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GLOBAL SOURCING BY MNE'S: IMPACT ON DOMESTIC FIRMS

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ABSTRACT

The unequal situation of large global firms with extensive networks and smaller domestic firms has created a dual structure in many industries. In this paper we examine the competitive position of domestic single-plant firms under growing rivalry of global companies that source abroad and flexibly coordinate production activities within a multinational network. Growing rivalry is modelled as a decrease in sourcing costs for multinational firms. We separate a direct and an indirect effect – i.e. competitive strategic effect- of a lower sourcing cost on the production decision of multinational and domestic firms. We show how cost characteristics of domestic firms determine the impact of these effects. We theoretically find that, ceteris paribus, output flexible firms will be most vulnerable and exit first from the market. Product differentiation is found to reduce the strategic effect of global sourcing by MNE's on the competitive position of domestic firms.

Keywords: Sourcing, multinational firms, flexibility, exit

INTRODUCTION

Globalization has drastically changed competitive conditions in many industries. The free movement of goods, people and money within globally integrated markets leads to important changes in the strategy of companies. Large companies are building international networks or supply possibilities, using new capabilities and efficiencies in a global market. The advantage of operating across borders lies not in being international, but in the ownership of options to coordinate flexibly multinational activities within a network (Kogut and Kulatilaka, 1994). In order to serve the market of a particular country, the multinational firm can easily shift part of its production from one country to another country where production costs can be reduced.

However, not all firms have the capacity and capabilities to invest abroad. This is especially true for smaller and younger firms, given the high sunk cost investment in setting up an international network. This unequal situation of global and smaller local firms has created a dual structure in many industries. This is especially true for the small and open economy of Belgium where globalization has been coupled to a strong deindustrialization of the economy. This is illustrated in Figure 1. Since 1986, the growth rate of foreign investment flows into Belgium has increased more than the growth rate of GDP. Import intensity (1970=100), defined as imports over production, has increased significantly[1] since 1970. Over the same period, employment in manufacturing (1970=100) has drastically declined. During the last decade, most of the jobs are lost due to relocation decisions of foreign investors and the closure of domestic firms that are not able to survive the strong competitive pressure of global rivals.

Insert Figure 1 About Here

In this paper we examine the position of local firms facing growing competitive pressure of multinational enterprises (MNE's) which are sourcing globally. The question arises what will happen with a domestic firm that has not the competitive advantage of an international network and is not able to outsource part of its activities (a domestic firm with no international activities).

[1] The growth rate of imports was stronger than the growth rate of exports during the last decade.

We examine the impact of rising global competition through a decrease[2] in global sourcing costs for multinational enterprises (or a lower sourcing cost relative to the cost of local production).

In analyzing the effects of a decreasing cost of global sourcing, we separate a direct (internal shift in regional production of the MNE) and an indirect effect (strategic effect) of a lower sourcing cost on the production decision of multinational and domestic firms. We show how cost characteristics of domestic firms determine the impact of the strategic effect. At the same time, the direct and the indirect effect of a lower sourcing cost are a measure for the vulnerability of local employment in certain industries. The MNE can use global sourcing as a strategic instrument to increase the competitive pressure on the domestic firms and to force them to exit. This leads to the following result: domestic firms that are not able to reduce their production costs in a flexible way (larger domestic firms with no international activities), will be crowded out by a competitor who produce globally. However, the more differentiated the produced goods of the MNE and the domestic firm, the lower will be the strategic crowding out effect of global sourcing on the output of the domestic firm when the MNE faces a lower cost of global sourcing.

The remainder of the paper is organized as follows. In section 2 we set up a basic theoretical model to address the strategic effect of global sourcing. We separate the indirect from the direct effect and show that the higher the output flexibility of the domestic firm, the stronger will be the indirect or strategic crowding out effect on its output. Section 3 analyzes the relation between product differentiation and the strategic crowding out effect of global sourcing using the same theoretical framework. Section 4 examines the impact of the strategic crowding out effect on the exit behavior of domestic firms. Section 6 summarizes the findings and concludes.

[2] A decrease in sourcing cost is possible through lower trade costs and labor or economic, legal changes in order to attract foreign production in some countries that try to open up their economy (developing countries, the opening up of Central and Eastern Europe,…). The multinational enterprise can also lower its sourcing cost from learning in foreign countries which make it possible to develop a more efficient cross-border coordination.

SEPARATING THE INDIRECT FROM THE DIRECT EFFECT

To address the strategic effect of global sourcing, we start from a basic model involving two representative firms, a MNE and a domestic firm, producing outputs of the same homogeneous good. Production takes place in two regions A and B. The multinational enterprise has a production plant in region A and has already made the sunk cost of investing in region B. The domestic firm has only one production plant located in region A. The domestic firm produces its total output in region A and is not able to invest abroad or to outsource part of its production[3]. The inverse demand function in region A is given by

$$p = \alpha - \beta(q_1 + q_2) \qquad \alpha > 0, \qquad \beta > 0,$$

Index 1 represents the MNE. The output quantity offered by the MNE in region A equals $q_1 = q_d + q_o$. q_d is the quantity of the good produced by the MNE in region A and q_o is the output quantity that the MNE obtains through intra-firm sourcing from its regional production plant in B. The cost of producing q_d and q_o differs. The quantity produced in region B depends on the sourcing cost which includes the cost of production in region B and the transportation costs of shipping the good from region B to region A. Region B can be any region or constitution of regions that generates the lowest possible sourcing cost. Index 2 represents the domestic firm. Table 1 depicts the cost curves of the MNE and the domestic firm. The cost of production in region A for the MNE and the domestic firm is respectively given by the cost functions $C_d(q_d)$ and $C_2(q_2)$.

Insert Table 1 About Here

[3] The domestic firm's managerial resources, technological knowledge, reputation, market position and possible scale are not important enough to build a production plant abroad involving a high sunk cost.

We assume positive and increasing marginal costs of producing in region A for both firms[4]. The marginal cost of sourcing τ is assumed to be constant. τ includes the cost of production of the subsidiary in B and the cost of transportation from region B to A. We assume that the marginal cost of producing the good is constant in region B as a result of the global network. For instance, the labor market in region A can be characterized by a shortage of skilled engineers[5]. If the MNE needs extra engineers for its production plant in region A, the MNE will have to pay higher wages to attract the engineers. Region B has an abundance of skilled engineers, can reallocate engineers or shift production.

