

Strategic Foreign Direct Investment in Vertically Related Markets*

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Abstract

By using a simple North-South trade model with vertically related markets, this paper draws our attention to previously unidentified effects of foreign direct investment (FDI), namely that a North downstream firm affects the pricing behavior of an input supplier through technology spillovers and market integration led by FDI. Whether the North firm strategically undertakes FDI in the presence of technology spillovers depends on South firm's capacity to absorb North's technology. When the capacity is not very high, the North firm could actually gain from technology spillovers to the South firm. FDI may benefit all producers and consumers.

Keywords: FDI, technology spillovers, North-South model, segmented and integrated markets, vertically related markets

JEL Classification: F12, F21, F23

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I Introduction

Foreign direct investment (FDI) has been expanding dramatically.¹ FDI is undertaken for various reasons such as cost saving, tariff-jumping and information acquiring.² The purpose of this paper is to draw our attention to previously unidentified motives for FDI. In particular, we are concerned with “strategic” motives. In an oligopolistic market, strategic interactions usually arise. Strategic motives in the present study mean that firms undertake FDI to take advantage of such strategic interactions under international oligopoly. Specifically, constructing a simple North-South model with vertically related markets,³ we identify strategic incentives for a North firm to invest in South.

The outline of our model is as follows. There are two countries, North and South. In each country, there is a downstream firm, but the South downstream firm may be a potential entrant. The final good is sold in North. There is an upstream firm in South. The North downstream firm may strategically choose South as its plant location. The North downstream firm imports the intermediate good if it locates in North, but exports the final good if it locates in South. We explore the North firm’s decision in two cases. In the first case, the South downstream firm is a potential entrant (hereafter, the potential-entrant case). In the second case, it is an incumbent (hereafter, the incumbent case).

When constructing our model, we specifically take the following two features into account. First, the price discrimination is widely observed between countries. However, it is not the case within a country. This is due to the presence of a regulation, an arbitrage opportunity within a country, and so on. For instance, it is illegal to price-discriminate in the US under a federal law, the Robinson-Patman Act. We should mention that intermediate goods are no exception to the price discrimination. Examples include dumping in the semiconductor industry.^{4,5} Therefore, it is assumed in our model that the upstream firm price-discriminates between two downstream firms as long as they are located in the different countries. However, if the North downstream firm undertakes FDI and is located in South, the upstream firm sets the uniform price between the North and the South downstream firms. That is, the intermediate-good market is segmented without FDI, but is integrated with FDI.

Market integration has been analyzed in the international trade literature, particularly in the context of regional trade agreements such as customs unions and free trade agreements.⁶ As far

¹For example, see the online data base of the United Nations Conference on Trade and Development (UNCTAD) (<http://stats.unctad.org/FDI/>).

²See Dunning (1977) and Caves (2007), for example. Chakrabarti (2001) summarizes the determinants of FDI in different studies.

³The literature on FDI acknowledges the importance of vertically related markets. For example, Barrios et al. (2005) say “multinationals’ demand for intermediate inputs, ..., can induce changes in the domestic industrial structure and can kick-start the development of local industry” and confirm this by using Irish data.

⁴A well-known example is that the Semiconductor Industry Association accused the Japanese semiconductor industry of conducting dumping in the US market in the mid 1980’s.

⁵For arguments over the price discrimination in the input market, see Katz (1987), DeGraba (1990), Yoshida (2000) and Valletti (2003), among others.

⁶For example, see Smith and Venables (1988), Ishikawa (2004) and Ishikawa et al. (2007).

as we know, however, no study has connected FDI with market integration in the intermediate-good market. An interesting point is that FDI could be motivated by price discrimination in the intermediate-good markets. This motive should be distinguished from another motive to reduce transport and other trade costs. In this paper, the effect that FDI leads to market integration of the intermediate good is referred to as “the market integration effect”.

Typical examples fitting our argument are natural resources. The Chinese government has been controlling the exports of rare earth to increase the prices in the foreign markets.⁷ By doing so, the Chinese government intends to induce high-tech firms using rare earth as the key inputs to produce in China. In fact, Hitachi Materials and Showa Denko have recently decided to shift the production of high-performance magnets and high-performance alloys, respectively, to China.⁸ They have never produced those goods outside of Japan to prevent technology leakage. Similarly, to attract FDI, petroleum exporting countries in the Middle East strategically offer materials such as natural gases to foreign petrochemical companies at low prices. The material price paid by Petro Rabigh, which is a joint venture between Sumitomo Chemical and Saudi Aramco and is one of the largest petrochemical plants in the world, is about one tenth of that paid by foreign rivals in developed countries (Nikkei, November 11, 2009). Not only Sumitomo Chemical but also Asahi Kasei, Dow Chemical, and Mitsubishi Chemical have invested or are planning to invest in Saudi Arabia.⁹

