(l,c)$, GVC will arise as an equilibrium outcome, where $R > 0$ holds.

(ii) If $\hat{f}(l,c) \leq f < \bar{f}(l,c)$, GVC will arise as an equilibrium outcome, where $R = 0$ holds.

[11] It is noted that the value of the fixed cost must not be too large for firm S to make a positive profit under competition. However, the Southern government can offer firm S a subsidy to enable firm S's production. However, this is not considered in this paper.

(iii) If $f \geq \bar{f}(l, c)$, competition will arise as an equilibrium outcome, where firm S produces zero output.

Proof: The proof follows from Lemma 2 and Proposition 7. ■

Proposition 9:

Suppose that $\bar{f}(l, c) - \hat{f}(l, c) < 0$ holds. Then:

(i) If $f < \hat{f}(l, c)$, GVC will arise as an equilibrium outcome, where $R > 0$ holds.

(ii) If $f \geq \hat{f}(l, c)$, competition will arise as an equilibrium outcome, but firm S produces zero output.

Proof: The proof follows from Lemma 2 and Proposition 7. ■

Propositions 8 and 9 together highlight the roles played by fixed cost of setting up a new production for the global value chain arrangement. Generally, when such fixed cost is sufficiently large, firm N will serve the global market from the North. Neither the Southern firm can emerge as a competitor in the marketplace in this case nor the GVC arrangement becomes fruitful since firm N would make a lesser profit as compared with the case it serves the global market from the North.

When the fixed cost of production in the South is sufficiently low, however, firm S can make a strictly positive profit in the equilibrium of the competition subgame. In this case, the GVC can arise as an equilibrium outcome, since the merged firm's profit is larger than the combined profit of firms N and S under competition, so that firm S can serve as a contract supplier of firm N and both firms are better off. Importantly, firm S can earn a strictly positive royalty/lumpsum payment in this case, which is no less than the profit it would be able to make under competition.

The role of fixed costs in international production location discussion is not new (for instance, see the work by Grossman, Helpman and Szeidl, 2005). However, here, fixed costs serve as a mechanism for welfare/rent transfer between the North and the South to enable the GVC arrangement. Provided that the fixed cost of setting up a new production in the South is low, the compensation that the Northern firm needs to make to the Southern firm in its invitation for the latter to participate in the GVC will be large enough to avoid direct competition which may arise if such an offer is turned down by the Southern firm. This suggests that there is a case for the Southern government to play in this context to either support Southern firms to enter a new industry with foreign competition or maximize the potential rents from GVCs for their participation.

5. Discussions and conclusions

In this paper, we attempt to model value chain trade with modified Melitz model. In our model, we assume there are two countries, the North and the South, and one industry, where two kinds of tasks are needed to supply products to final consumers, manufacturing and non-manufacturing tasks. The latter consists of marketing, distribution, retailing and innovation. The North is more developed with comparative advantage in marketing and distribution as well as technology innovation than the South. The key difference between the two tasks is that physical production has location and can be relocated between the two countries, whereas the marketing, distribution and technology innovation tasks can be embodied into the physical product regardless of production locations. We assume that North firms can do global branding, when a brand is established in the North, it is automatically recognized globally. On the other hand, when a brand is established in the South, it requires additional effort, especially the setup costs associated with new production facilities for Southern firms albeit a lower marginal production cost as is usually the case. With the model structure, we have analyzed the choices of the Southern firms: manufacturing products independently and competing with Northern firms or participating in the GVCs run by Northern firms as a contract manufacturer.

Our results show that the mixture of late comer advantage in terms of marginal production cost, the level of product substitutability, the fixed (setup) cost and the Northern firms' marketing, distribution and innovative capability all play crucial roles in driving the choices by participating firms. In particular, parameterizations exist in which the Northern firm invites and subsequently the Southern firm accepts to participate the GVC run by the Northern firm. In some sense, the GVC choice is a win-win solution for Northern and Southern firms given they can combine their best expertise to serve global consumers. Then, Southern firms' low marginal production cost advantage will serve as a bargaining vehicle for these late comers to collect more rent share under the GVC arrangement.

The findings of the paper fit nicely in the discussions on global value chain in which a pressing issue is how Southern firms (and, to a larger extent, Southern countries) can benefit from global value chains traditionally run by Northern conglomerates. We argue that when new product development fails to be a sustainable option for Southern firms (to enter the global market), serving foreign consumers by participating in the GVC of Northern established firms as a contract manufacture can be an effective alternative, which contributes significantly to export performance of the South. Interestingly, our model and results provide an alternative theoretical explanation about the extraordinary export performance of countries that have experienced remarkable export stories in the recent decades, China and Vietnam in particular, and suggest that low productivity is not a necessary barrier for firms from developing countries to access the global market in the age of GVCs. This study makes a new contribution to the literature and improve our understanding about GVCs based modern trade, where MNCs North can be factoryless and specialize in non-manufacturing tasks such as R&D, branding and marketing while firms from the South specialize in manufacturing and assembling ones (see Xing, 2021b, for some useful motivating examples). More importantly, findings indicate that the Southern government might have a role to play in maximizing Southern welfare in this context. In particular, it can provide a means to lower the fixed costs of setting up production facilities in the South so as to either induce the emergence of domestic industries that can compete in the international market or boost the rent payments from global conglomerates as they invite Southern firms to participate in GVCs. Experiences from successful companies in transitional economies such as China and Vietnam provide a perfect match for our theoretical results.