The MNE chooses its production in region A as such that the marginal cost of producing locally equals the constant marginal cost of sourcing[6]. This equation determines quantity q_d if the cost function C_d is known. We illustrate this in

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[4] The existence of an unique equilibrium requires that the MNE has an increasing marginal production cost where for some output q_d, $\frac{\partial C_d(q_d)}{\partial q_d} < \tau$. To keep the model manageable, we will assume that these cost functions are simple quadratic functions.

[5] Siemens is a global manufacturer who deals with this problem :
"It's indisputable that there are enormous cost differences worldwide that a global player must use to its advantage. China, India and Eastern Europe are an excellent source of qualified employees, especially for IT. Just 5,500 students graduate from IT-related programs in Germany each year. But in India it's 120,000 and in China 70,000. The company also finds outstandingly well-educated IT specialists in many Eastern and Southeastern European countries. In Germany, the company gradually relocates its production process. Klaus-Peter Gittler, head of the Global Manufacturing Concept initiative, says there has to be a change in attitudes. "Highly industrialized countries like Germany have to be highly innovative and assume the role of trendsetter to justify their higher costs."

[6] Given the profit of the MNE: $\pi_1 = (q_d + q_o)\left[\alpha - \beta(q_d + q_o + q_2)\right] - C_d(q_d) - \tau.q_o$, the first-order conditions to maximize π_1 with respect to q_d and q_o gives the equations of the MNE's best-response function which result in $\frac{\partial C_d(q_d)}{\partial q_d} = \tau$. The MNE produces in region A as long as $\frac{\partial C_d(q_d)}{\partial q_d} \leq \tau$. When marginal costs of production in region A exceed the sourcing cost, the MNE stops producing in its production plant in A and starts to source a quantity $q_o > 0$ of its production from region B. We further assume that the MNE has a more efficient production technique than the domestic firm (following the OLI-framework of Dunning (1977)). So for every output q, we assume that $\frac{\partial C_d(q)}{\partial q_d} < \frac{\partial C_2(q)}{\partial q_2}$. Our assumption that the MNE is a more cost efficient firm than the domestic firm, is a sufficient condition[6] for $\frac{\partial C_2(q_2)}{\partial q_2} > \tau$: the marginal cost of the domestic firm exceeds the sourcing cost of the MNE in the observed range. Indeed,

Insert Figure 2 About Here

Insert Figure 2 About Here

The quantity q_o has to be chosen considering the domestic firm's best response function, both depending on the sourcing cost of the MNE. The value of the parameter τ will determine the decision of the MNE how much to produce in region A and which proportion of the output it will source from abroad. However, a change in the parameter τ not only causes a shift in producing locally or through global sourcing by the MNE (direct effect) but has also an effect on output through the reaction in the output supplied by the domestic firm (indirect effect). This is graphically illustrated in Appendix 1.

Writing q_o as an implicit function of q_d and q_2 yields $q_o = \frac{\alpha - \beta(2q_d + q_2) - \tau}{2\beta}$. The quantity q_2 influences the quantity q_o, determined by τ, such that

$$q_o = q_o\big(q_d(\tau), q_2(\tau)\big)$$

Since q_d is not directly affected by the amount of output q_2, the derivative $\frac{dq_0}{d\tau}$ can be written as

$$\frac{dq_0}{d\tau} = \frac{\partial q_o}{\partial q_d}\frac{dq_d}{d\tau}\bigg|_{dq_2=0} + \frac{\partial q_o}{\partial q_2}\frac{dq_2}{d\tau} \qquad (1)$$

The first term on the right is ***the direct or internal effect*** on the production of the MNE in region A. Due to a change in the cost of sourcing, the MNE will prefer to shift its production

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if $q_2 \geq q_d$ than $\frac{\partial C_2(q_2)}{\partial q_2} > \frac{\partial C_d(q_2)}{\partial q_2} > \frac{\partial C_d(q_d)}{\partial q_d} = \tau$, if $q_2 < q_d$, it follows from the best-response functions of the MNE and the domestic firm that $\frac{\partial C_2(q_2)}{\partial q_2} - \tau = \beta(q_d + q_o - q_2) > \beta.q_o > 0$ (given that $q_2, q_d, q_o > 0$)

from region A to region B. The second term on the right describes ***the indirect or the strategic crowding out effect*** after a decrease in sourcing cost. We call this effect a strategic crowding "out" effect to stress the gain in market share for the MNE at the cost of the competitive position of the domestic firm. We first introduce the concept of output flexibility which will be of high relevance to measure the relative importance of the direct and the indirect effect.

We use the term "output flexible firm" to denote a firm that can adjust output production without strongly changing its operating cost. The slope of the marginal cost curve will be used as our measure of output flexibility in line with Stigler (1939) and Marschak and Nelson (1962): if changes in output are associated with small cost changes (a flat marginal cost curve), the technique of this type of firm will give the firm some output flexibility. An output flexible firm has an inflexible cost curve: changes in output will not cause a large change in marginal cost. The slope of the marginal cost curve is determined by the second order derivative of the cost function with respect to the output quantity. The lower $\frac{\partial^2 C}{\partial q^2}$, the higher the output flexibility. Using the concept of output flexibility – a concept which reflects cost inflexibility – allows us to formulate the next set of propositions, given a decrease in sourcing cost for the MNE.

Proposition 1: The more output flexible the domestic firm, the stronger will be the strategic crowding out effect on its output

Proof: The strategic effect is given by $\frac{\partial q_o}{\partial q_2}\frac{dq_2}{d\tau}$ (see equation (1)). To analyze $\frac{\partial q_o}{\partial q_2}$, we use the reaction function of the domestic firm. Rearranging this reaction function yields $q_o = -q_d - 2q_2 - \frac{1}{\beta}\left(\frac{\partial C_2}{\partial q_2} - \alpha\right)$. Taking the derivative from q_o according to q_2 results[7] in $\frac{\partial q_o}{\partial q_2} = -2 - \frac{1}{\beta}\left(\frac{\partial^2 C_2}{\partial {q_2}^2}\right)$. In order to find the strategic effect we show in Appendix 2 that $\frac{dq_2}{d\tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_2}{\partial {q_2}^2}}$. The strategic crowding out effect on the output of the domestic firm is given by

$$\frac{\partial q_o}{\partial q_2}\frac{dq_2}{d\tau} = \frac{2\beta + \frac{\partial^2 C_2}{\partial {q_2}^2}}{-\beta\left(3\beta + 2\frac{\partial^2 C_2}{\partial {q_2}^2}\right)} = \frac{2\beta + b_2}{-\beta(3\beta + 2b_2)} < 0 \qquad (2)$$

The strategic crowding out effect has a negative sign. Given a decrease in the cost of sourcing for the MNE, the MNE will increase its output and decrease the output of the domestic firm. The magnitude of increase in q_o and decrease in q_2 depends on the ouput flexibility of the domestic firm reflected by $\frac{\partial^2 C_2(q_2)}{\partial {q_2}^2} = b_2$.