Second, FDI generates technology or knowledge spillovers to local rivals. Keller (2004) says “For instance, both micro-econometric studies and case studies point in the same direction. The evidence suggests that there can be FDI spillovers, ...”¹⁰ The advanced technology of the North downstream firm spills over to South’s rival only if the North firm builds its plant in South.¹¹ In this paper, this effect is referred to as “the technology spillover effect”. In the potential-entrant case, the technology spillover effect may lead South’s potential entrant to enter the market. It has been pointed out that technology spillovers crucially depend on South firm’s capacity to absorb North firm’s technology.¹² Following Cohen and Levinthal (1989, 1990), we call such a capacity “absorptive capacity”. We show that South firm’s absorptive capacity also plays a crucial role in

⁷The Ministry of Economy, Trade and Industry of Japan points out that the price gaps between Chinese markets and foreign markets are extraordinarily large.

⁸Toyota has recently announced to produce key parts such as engines for hybrid vehicles in China, because rare earth is indispensable to those high-tech parts (Nikkei, September 4, 2011).

⁹With respect to manufacturing, Nikkei Business (October 4, 1993) reports that the prices of intermediate inputs (such as ABS polymer, polystyrene and galvanized sheet steel) for a Japanese consumer electronics company are more than 30% lower in Thailand than in Japan. Recently, the largest Japanese consumer electronics company, Panasonic, has decided to shift the procurement department from Japan to Singapore to procure cheap parts and produce outside Japan (Nikkei, August 11, 2011).

¹⁰For empirical evidences, see Kokko (1994), Dimelis and Louri (2002), Griffith et al. (2002), Görg and Strobl (2002,2003), Smarzynska Javorcik (2004), and Branstetter (2006), for example. For theoretical studies, see Findlay (1978), Ethier and Markusen (1986), and Glass and Saggi (1999,2002), for example.

¹¹Empirical studies such as Eaton and Kortum (1999), Branstetter (2001) and Keller (2002) suggest that knowledge spillovers are geographically localized.

¹²See, for example, Findly (1978), Kokko (1994) and Glass and Saggi (1998).

our analysis.

In the presence of FDI spillovers, FDI seems detrimental to the interests of the investing firm, because it makes competition tougher either by making the local incumbent firm more efficient or by creating a new rival. In the potential-entrant case, however, the “investing” firm may gain from FDI spillovers. In other words, the investing firm may take advantage of FDI spillovers. When FDI induces the entry of a potential entrant, this affects the pricing behavior of the upstream firm and hence the profits of the investing firm. In fact, under certain situations, all producers as well as consumers gain from FDI, that is, market integration of the intermediate good and technology spillovers through FDI result in Pareto gains. In the incumbent case, FDI spillovers are mostly harmful for the investing firm,¹³ but it could still gain from FDI because of the market integration effect. Pareto gains are also possible in the incumbent case.

Another contrast between the potential-entrant case and the incumbent case is that FDI induces the South firm to enter the market in the former, while it may force the South firm to exit the market in the latter. In general, the entry is induced by the technology spillover effect, while the exit is due to intensified competition.¹⁴ In our incumbent case, FDI increases the intermediate-input price due to the market integration effect, which could dominate the technology spillover effect and induce exit.

There are not many studies that deal with strategic motives of FDI. Horstmann and Markusen (1987) and Vannini (1998) consider the preemptive motive for FDI. Under this motive, a multinational enterprise (MNE) undertakes FDI to delay the entry of local firms. Similarly, Lin and Saggi (1999) argue that a MNE may undertake FDI to delay other MNEs’ switch from exports to FDI. The delay is caused because FDI makes the local firm’s imitation of an advanced technology easier and intensifies competition in the South market. Our incumbent case is somewhat related to the preemptive motive. FDI raises the cost of the intermediate input and makes the local firm less competitive and hence it is forced to exit the market under certain circumstances. Bjorvatn and Eckel (2006) show another reason why a North firm (the leading firm) may invest in South regardless of technology spillovers to a local firm (the lagging firm). They point out that FDI by the leading firm deters the lagging firm from technology sourcing FDI.