Being the first paper to capture GVCs in an international oligopoly setting, our model can easily be extended to include market heterogeneity as well as welfare implications at the global scale. These extensions will expand our knowledge in international trade looking from a new but quickly expanding formulation of global value chains. Due to the technical complexity, we leave these potential extensions for future research.

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References

Bernard, A. B. and Jensen, J. B. (1995), "Exports, Jobs, and Wages in US Manufacturing: 1976-87," *Brookings Paper on Economic Activity: Microeconomics*, 67-119.

Bernard, A. B., Eaton, J., Jensen, J. B. and Kortum, S. (2003), "Plants and Productivity in International Tarde," *American Economic Review*, 93(4), 1268-1290.

Bond, E. W. and Saggi, K. (2018), "Compulsory Licensing and Patent Protection: A North-South Perspective," *Economic Journal*, 128, 1157-1179.

Chaney, T. (2008), "Distorted Gravity, Heterogeneous Firms, Market Structure, and the Geography of International Trade," *American Economic Review*, 98, 1707-1721.

Dai, M., Maitra, M and Yu, M. (2016), "Unexceptional Exporter Performance in China? The Role of Processing Trade," *Journal of Development Economics*, 123, 177-189.

Gereffi, G. (1999), "International Trade and Industrial Upgrading in the Apparel Commodity Chain," *Journal of international Economics*, 48, 37-70

Ghosh, A., Morita, H. and Nguyen, X. (2018), "Technology Spillovers, Intellectual Property Rights, and Export-Platform FDI," *Journal of Economic Behavior & Organization*, 151, 171-190.

Greenaway, D. and Kenller, R. (2004), "Exporting and Productivity in the United Kingdom," *Oxford Review of Economic Policy*, 20(3), 358-371.

Grossman G. M. and Rossi-Hansberg, E. (2008), "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 98(5), 1978-1997.

Grossman, G. M., Helpman, E. and Szeidl, A. (2005), "Complementarities between Outsourcing and Foreign Sourcing," *American Economic Review*, 95(2), 19-24.

Kaplinsky, R. (2004), "Spreading the Gains from Globalization: What Can Be learned from Value Chain Analysis," *Problems of Economic Transition,* 47(2), 74-115.

Krugman, P. (1980), "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review*, 70(5), 950-959.

Lu, D. (2010), "Exceptional Exporter Performance? Evidence from Chinese Manufacturing firms," University of Chicago.

Malikov, E., Zhao, S. and Kumbhakar, S. C. (2020), "Estimation of firm-level productivity in the presence of exports: evidence from China's Manufacturing," *Journal of Applied Econometrics*, 35(4), 457-480.

Melitz, M. (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6), 1695–1725.

Meng, B., Ye, M. and Wei, S. (2020), "Measuring Smile Curves in Global Value Chains," *Oxford Bulletin of Economics and Statistics*, 82(5), 988-1016.

Morita, H. and Nguyen, X. (2021), "FDI and Quality-Enhancing Technology Spillovers," *International Journal of Industrial Organization*, 102787.

Naghavi, A. (2007), "Strategic Intellectual Property Rights Policy and North-South Technology Transfer," *Review of World Economics*, 143, 55-78.

Nielsen, (2014), *The State of Private Label around the World*, The Nielsen Company.

Nielsen, (2018), *The Rise and Rise Again of Private,* The Nielsen Company.

Schmitz, H. (2007), "Reducing Complexity in the Industrial Policy Debate," *Development Policy Review*, 25(4), 417-428.

Xing, Y. (2016), "Global Value Chains and China's Exports to High-Income Countries," *International Economic Journal*, 30(2), 191-203.

Xing, Y. (2020), "How the iPhone Widens the US Trade deficit with China: the Case of the iPhone X," *Frontiers of Economics in China*, 15(4), 642-658.

Xing, Y. (2021a), *Decoding China's Export Miracle: A Global Value Chain Analysis*, World Scientific Publishing.

Xing, Y. (2021b), "Factoryless Manufacturers and International Trade in the Age of Global Value Chains," *GRIPS Discussion Paper 21-02*.

Zigic, K. (1998), "Intellectual Property Rights Violations and Spillovers in North-South Trade," *European Economic Review*, 42, 1779-1799.

Zigic, K. (2000), "Strategic Trade Policy, Intellectual Property Rights Protection, and North-South Trade," *Journal of Development Economics*, 61, 27-60.