Insert Figure 3 About Here

Figure 3 shows the strategic crowding out effect for different values of β and b_2.

[7] $\frac{\partial q_d}{\partial q_2} = 0$ because q_d is only determined by τ.

For a fixed value of the parameter[8] β - which is inversely related to the demand elasticity-, the strategic crowding out effect is most negative (highest in absolute value) when b_2 is almost zero. This will be the case when the domestic firm has an almost constant marginal cost of production. When b_2 increases, the strategic crowding out effect will decrease since the domestic firm can easily decrease its marginal cost of production by a small quantity change in its output. Therefore, the higher the output flexibility of the domestic firm, the stronger the strategic crowding out effect on its output when the MNE benefits from a lower sourcing cost.

In Appendix 3 we show how the direct effect or internal shift in regional production of the MNE after a decrease in sourcing cost, is determined by the output flexibility of the MNE in region A. We derive the following proposition:

Proposition 2: The more output flexible the MNE's local production plant, the stronger the direct effect for a MNE facing a lower cost of sourcing.

Proof: The direct effect on the shift in regional production of the MNE equals (cfr. Appendix 3 for the derivation)

$$\left.\frac{\partial q_o}{\partial q_d}\frac{dq_d}{d\tau}\right|_{dq_2=0} = \frac{-1}{\frac{\partial^2 C_d}{\partial q_d{}^2}} = -(b_d)^{-1} < 0 \qquad (3)$$

[8] For a fixed value of the parameter β, the value of the strategic effect will lie in the open interval: $\left]\frac{-2}{3\beta}, \frac{-1}{2\beta}\right[$. In equation (2) not only the production cost curve of the domestic firm determines the strategic crowding out effect but also the parameter β. For a fixed value of b_2 the strategic effect is the most negative (highest in absolute value) for a very low value of the parameter β. The less sensitive the price will be to output changes, the larger will be the strategic crowding out effect. The MNE can produce more output in a more cost efficient way (compared with the production process of the domestic firm) without a strong price increase.

If the sourcing cost decreases, the MNE will decrease its local production in region A and change it by production through global sourcing from region B. In order to have a strong direct effect, the denominator in the right term of equation (3) should be small, which is true for a MNE characterized by a high output flexibility.

In this section, we have analyzed two effects of a decreasing sourcing cost: the direct effect on the shift in regional production of the MNE and the strategic crowding out effect on the output of the domestic firm. These two effects are a measure for the vulnerability of production plants located in region A. For instance, in some industries in region A, the technique of the local production plants of the MNE and the domestic firm is characterized by a high output flexibility. A decrease in sourcing cost will cause a strong direct and strategic effect, which means a strong shift in production from region A to region B. The MNE can produce more cost efficient in region B and will strongly decrease its production in region A. At the same time, the domestic firm will loose market share in region A due to increased sourcing by the MNE from its production plant in region B. This shift in production from region A to B can cause an important loss of jobs in region A while creating numerous jobs in region B[9]. In our model, we made the assumption of homogeneous goods. The next section elaborates our study of the strategic crowding out effect in case of product differentiation.

PRODUCT DIFFERENTIATION AND THE STRATEGIC CROWDING OUT EFFECT

In this section we analyze the strategic crowding out effect on the output of the domestic firm given that the product of the domestic firm is differentiated from the product of the MNE. We model product differentiation similar to Stephen Martin (2001) where both firms, the MNE and the domestic firm, have their own inverse demand curve. The first equation is the inverse demand curve of the MNE and the second equation is the inverse demand curve of the domestic firm:

$$p_1 = \alpha - \beta(q_1 + \vartheta.q_2) \qquad \alpha > 0, \quad \beta > 0,$$
$$p_2 = \alpha - \beta(\vartheta.q_1 + q_2) \qquad \alpha > 0, \quad \beta > 0,$$

[9] Using a panel of Austrian industries, Hartmunt and Peter Egger (2003) found that shifts in production activities from Austria to Central and Eastern Europe significantly shifts relative employment in favor of high-skilled labor.

ϑ is the product differentiation parameter and is a number between zero and one. If ϑ equals one, we have no product differentiation. For decreasing values of ϑ, starting from one to close to zero, the products of the MNE and the domestic firm become more and more differentiated. We prove the following proposition:

Proposition 3: The more differentiated the goods produced by the MNE and the domestic firm, the lower will be the strategic crowding out effect on the output of the domestic firm

Proof: Similar to the methodology used in the previous section, the strategic crowding out effect in case of product differentiation is given by

$$\frac{\partial q_o}{\partial q_2}\frac{dq_2}{d\tau} = \frac{2\beta + \frac{\partial^2 C_2}{\partial {q_2}^2}}{-\beta\left(4\beta - \beta.\vartheta^2 + 2\frac{\partial^2 C_2}{\partial {q_2}^2}\right)} = \frac{2\beta + b_2}{-\beta(4\beta - \beta.\vartheta^2 + 2b_2)} < 0 \qquad (4)$$

In the case of no product differentiation ($\vartheta = 1$) we get the same equation (2) for the strategic crowding out effect. The strategic crowding out effect on the output of the domestic firm decreases in absolute value for decreasing values of the product differentiation parameter. The more differentiated the produced goods of the MNE and the domestic firm, the lower will be the strategic crowding out effect on the output of the domestic firm when the MNE faces a lower cost of global sourcing.