Our potential-entrant case is related to Pack and Saggi (2001), Ishikawa (2007) and Horiuchi and Ishikawa (2009) that consider strategic uses of other types of international technology transfer in vertically related markets. Pack and Saggi (2001) also show a possibility of Pareto-improving technology transfer. However, their focus is different from ours. They are primarily concerned with vertical technology transfer (through outsourcing) rather than horizontal one. In Ishikawa (2007) and Horiuchi and Ishikawa (2009), a vertically integrated North firm strategically transfers technology to a South potential entrant through trade in an intermediate product in order to deter a North rival from entering the market.

¹³Even in the incumbent case, the investing firm could gain from technology spillovers (see Proposition 3).

¹⁴It is widely observed that FDI leads to both entry and exit of local firms depending on countries and industries. See Görg and Strobl (2002,2003), De Backer and Sleuwaegen (2003), Smarzyska Javorcik (2004), and Barrios et al. (2005), for example.

Our analysis is also related to Markusen and Venables (1999) which develops a theoretical model with monopolistically competitive industries where FDI generates both backward and forward linkages in the host country. In their model, there is initially no local production at all. Then FDI makes it possible for local suppliers to enter the local market by creating demand for non-tradable intermediate goods (backward linkage) and this in turn induces local final-good producers to enter the local market (forward linkage). In their model, however, technology spillovers are absent. Moreover, they highlight a possibility that local production eventually overtakes and forces out FDI plants. It should be noted that in contrast with Markusen and Venables (1999), our backward linkage is not directly created by FDI. That is, the investing downstream firm gains from FDI which affects the intermediate-good supplier indirectly through horizontal technology spillovers to the local downstream firm. Thus, this is not a simple backward linkage often indicated in the literature of technology transfer.

The rest of the paper is organized as follows. Section 2 presents the basic model. Section 3 shows that the North firm may have incentives to undertake FDI because of market integration and technology spillovers. Section 4 concludes the paper.

II The Basic Model

There are two countries, North and South, each with one downstream firm denoted by firm N and firm S , respectively. There is a single upstream firm, firm M , which is located in South. Using the intermediate good, firm N and firm S produce a homogeneous final good. The final good is consumed in North.¹⁵ Firm N chooses its plant location, either North or South. That is, firm N either imports the intermediate good to produce the final good in North or undertakes FDI to purchase the intermediate good and produce the final good in South. Technology does not spill over to firm S if firm N locates in North, while it does if firm N locates in South. To neutralize the motive for FDI associated with trade costs, we assume that there is no trade cost between two countries.

The model involves four stages of decision. In stage 1, firm N chooses its plant location. In stage 2, firm M sets the price(s) of the intermediate good. In stage 3, firm S decides whether to serve the final-good market. If it does, firms N and S engage in Cournot competition in the final-good market in stage 4. If firm S does not serve the market, firm N monopolizes the market.

The inverse demand for the final good is given by

$$p(X) = b - aX, \tag{1}$$

where p and X are, respectively, the price and the demand of the final good.¹⁶ One unit of the intermediate good is required for each unit of the final good. The MC to produce the intermediate

¹⁵The assumption that firm M is in South and consumers of the final product are in North is innocuous. The main results still hold without this assumption. This assumption follows from the case of natural resources in Section 1.

¹⁶Even if the demand function is non-linear, the essence of our results would not change.

good is normalized to be zero. If firms N and S are, respectively, located in North and South, firm M can set the different prices across firms, r_N and r_S , because of market segmentation.¹⁷ If both firms are located in South, however, firm M is forced to set the uniform price, r , because of a single market. The MC to produce the final good from the intermediate good is c_N for firm N and c_S for firm S . When firm N does not invest in South, c_S is equal to \bar{c}_S which is exogenously given. When firm N undertakes FDI, on the other hand, c_S depends on the firm S 's capacity to absorb firm N 's technology (i.e., "absorptive capacity"). For simplicity, the absorptive capacity, α , is exogenously given. Specifically, in the presence of FDI, the relationship between the MC and the absorptive capacity is given by

$$c_S = \bar{c}_S - \alpha(\bar{c}_S - c_N) = (1 - \alpha)\bar{c}_S + \alpha c_N, \alpha \in [0, 1]. \quad (2)$$

$\alpha = 0$ implies the nil capacity and $c_S = \bar{c}_S$ holds. On the other hand, $\alpha = 1$ implies the perfect capacity and $c_S = c_N$.

The profits of firms M , N , and S are, respectively, given by

$$\begin{aligned} \pi_M &= r_N x_N + r_S x_S, \\ \pi_N &= [p - (c_N + r_N)]x_N - f_N, \\ \pi_S &= [p - (c_S + r_S)]x_S - f_S, \end{aligned}$$

where x_i ($i = N, S$) is the output of firm i ; and f_i ($i = N, S$) is the setup fixed cost (FC). To focus on the strategic motive for FDI, we assume that for firm N , both MC and FC are identical between North and South. That is, there is no cost-saving motive for firm N to undertake FDI. Since the setup FCs are not crucial to derive our main results, we set $f_i = 0$ ($i = N, S$) for simplicity.

III Strategic Motives for FDI

In this section, we show that firm N may have incentives to undertake FDI because of the market integration effect and the technology spillover effect. We consider two cases. In the first case, \bar{c}_S is too high for firm S to enter the market. That is, firm S is a potential entrant and its entry is possible only if firm N undertakes FDI (i.e., the potential-entrant case). In the second case, \bar{c}_S is low enough for firm S to serve the final-good market, that is, firm S can serve the final-good market without firm N 's FDI (i.e., the incumbent case).¹⁸

(i) The Potential-Entrant Case

We solve the game by backward induction. There are two cases in the last stage. Firm S does not enter the market in the first case and does in the second case. Without firm S 's entry,

¹⁷Market segmentation stems from regulations, laws, transport costs, etc. For example, if parallel imports are prohibited by law, then arbitrage across countries would not occur. If market segmentation is due to the presence of trade costs, we need to introduce trade costs into the model. However, this modification would not affect the essence of our results.

¹⁸The conditions under which each case arises are given in footnote 22.

firm N monopolizes the market. In either case, a single intermediate-good price prevails. In the absence of firm S , firm N is a monopolist in the final-good market.

In the first case, given the intermediate-good price, r^N , the equilibrium is given by

$$x_N^N = X^N = \frac{b - c_N - r^N}{2a} > 0, p^N = \frac{b + c_N + r^N}{2}, \pi_N^N = \frac{(b - c_N - r^N)^2}{4a}, \quad (3)$$

where a superscript “ N ” stands for the case without firm S ’s entry.

With firm S ’s entry, the duopoly between firms N and S arises. Given r^{SS} , we obtain

$$x_N^{SS} = \frac{b + (c_S + r^{SS}) - 2(c_N + r^{SS})}{3a}, x_S^{SS} = \frac{b + (c_N + r^{SS}) - 2(c_S + r^{SS})}{3a}, \quad (4)$$

$$X^{SS} = \frac{2b - (c_S + r^{SS}) - (c_N + r^{SS})}{3a}, p^{SS} = \frac{1}{3}(b + 2r + c_N + c_S), \quad (5)$$

$$\pi_N^{SS} = \frac{[b + (c_S + r^{SS}) - 2(c_N + r^{SS})]^2}{9a}, \pi_S^{SS} = \frac{[b + (c_N + r^{SS}) - 2(c_S + r^{SS})]^2}{9a}, \quad (6)$$

where a superscript “ SS ” stands for the case with firm S ’s entry. In stage 3, firm S enters the market if and only if $\pi_S^{SS} > 0$.

We now consider stage 2 in which given the FDI decision of firm N , firm M sets the price in the intermediate-good market to maximize its profits under the derived demand. Without FDI, noting $x_M = x_N$ (where x_M is the output of firm M), we have

$$x_M^{N*} = \frac{1}{4a}(b - c_N), r^{N*} = \frac{b - c_N}{2}, \pi_M^{N*} = \frac{1}{8a}(b - c_N)^2, \quad (7)$$

$$x_N^{N*} = X^{N*} = \frac{1}{4a}(b - c_N), p^{N*} = \frac{1}{4}(3b + c_N), \pi_N^{N*} = \frac{1}{16a}(b - c_N)^2. \quad (8)$$

Asterisk “ $*$ ” denotes equilibrium value.

With FDI, on the other hand, firm M has two options: charging the high price so that only firm N is served or charging the low price to accommodate firm S ’s entry. Firm M compares its profits between these two cases. In the former case, the equilibrium is given by (7) and (8). In the latter, facing the derived demand (5), firm M charges the uniform price

$$r^{SS*} = \frac{2b - c_N - c_S}{4}$$

for the intermediate good. Therefore,

$$x_N^{SS*} = \frac{2b - 7c_N + 5c_S}{12a}, x_S^{SS*} = \frac{2b - 7c_S + 5c_N}{12a}, \quad (9)$$

$$X^{SS*} = \frac{2b - c_N - c_S}{6a}, p^{SS*} = \frac{1}{6}(4b + c_N + c_S),$$

$$\pi_N^{SS*} = \frac{1}{144a}(2b - 7c_N + 5c_S)^2, \pi_S^{SS*} = \frac{1}{144a}(2b - 7c_S + 5c_N)^2,$$

$$\pi_M^{SS*} = \frac{(2b - c_N - c_S)^2}{24a}.$$

For $x_S^{SS*} > 0$, we need $2b - 7c_S + 5c_N > 0$, i.e., $c_S < (2b + 5c_N)/7 \equiv \tilde{c}$.¹⁹

¹⁹Since $c_N \leq c_S$, $x_N^{SS*} > 0$ holds if $x_S^{SS*} > 0$.