A domestic firm can survive more easily the competitive pressure of multinational firms in a globalized world, if it is able to differentiate its product from the good produced by the multinational firm. A domestic firm can differentiate its product by means of the perceived difference in product quality, customer service, advertising, product design and other product characteristics. Given its production technique and management operating process, the domestic firm has to find the most realistic and most efficient way to differentiate its products from those of the multinational firm. Depending on the competitive position of the domestic firm, differentiation in product quality or in perceived brand image will generally present a difficult task. Differentiation through quality improves from innovation but entails important financial risks. The most easy way for the domestic firm to differentiate from the MNE, is to serve a group

of customers which has more special product or service requirements. Given the large adaptation cost for the MNE to serve such a group of customers and given the low marginal return of this investment, the MNE will rather neglect these smaller niche markets. A smaller firm that focus on its specific product market, can more easily achieve a higher level of customer satisfaction.

EXIT

Relating survival to the different cost characteristics of domestic firms, we next analyze the impact of the strategic crowding out effect on the exit behavior of domestic firms. We study two cases. In the first case, the production technique of the domestic firm is characterized by high output flexibility. The second case is similar to the first, except that the technique of the domestic firm is now characterized by low output flexibility. We study the behavior of the MNE[10] and the two types of domestic firms after a decrease in sourcing cost for the MNE. The cost structure of the domestic firm is affined to $C_{2i}(q_{2i}) = F_{2i} + b_{2i}.q_{2i}^2$ consistent with previous assumptions. The production plant incur a fixed periodical cost of operation F . This latter cost could be a leasing cost of fixed assets needed for production. We use a double index for the parameters of the domestic firm. The first index is always two, indicating the domestic firm and the second index refers to its degree of output flexibility: high output flexibility (b_{21}) and low output flexibility (b_{22} , $b_{22} > b_{21}$). A domestic firm with high output flexibility is typically characterized by a high fixed cost F_{21}. Output flexibility is similar with the option to have a rather unrestrained capacity output, so the production plant of this type of firm should be large. Especially manufacturing firms characterized by high output flexibility, may be assumed to have a higher fixed cost of operation than manufacturing firms with low output flexibility or $F_{21} > F_{22}$. The fixed cost F_{22} of the domestic firm characterized by low output flexibility, is assumed to be lower than the fixed cost F_{21} of a domestic firm characterized by high output flexibility. These assumptions are similar with Stigler (1939) who concluded that flexibility is not a free good. Also Weiss (1999)

[10] The MNE's cost structure is defined by $C_1(q_{1i}) = C_d(q_d) + C_o(q_{oi})$ with $C_d(q_d)$ the cost of production in region A given by $C_d(q_d) = F_1 + b_d.q_d^2$ and the sourcing cost $C_o(q_{oi}) = \tau.q_{oi}$. F_1 is the fixed cost of operating the activities of the MNE in its production plant in region A. Since the amount of global sourcing q_o depends on the cost structure of the domestic firm, this parameter is also denoted by a double index.

captured this idea of lower average costs for an inflexible technique and assumed fixed costs F to vary inversely[11] with b.

Given the two assumptions $F_{21} > F_{22} > 0$

$$0 < b_d < b_{21} < b_{22} \quad ,$$

we want to study the difference between the critical exit values for the two types of domestic firms. The critical value of exiting the market is given by the limiting amount $\overline{q_{2i}}$ so that for any smaller quantity the domestic firm fails to make any positive profit. We analyze the critical exit value of both types of domestic firms (i=1,2) presented in

Table 2

Insert Table 2 About Here

The denominator in the critical exit value of a domestic firm with high output flexibility is always lower than the denominator in the critical exit value of a domestic firm with low output flexibility, for every positive value of β. Due to the strategic crowding out effect studied in the previous sections and induced by a cost efficiency in sourcing for the MNE, the magnitude of decrease in output quantity of the domestic firm with high output flexibility is stronger than that of a domestic firm with low output flexibility.

These two differences for the two types of domestic frms have two important implications. The critical exit value of a domestic firm with high output flexibility lies on the right side of the critical exit value of a domestic firm with low output flexibility. Furthermore, the

[11] Using the relation between marginal cost and productivity, one can derive $MC = \frac{w}{\frac{\partial F}{\partial L}}$. Taking the derivative of MC with respect to K of both parts of the equation, yields that capital is inversely related to b under the assumption of a homothetic production function.

strategic effect of sourcing reinforces the exit behavior of a domestic firm with high output flexibility due to a stronger decrease in its output (after a decrease in sourcing cost for the MNE). These results strengthens our proposition

Proposition 4: A domestic firm with high output flexibility will exit[12] before a domestic firm with low output flexibility.

Domestic firms that have not the option to operate flexible on an international level, should keep their cost efficiency as a priority in order to survive a global competitive pressure. However, domestic firms that are not able to reduce their production costs in a flexible way (larger domestic firms with no international activities), will be crowded out by a competitor who produce globally, and will exit first from the industry. Our result is in line with the conclusion of Ghemawat and Nalebuff (1985). These authors show that in a declining industry (we assumed stronger international competition) smaller firms outlast their larger competitors. The results in the previous sections are also consistent with the result of Christoph Weiss (1999). Weiss concluded that the attractiveness of output flexibility increased with market power: "*Whereas a monopolist would choose the flexible technique in a specific environment, oligopolists in the same market would prefer the inflexible one.*" He also found that flexibility is stronger in quickly growing markets with high entry barriers. There seems to be an advantage of flexible production techniques when demand is increasing. However, we may not neglect the disadvantage of being flexible due to the vulnerability of such production technique when competition is increasing.

CONCLUSIONS

This paper shows the importance of the strategic crowding out effect of global sourcing on the competitive position of domestic firms. The strategic crowding out effect due to a lower marginal cost of global sourcing, will be stronger for a domestic firm characterized by high output flexibility than for a domestic firm with low output flexibility. Moreover, a domestic firm that has high output flexibility will reach its critical exit value before a domestic firm with low output flexibility. This is true because of two reasons; a higher critical value of exiting the market

[12] if exit is the only possible mode of restructuring

and a stronger strategic crowding out effect due to a decrease in marginal cost of sourcing. So a MNE who is able to lower its production costs due to an efficient international network and a decreased cost of intra-firm trade, will increase the pressure on competing firms, especially domestic firms with high output flexibility who are not able to source part of their production or improve their cost structure. Especially the activities of these domestic firms will be threatened by the MNE's operating flexibility.