The above two cases are depicted in Figure 1. In panel (a), $d^N d^{N'}$ is the derived demand for the intermediate good without FDI. The marginal revenue (MR) curve associated with $d^N d^{N'}$ is $d^N m^N$. Since $MC = 0$, the equilibrium in the intermediate-good market is given by point E^N . Once FDI is undertaken, the derived demand and its MR curve become $d^N d^{SS} d^{SS'}$ and $d^N m^{N'}$ plus $m^{SS} m^{SS'}$, respectively. Since the demand curve kinks at d^{SS} , the MR curve becomes discontinuous and consists of two segments. Then the equilibrium becomes E^{SS} . In the presence of FDI, firm M obtains the higher profits at E^{SS} than at E^N and hence induces firm S to enter. In panel (b), d^{SS} is located to the southeast of E^N . Then, both E^N and E^{SS} are a candidate for equilibrium. If point E^N gives the higher profits for firm M , it charges r^{N*} for the intermediate good. Hence, firm S cannot enter even with FDI.

The difference in the profits of firm M between the two cases is

$$\Delta\pi_M^E \equiv \pi_M^{SS*} - \pi_M^{N*} = \frac{1}{24a} (b^2 + 2bc_N - 4bc_S - 2c_N^2 + 2c_N c_S + c_S^2), \quad (10)$$

where $\Delta\pi_M^E = 0$ holds at $c_S = (2 + \sqrt{3})b - (\sqrt{3} + 1)c_N$ and $(2 - \sqrt{3})b + (\sqrt{3} - 1)c_N (\equiv c_M^{SS=N})$.²⁰ A superscript “ E ” stands for the potential-entrant case. We can verify $c_N < c_M^{SS=N} < \tilde{c} < (2 + \sqrt{3})b - (\sqrt{3} + 1)c_N$.

Thus, the following lemma is immediate.

Lemma 1 *When firm N undertakes FDI, firm M induces firm S 's entry if and only if $c_N \leq c_S < c_M^{SS=N}$.*

Intuitively, firm M is likely to benefit from the presence of firm S as a result of FDI, because the demand for the intermediate good rises. However, if firm S is not very efficient (i.e., if $c_S \geq c_M^{SS=N}$), firm M has to lower the intermediate-good price sufficiently to serve both firms N and S . In this case, since the firm M 's profits fall, firm M serves only firm N by charging high price. This case is equivalent to the case without FDI. Thus,

Lemma 2 *Firm M never loses from FDI.*

We now consider stage 1. Comparing the profits of firm N with and without firm S 's entry, we have

$$\Delta\pi_N^E \equiv \pi_N^{SS*} - \pi_N^{N*} = \frac{5}{144a} (-b^2 - 2bc_N + 4bc_S + 8c_N^2 - 14c_N c_S + 5c_S^2).$$

$\Delta\pi_N^E = 0$ holds at $c_S = 2c_N - b$ and $(b + 4c_N)/5 (\equiv c_N^{N=SS})$. Noting $2c_N - b < c_N < c_N^{N=SS} < c_M^{SS=N} < \tilde{c}$ and Lemma 1, we establish the following lemma.

Lemma 3 *Firm N benefits from FDI if and only if $c_N^{N=SS} < c_S < c_M^{SS=N}$.*

²⁰ $c_i^{A=B}$ is a threshold for firm i meaning the following. Firm i 's profits are greater under market structure “ A ” than under market structure “ B ” with $c_S < c_i^{A=B}$ and vice versa with $c_S > c_i^{A=B}$.

The reason why firm N benefits from FDI is as follows. Suppose that firm S enters the market as a result of FDI. Although the presence of a rival makes the final-good market more competitive, it reduces the intermediate-good price by shifting the derived demand for the intermediate good.²¹ If the latter effects dominate the former (i.e., if $c_N^{N=SS} < c_S$), firm N gains. As the absorptive capacity of firm S becomes lower (i.e., as c_S increases), the intermediate-good price becomes lower and hence firm N is more likely to gain. Put differently, by creating a technologically inferior rival, FDI can weaken firm M 's market power. In the presence of FDI, therefore, firm N faces a trade-off between the presence of a rival and the lower intermediate-good price. If $c_N \leq c_S < c_N^{N=SS}$, firm N has no incentive to undertake FDI.

The difference in the total output is

$$\Delta X^E \equiv X^{SS*} - X^{N*} = \frac{1}{12a} (b + c_N - 2c_S) > \frac{1}{12a} (b - c_N) (2\sqrt{3} - 3) > 0,$$

where the inequality comes from $c_S < c_M^{SS=N}$. As is expected, the total output is larger in the presence of firm S . Therefore,

Lemma 4 *Consumers never lose from FDI. If FDI leads firm S to enter the market, consumers as well as firm S necessarily gain.*

The above analysis establishes the following proposition.

Proposition 1 *Suppose that firm S cannot enter the market without firm N 's FDI. Firm N has an incentive to undertake FDI if and only if the absorptive capacity of firm S is medium so that $c_N^{N=SS} < c_S < c_M^{SS=N}$ holds. With $c_N^{N=SS} < c_S < c_M^{SS=N}$, FDI induces firm S to enter the market. FDI results in Pareto gains, that is, FDI benefits all producers (i.e. firms M , N and S) and consumers.*

This proposition is depicted in Figure 2. In the figure, π_N^{N*} and π_M^{N*} are horizontal because they are independent of the absorptive capacity, or, c_S . As the absorptive capacity rises (i.e., as c_S falls), π_N^{SS*} decreases but π_M^{SS*} increases. As long as $c_S > c_N^{N=SS}$, firm N is willing to invest. However, firm M does not allow firm S 's entry if $c_S > c_M^{SS=N}$. On the other hand, as long as $c_S < c_M^{SS=N}$, firm M is willing to accommodate firm S 's entry but firm N does not undertake FDI if $c_S < c_N^{N=SS}$.

(ii) *The Incumbent Case*

We next consider the incumbent case. There are two cases in the last stage. In the first case, firm N undertakes FDI and both firms N and S are located in South. This case has been examined in the last subsection. As we see below, however, firm S may be forced to exit the market in this case. This depends on the pricing behavior of firm M .

In the second case, firms N and S , respectively, produce in North and in South. In this case, there exist no technology spillovers and hence $c_S = \bar{c}_S$. Also firm M can price-discriminate

²¹Since firm S cannot be more efficient than firm N , firm S 's entry never increases the intermediate-good price.

between firms N and S , because of market segmentation. Given the intermediate-good prices, r_N^{NS} and r_S^{NS} , the equilibrium is given by

$$x_N^{NS} = \frac{b + (\bar{c}_S + r_S^{NS}) - 2(c_N + r_N^{NS})}{3a}, x_S^{NS} = \frac{b + (c_N + r_N^{NS}) - 2(\bar{c}_S + r_S^{NS})}{3a}, \quad (11)$$

$$X^{NS} = \frac{2b - (\bar{c}_S + r_S^{NS}) - (c_N + r_N^{NS})}{3a}, p^{NS} = \frac{1}{3} (b + r_S^{NS} + r_N^{NS} + c_N + \bar{c}_S), \quad (12)$$

$$\pi_N^{NS} = \frac{[b + (\bar{c}_S + r_S^{NS}) - 2(c_N + r_N^{NS})]^2}{9a}, \pi_S^{NS} = \frac{[b + (c_N + r_N^{NS}) - 2(\bar{c}_S + r_S^{NS})]^2}{9a}, \quad (13)$$

where “ NS ” stands for the case in which firms N and S , respectively, produce in North and in South.

With price discrimination, firm M sets the prices of the intermediate good, r_N and r_S as follows:

$$r_N^{NS*} = \frac{b - c_N}{2}, r_S^{NS*} = \frac{b - \bar{c}_S}{2}. \quad (14)$$

Then,²²

$$x_N^{NS*} = \frac{b - 2c_N + \bar{c}_S}{6a}, x_S^{NS*} = \frac{b + c_N - 2\bar{c}_S}{6a}, \quad (15)$$

$$X^{NS*} = \frac{2b - c_N - \bar{c}_S}{6a}, p^{NS*} = \frac{1}{6} (4b + c_N + \bar{c}_S),$$

$$\pi_N^{NS*} = \frac{1}{36a} (b - 2c_N + \bar{c}_S)^2, \pi_S^{NS*} = \frac{1}{36a} (b + c_N - 2\bar{c}_S)^2,$$

$$\pi_M^{NS*} = \frac{1}{6a} (b^2 - bc_N - b\bar{c}_S + c_N^2 - c_N\bar{c}_S + \bar{c}_S^2).$$