Firms with high output flexibility have a cost structure that allows an unconstrained expansion. Therefore, most output flexible firms, especially in manufacturing, are relatively large firms. If demand is decreasing, domestic "large" firms who are not able to reduce their cost structure, because of a lack of a broader international network, will first exit from the market.

A domestic firm can survive more easily the competitive pressure of multinational firms, if it is able to differentiate its product from the good produced by the multinational firm. The most easy way for the domestic firm to differentiate its product from the MNE, is to focus on a group of customers with special product or service requirements.

MNE's that operate production plants characterized by high output flexibility will shift their production process substantially from domestic to foreign production after a decrease in sourcing cost. This implies that international firms that operate large production plants, have a stronger intention to relocate production. This strong direct effect together with the strategic crowding out effect on domestic competitors increases substantially the vulnerability of employment in the host country. Policy makers should monitor this vulnerability more carefully and design appropriate measures to safeguard employment in the most sensitive industries.

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APPENDIX 1

Direct and indirect effect of lower sourcing cost

Figure 4 shows the indirect effect or the strategic crowding out effect of a decrease in sourcing cost on the output of the domestic firm, given the following cost curves of the two firms in Table 3.

Insert Table 3 About Here

The reaction curve of the MNE is a broken line at the point where $q_d = \tau$. For every value $q_d \leq \tau$, the reaction curve is the first equation of the MNE's best-response function with $q_o = 0$. For every value $q_d > \tau$, the reaction curve is determined by the second equation of the MNE's best-response function with $q_d = \tau$.

Suppose τ decreases with $\Delta\tau$. The right part of the reaction curve denoted by ((*2)) goes up until the new reaction curve of the MNE is broken at the point $q_d' = \tau - \Delta\tau$. The left part of the reaction curve of the MNE denoted by ((*1)) and the reaction curve of the domestic firm does not change when τ decreases with $\Delta\tau$. The point where the reaction curves of the two firms meet, is shifted to the right below the previous meeting point. This results in a higher q_1' and a lower q_2' and is indicated as the indirect or strategic effect. The direct or internal effect is given by a lower output q_d' in the production plant of the MNE in region A and a higher production in region B. Notice that the increase in q_1 exceeds the magnitude of decrease in q_2. Therefore, the strategic effect not only increases the output of the MNE while decreasing the output of the domestic firm. The so-called strategic crowding out effect also reinforces the market power of the MNE due to its cost efficiency and at the same time induces a lower price for the good. In the next section, we study the direct and indirect effect in more detail.

Insert Figure 4 About Here

APPENDIX 2

Comparative Statics

In order to study the direct and strategic crowding out effect of global sourcing in a duopoly with homogeneous goods, we use comparative statistics. By this method, we obtain the sensitivity of the optimum outputs of both firms to changes in the sourcing parameter τ. Define

$$F_1(q_d, q_o, q_2, \tau) = \alpha - \beta(2q_d + 2q_o + q_2) - \frac{\partial C_d(q_d)}{\partial q_d} = 0$$

$$F_2(q_d, q_o, q_2, \tau) = \alpha - \beta(2q_d + 2q_o + q_2) - \tau = 0$$

$$F_3(q_d, q_o, q_2, \tau) = \alpha - \beta(q_d + q_o + 2q_2) - \frac{\partial C_2(q_2)}{\partial q_2} = 0$$

which are the first-order conditions for the best-response functions of both firms with fixed nonnegative constants α and β. Writing the exogenous parameter τ on the right side of the linear equations (variables q_d, q_o and q_2 are endogenous) we obtain

$$\frac{\partial F_1}{\partial q_d} dq_d + \frac{\partial F_1}{\partial q_o} dq_o + \frac{\partial F_1}{\partial q_2} dq_2 = -\frac{\partial F_1}{\partial \tau} d\tau$$

$$\frac{\partial F_2}{\partial q_d} dq_d + \frac{\partial F_2}{\partial q_o} dq_o + \frac{\partial F_2}{\partial q_2} dq_2 = -\frac{\partial F_2}{\partial \tau} d\tau$$

$$\frac{\partial F_3}{\partial q_d} dq_d + \frac{\partial F_3}{\partial q_o} dq_o + \frac{\partial F_3}{\partial q_2} dq_2 = -\frac{\partial F_3}{\partial \tau} d\tau$$

After calculation of the partial derivatives, it follows that

$$\begin{bmatrix} -2\beta - \frac{\partial^2 C_d}{\partial {q_d}^2} & -2\beta & -\beta \\ -2\beta & -2\beta & -\beta \\ -\beta & -\beta & -2\beta - \frac{\partial^2 C_2}{\partial {q_2}^2} \end{bmatrix} \begin{bmatrix} \frac{dq_d}{d\tau} \\ \frac{dq_o}{d\tau} \\ \frac{dq_2}{d\tau} \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \qquad \text{(A1)}$$

The first 3x3 matrix on the left of equation (A1) is the Jacobian matrix $\left(\frac{\partial F}{\partial Q}\right)$ which equals the Hessian matrix $\left(\frac{\partial^2 \pi}{\partial Q^2}\right)$ with vectors $F = (F_1, F_2, F_3)$, $Q = (q_d, q_o, q_2)$. The second order necessary condition for the maximization of profits is the condition that $\left(\frac{\partial^2 \pi}{\partial Q^2}\right)$ is negative definite[13], this is, all leading principal minors alternate in sign from negative to positive. Given our model, it is clear that the first and second order principal minors are respectively negative and positive. Define J as the determinant of the Jacobian matrix $\left(\frac{\partial F}{\partial Q}\right)$, then J should be negative. This is the case since $J = -\beta \frac{\partial^2 C_d}{\partial {q_d}^2}(3\beta + 2\frac{\partial^2 C_2}{\partial {q_2}^2}) < 0$. Applying Cramer's rule, we obtain

$$\frac{dq_d}{d\tau} = \frac{1}{\frac{\partial^2 C_d}{\partial {q_d}^2}} > 0 \quad \text{and} \quad \frac{dq_2}{d\tau} = \frac{1}{3\beta + 2\frac{\partial^2 C_2}{\partial {q_2}^2}} > 0 \quad . \qquad \text{(A2)}$$