There are two opposing effects of firm N 's FDI on firm M 's profits. Under FDI, firm M is forced to set the uniform price, which reduces firm M 's profits relative to the case without FDI. On the other hand, FDI generates technology spillovers from firm N to firm S , which allows firm M to increase the intermediate-good price relative to the case without any technology spillovers. Thus, firm M may or may not gain from FDI. We have

$$\Delta\pi_M^I \equiv \pi_M^{SS*} - \pi_M^{NS*} = \frac{1}{24a} (c_S^2 + 2c_Sc_N - 4bc_S - 3c_N^2 + 4c_N\bar{c}_S - 4\bar{c}_S^2 + 4b\bar{c}_S),$$

where a superscript “ I ” stands for the incumbent case. $\Delta\pi_M^I = 0$ holds at $c_S = 2b - c_N - 2\sqrt{Z}$ ($\equiv c_M^{SS=NS}$) and $2b - c_N + 2\sqrt{Z}$, where $Z \equiv b^2 - bc_N - b\bar{c}_S + c_N^2 - c_N\bar{c}_S + \bar{c}_S^2 = (b - \bar{c}_S)^2 + (b - c_N)(\bar{c}_S - c_N) > 0$. Since $c_M^{SS=NS} < \bar{c} < 2b - c_N + 2\sqrt{Z}$, $\Delta\pi_M^I > 0$ ($\Delta\pi_M^I < 0$) if and only if $c_N \leq c_S < c_M^{SS=NS}$ ($c_M^{SS=NS} < c_S \leq \bar{c}_S$).²³ $c_S < c_M^{SS=NS}$ implies that the technology spillovers from firm N to firm S are large enough to benefit firm M .

When $\Delta\pi_M^I < 0$, firm M has two options in the presence of FDI. One is to keep serving both firms N and S . The other is to stop serving firm S by charging a high price for the intermediate good. It should be noted that in either case, firm N 's FDI is harmful to firm M , which never happens in the potential-entrant case (recall Lemma 2). Since π_M^{SS*} is decreasing with respect

²²We can conclude from (15) that the incumbent case arises if $\bar{c}_S < (b + c_N)/2$ and the potential-entrant case arises if $\bar{c}_S \geq (b + c_N)/2$.

²³The appendix shows that there exist some parameter values under which $c_N < c_M^{SS=NS}$ holds.

to c_S and $\pi_M^{NS*} > \pi_M^{N*}$, we have $c_M^{SS=NS} < c_M^{SS=N} (\equiv (\bar{c}_S (\sqrt{3} + 1) - b (\sqrt{3} - 1)) / 2)$. Also by noting Lemma 1, the following lemma is immediate.

Lemma 5 *Firm M gains from FDI if and only if $c_N \leq c_S < c_M^{SS=NS}$ but loses if and only if $c_M^{SS=NS} < c_S \leq \bar{c}_S$. When it loses, firm M forces firm S to exit the market if and only if $c_M^{SS=N} < c_S \leq \bar{c}_S$.*

Lemma 5 is illustrated in Figure 3 (a). If c_S is in Region 1 or Region 2 as a result of FDI, then the duopoly between firm N located in South and firm S located in South arises. Firm M gains in Region 1 but loses in Region 2. If c_S is in Region 3, then firm S is led to exit the market and hence the monopoly by firm N arises. Firm M loses in Region 3.

The economic intuition behind Lemma 5 is similar to that in the potential-entrant case. The greater the technology spillovers from firm N to firm S are, the larger the firm M 's gains from FDI. Since the case without FDI is the duopoly between firm N located in North and firm S located in South, however, FDI (i.e., the duopoly between firm N located in South and firm S located in South) hurts firm M if technology spillovers are not large enough. When technology spillovers are too small (i.e., $c_M^{SS=N} < c_S \leq \bar{c}_S$), firm M can avoid a large loss by forcing firm S to exit the market.

Before considering stage 1, we examine the effect of FDI on consumers and firm S 's profits on the basis of Lemma 5. First of all, it is obvious that if only firm N is served under FDI, both firm S and consumers lose from FDI. When firm M serves both firms N and S under FDI, FDI benefits consumers, because $p^{NS*} > p^{SS*}$. The final-good price is lower with FDI than without FDI, because technology spillovers make firm S more efficient.²⁴ The difference in the profits of firm S is

$$\Delta\pi_S^I \equiv \pi_S^{SS*} - \pi_S^{NS*} = \frac{1}{144a} (3c_N - 7c_S + 4\bar{c}_S) (4b - 7c_S + 7c_N - 4\bar{c}_S).$$