[13] or negative semidefinite

APPENDIX 3

Direct effect and the output flexibility of the MNE

The direct effect is given by $\left.\frac{\partial q_o}{\partial q_d}\frac{dq_d}{d\tau}\right|_{dq_2=0}$ Since the total output of the MNE is supposed to be constant when only the direct effect is taken into account, a decrease in one unit of the good produced in region A will raise the quantity obtained through sourcing with one unit. Therefore the term $\left.\frac{\partial q_o}{\partial q_d}\right|_{dq_2=0}$ equals –1. In , we have derived the following comparative statics result $\frac{dq_d}{d\tau} = \frac{1}{\frac{\partial^2 C_d}{\partial q_d{}^2}}$. The effect of a change in the sourcing cost τ on the quantity q_d is consistent with $\frac{\partial C_d(q_d)}{\partial q_d} = \tau$. Taking the derivative to q_d of both parts of the equality in reverse order, the same result is obtained. So, the direct effect is given by

$$\left.\frac{\partial q_o}{\partial q_d}\frac{dq_d}{d\tau}\right|_{dq_2=0} = \frac{-1}{\frac{\partial^2 C_d}{\partial q_d{}^2}} = -(b_d)^{-1} < 0$$

To check our results, we show that equation (1) corresponds to the sum of obtained direct and strategic crowding out effect. In a similar way as in Appendix 1 (using comparative statics) we obtain:

$$\frac{dq_0}{d\tau} = \frac{3\beta^2 + 2\beta\left(\frac{\partial^2 C_d}{\partial q_d{}^2} + \frac{\partial^2 C_2}{\partial q_2{}^2}\right) + \frac{\partial^2 C_d}{\partial q_d{}^2}\frac{\partial^2 C_2}{\partial q_2{}^2}}{-\beta\frac{\partial^2 C_d}{\partial q_d{}^2}(3\beta + 2\frac{\partial^2 C_2}{\partial q_2{}^2})} \qquad \text{(B1)}$$

$\frac{dq_0}{d\tau}$ should equal the additional sum of the direct effect and the strategic effect or

$$\frac{dq_o}{d\tau} = \frac{-1}{\frac{\partial^2 C_d}{\partial q_d{}^2}} + \frac{2\beta + \frac{\partial^2 C_2}{\partial q_2{}^2}}{-\beta\left(3\beta + 2\frac{\partial^2 C_2}{\partial q_2{}^2}\right)} \qquad \text{(B2)}$$

Rewriting (B2) and rearranging the terms in the numerator, we obtain

$$\frac{dq_0}{d\tau} = \frac{3\beta^2 + 2\beta\left(\frac{\partial^2 C_d}{\partial q_d{}^2} + \frac{\partial^2 C_2}{\partial q_2{}^2}\right) + \frac{\partial^2 C_d}{\partial q_d{}^2}\frac{\partial^2 C_2}{\partial q_2{}^2}}{-\beta\frac{\partial^2 C_d}{\partial q_d{}^2}(3\beta + 2\frac{\partial^2 C_2}{\partial q_2{}^2})}$$

Therefore (B1) equals (B2).

Appendix 4: Digression on price effect and welfare changes

The change in global sourcing cost through its direct and strategic impact induces an important price effect. Figure 4 (see previous) shows that the total output produced by the MNE increases strongly after a lower sourcing cost. Due to cost efficiency the MNE will produce an extra amount and will cause a higher total output in the market.

Proposition 3: The less output flexible the domestic firm, the stronger will be the price effect from a lower global sourcing cost for the MNE.

Proof: The price effect from a lower global sourcing cost for the MNE equals

$$\frac{dp}{d\tau} = \frac{\beta + \frac{\partial^2 C_2}{\partial q_2{}^2}}{3\beta + 2\frac{\partial^2 C_2}{\partial q_2{}^2}} = \frac{\beta + b_2}{3\beta + 2b_2} > 0$$

The price effect has a positive sign. After a decrease in sourcing cost, the output price will also decrease, due to an increase in total production. Especially when the domestic firm is not output flexible (inducing only a weak strategic crowding out effect), the total output will increase strongly and lowers the price.

After a decrease in global sourcing cost for the MNE, the price effect will increase consumer surplus while the strategic crowding out effect will decrease the profit of the domestic firm.

Proposition 4: The less output flexible the domestic firm, the more positive the welfare change when the cost of global sourcing decreases for the MNE.

Proof: The increase in consumer surplus exceeds the decrease in profit of the domestic firm as long as the domestic firm does not exit the market. The higher b_2 or the less output

flexible[14] the domestic firm, the more positive the welfare change[15] when the cost of sourcing decreases for the competing MNE.

[14] Depending on the value of b_2 which reflects the output flexibility of the domestic firm, a decrease in the cost of global sourcing for the MNE can lead to positive or negative welfare changes. If the MNE competes with a domestic firm that has a cost structure given by $C_2(q_2) = F_2 + b_2.q_2^2$ where $0 < b_2 < \frac{-\beta(2\alpha - 3\tau_G) + \beta\sqrt{4\alpha^2 - 3\tau_G^2}}{4(\alpha - \tau_G)}$, a decrease in the cost of global sourcing for the MNE will lead to a loss in welfare in region A. ($\tau_G = \frac{\tau + (\tau - \Delta\tau)}{2}$ denotes the average of the cost of global sourcing before and after the cost efficiency in global sourcing for the MNE) For $b_2 = \frac{-\beta(2\alpha - 3\tau_G) + \beta\sqrt{4\alpha^2 - 3\tau_G^2}}{4(\alpha - \tau_G)}$ there is not a total welfare effect in region A since the increase in consumer surplus equals the decrease in profit for the domestic firm. For $b_2 > \frac{-\beta(2\alpha - 3\tau_G) + \beta\sqrt{4\alpha^2 - 3\tau_G^2}}{4(\alpha - \tau_G)} = b_2^*$ the welfare change will be positive after a cost efficiency in global sourcing. It follows that $b_2^* < \tau_G < \tau$ on the condition that α or the size of the market is large enough ($\beta < \frac{4}{5}(\alpha - \tau)$). The values of b_2 which are in line with the assumptions in our model are therefore higher than b_2^*. Therefore, the less output flexible the domestic firm or the higher b_2 compared to b_2^*, the more positive the welfare change in region A.

[15] The welfare effects do not include the loss of jobs in country A.

FIGURE 1:

The case of Belgium: evolution of employment in manufacturing, import intensity and FDI inward stock as percentage of GDP (1970-2001).

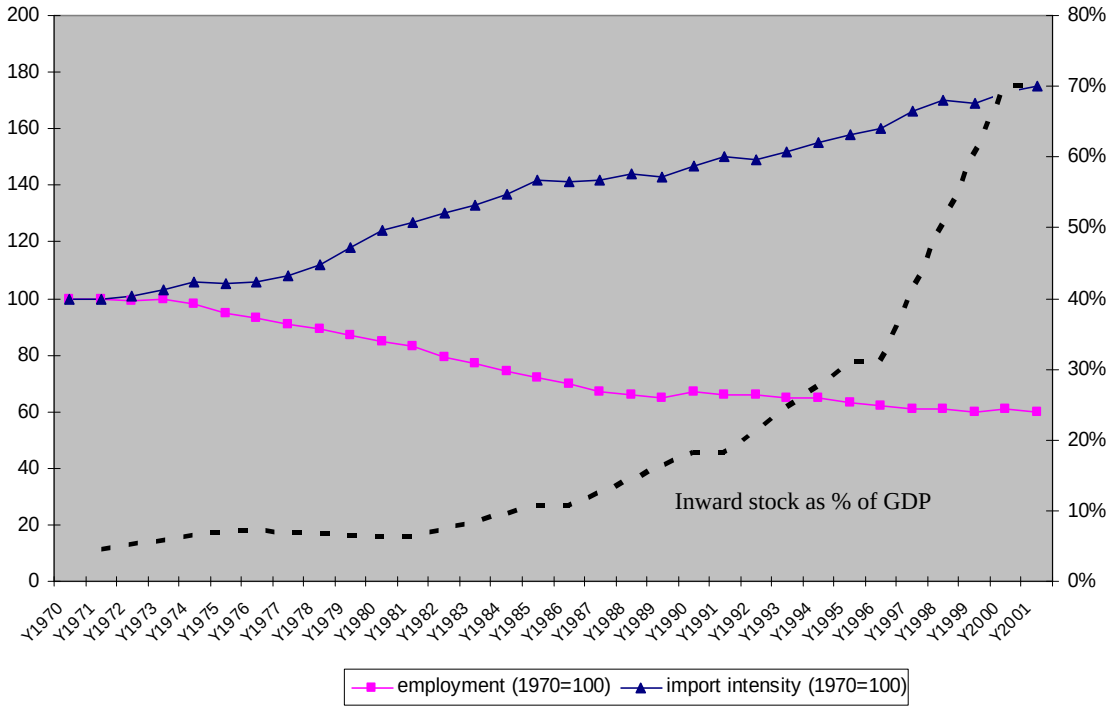


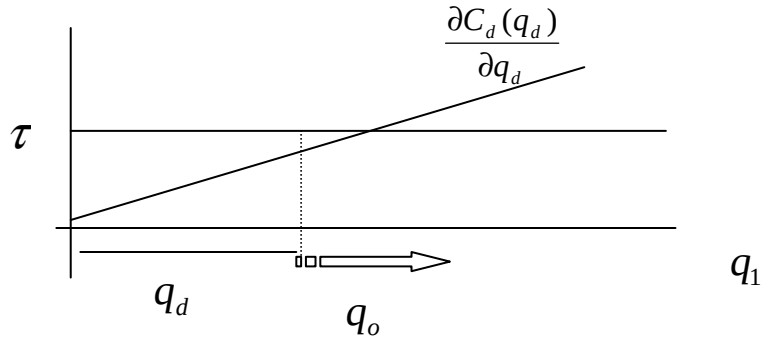
TABLE 1

Cost curves of the two firms

	Firm 1 = MNE	Firm 2 = Domestic firm
Production in A	Cost function $C_d(q_d)$ with $\frac{\partial C_d(q_d)}{\partial q_d} > 0, \frac{\partial^2 C_d(q_d)}{\partial {q_d}^2} > 0$	Cost function $C_2(q_2)$ with $\frac{\partial C_2(q_2)}{\partial q_2} > 0, \frac{\partial^2 C_2(q_2)}{\partial {q_2}^2} > 0$
Sourcing from B	$C_o(q_o) = \tau.q_o$ with $\tau > 0$	No sourcing activities

FIGURE 2

Total production of the MNE[16]



[16] for the assumed quadratic cost function

FIGURE 3

The strategic crowding out effect as a function of b_2 and fixed values of β .

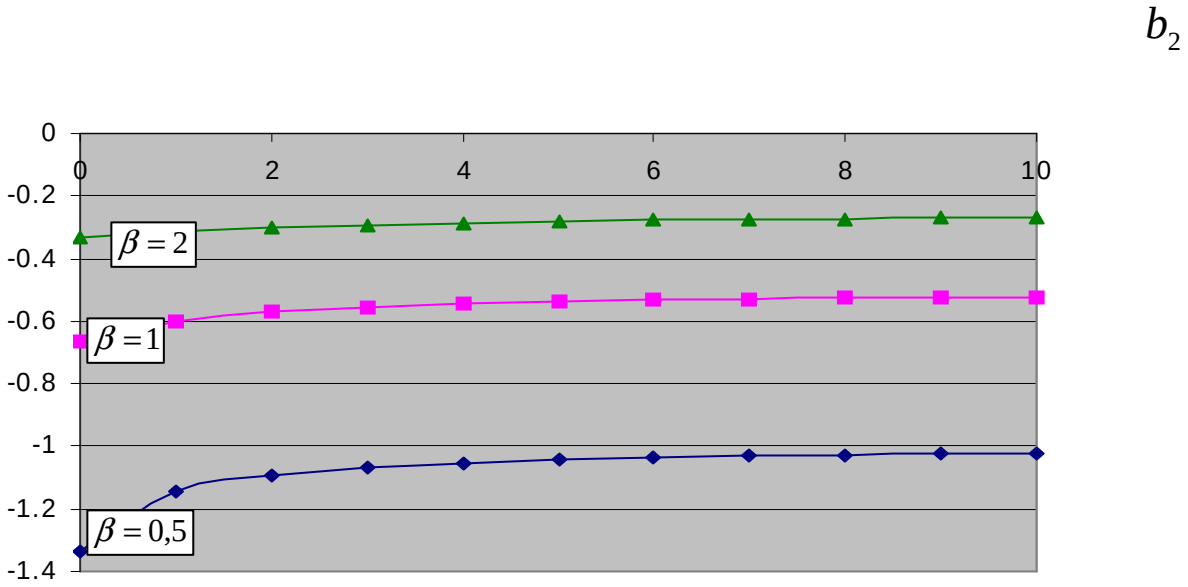


TABLE 2

Exit behavior for the two types of domestic firms

Critical exit value of the domestic firm with **high (i=1)** and **low (i=2) output flexibility**

$$\overline{q_{2i}} = \sqrt{\frac{F_{2i}}{\beta + b_{2i}}}$$

Fixed costs: $F_{21} > F_{22}$ **Production technology:** $b_{21} < b_{22}$

Critical exit values $\overline{q_{21}} > \overline{q_{22}}$

Reinforcement of the exit behavior of the domestic firm with high output flexibility

Strategic effect $\Delta q_{21} > \Delta q_{22}$
(decrease in τ with $\Delta\tau$)

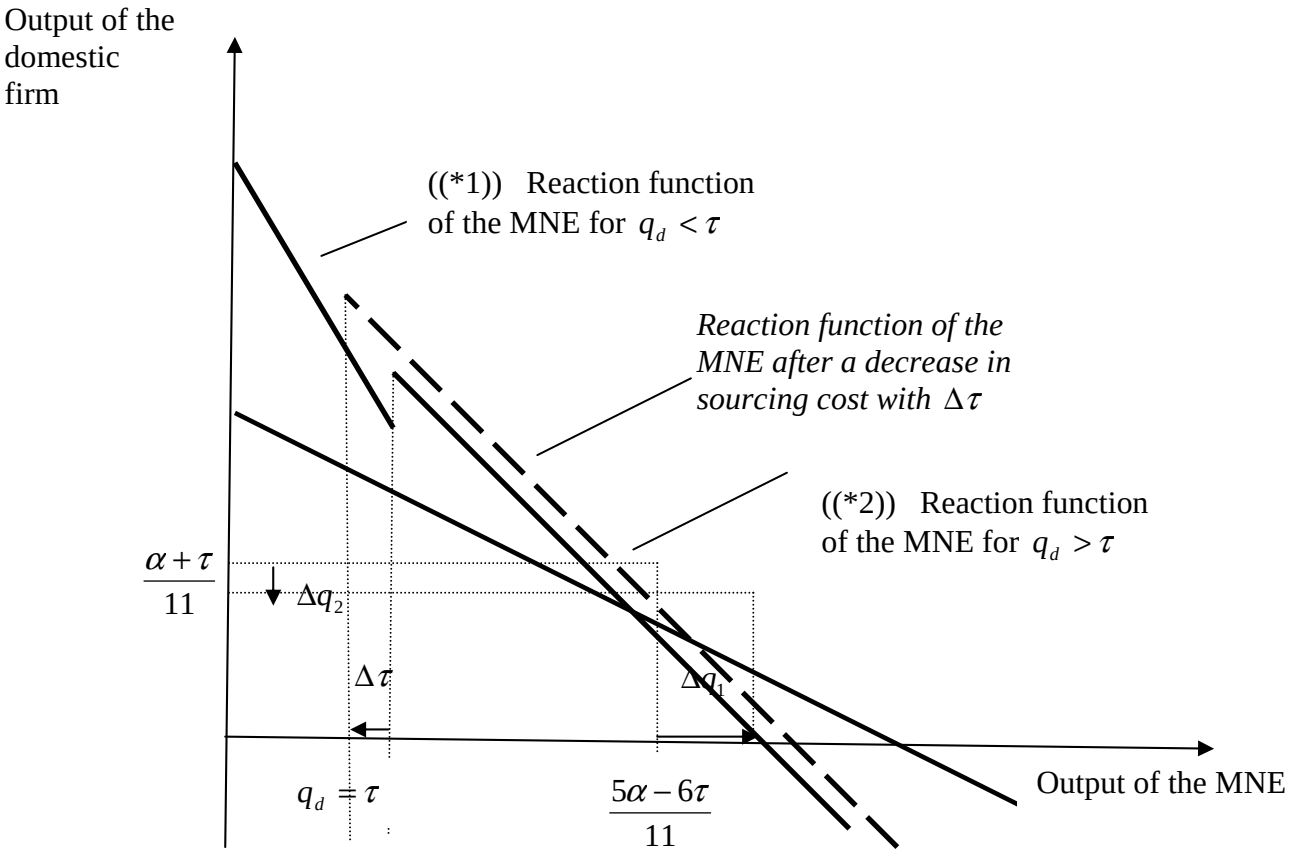
TABLE 3

Cost curves of the two firms in our example

	MNE	Domestic firm
Production in A	$C_d(q_d) = \frac{1}{2}q_d^2$	$C_2(q_2) = 2q_2^2$
Sourcing from B	$C_o(q_o) = \tau.q_o$ with $\tau > 0$	No production

FIGURE 4

The direct and indirect effect of a decrease in sourcing cost in region A[17]



[17] Since on the horizontal axis the output of the MNE is drawn, the obtained value q_o should be increased with $q_d = \tau$. The reaction function of the MNE for $q_d < \tau$ denoted by ((*1)), equals $\alpha - (3q_d + q_2) = 0$ with $\beta = 1$ and $q_o = 0$. The point on the vertical axis is $(\alpha - q_2, 0)$ and on the horizontal axis $(\alpha - 3q_d, 0)$. The reaction function of the MNE for $q_d > \tau$ denoted by ((*2)) equals $\alpha - (3\tau + 2q_o + q_2) = 0$ with $\beta = 1$ and $q_d = \tau$. The point on the vertical axis is now $(\alpha - q_2 - 3\tau, 0)$ and lies below the point on the vertical axis of ((*1)) and on the horizontal axis $(\alpha - 3\tau - 2q_o, 0)$ which lies on the right side[17] of the point on the horizontal axis of ((*1)). So ((*2)) is a flatter curve than ((*1)). The reaction curve of the domestic firm equals $\alpha - (q_d + q_o + 6q_2) = 0$. The Cournot equilibrium is given by $q_d = \tau,\ q_o = \frac{5\alpha - 17\tau}{11}$ and $q_2 = \frac{\alpha + \tau}{11}$. We assume that α which reflects the market size, is large enough such that $q_1 > q_2$ or $4\alpha > 7\tau$.