$\Delta\pi_S^I = 0$ holds at $c_S = (4b + 7c_N - 4\bar{c}_S) / 7$ and $(3c_N + 4\bar{c}_S) / 7 (\equiv c_S^{SS=NS})$. In view of (9) and (15), we can verify $c_N < c_S^{SS=NS} < \bar{c}_S < (4b + 7c_N - 4\bar{c}_S) / 7$. Thus, $\Delta\pi_S^I > 0$ holds if and only if $c_N \leq c_S < c_S^{SS=NS}$. The intuition is as follows. FDI makes the intermediate-good price higher for firm S . However, technology spillovers through FDI make firm S more efficient. If the spillovers are large enough (i.e., if $c_S < c_S^{SS=NS}$), then firm S could gain from FDI. However, we should mention that $c_M^{SS=N} < c_S^{SS=NS}$ could hold (see the appendix). When $c_M^{SS=N} < c_S < c_S^{SS=NS}$, firm M forces firm S to exit the market with FDI (recall Lemma 5).

The above result is illustrated in Figure 3 (b) and (c). In Figure 3 (b), $c_S^{SS=NS} < c_M^{SS=N}$ holds, while, in Figure 3 (c), $c_M^{SS=N} < c_S^{SS=NS}$ holds. In both figures, the monopoly by firm N arises if c_S is in Region 3, while the duopoly arises if c_S is in Region 4 or Region 5 (i.e., in Region 6). In Region 3, firm S loses. In Figure 3 (b), firm S gains if c_S is in Region 4 but loses if c_S is in Region 5. In Figure 3 (c), firm S gains in Region 6.

Thus, we obtain

²⁴Since the demand for the final good is linear, the final-good price is not affected by market integration. Thus, technology spillovers are crucial for the decrease in the final-good price.

Lemma 6 *Firm S benefits from FDI if and only if $c_N \leq c_S < \min\{c_M^{SS=N}, c_S^{SS=NS}\}$, but loses if and only if $\min\{c_M^{SS=N}, c_S^{SS=NS}\} < c_S \leq \bar{c}_S$.*

For consumers, unless FDI leads firm S to exit the final-good market, FDI is beneficial. In Figure 3, FDI benefits consumers unless c_S is in Region 3. Thus, we obtain

Lemma 7 *Consumers benefits from FDI if and only if $c_N \leq c_S < c_M^{SS=N}$, but loses if and only if $c_M^{SS=N} < c_S \leq \bar{c}_S$.*

We next consider stage 1. In stage 1, firm N decides its plant location. For this, firm N compares the profits of each location. If only firm N is served under FDI, firm N compares π_N^{NS*} with π_N^{N*} . Since the intermediate-good prices for firm N are the same between these two market structures (i.e., $r_N^{NS*} = r_N^{N*}$), $\pi_N^{NS*} < \pi_N^{N*}$ holds. Thus, if $c_M^{SS=N} < c_S \leq \bar{c}_S$ holds, then firm N undertakes FDI and becomes the monopolist.

If firm M serves both firms N and S under FDI, on the other hand, firm N compares π_N^{NS*} with π_N^{SS*} :

$$\Delta\pi_N^I \equiv \pi_N^{SS*} - \pi_N^{NS*} = -\frac{1}{144a} (3c_N - 5c_S + 2\bar{c}_S) (4b + 5c_S - 11c_N + 2\bar{c}_S).$$

$\Delta\pi_N^I = 0$ holds at $c_S = (11c_N - 2\bar{c}_S - 4b)/5$ and $(3c_N + 2\bar{c}_S)/5$ ($\equiv c_N^{NS=SS}$). Noting $(11c_N - 2\bar{c}_S - 4b)/5 < c_N < c_N^{NS=SS}$, we have $\Delta\pi_N^I > 0$ if and only if $c_N^{NS=SS} < c_S \leq \bar{c}_S$. This result stems from the following trade-off. Without FDI, firm M price-discriminates between firms N and S . Since firm N is more efficient than firm S , the price firm N faces is higher than that firm S does. On the one hand, firm N 's FDI makes firm S more efficient because of technology spillovers: on the other hand, it leads firm M to set the uniform price and firm N faces the lower intermediate-good price. If the latter effect exceeds the former, firm N gains from FDI. This is likely to be the case when the technology spillovers are not very strong.

Therefore, noting $c_N^{NS=SS} < c_M^{SS=N}$, we establish the following lemma.²⁵

Lemma 8 *Firm N benefits from FDI if and only if $c_N^{NS=SS} < c_S \leq \bar{c}_S$.*

When technology spillovers are too large (i.e., $c_N \leq c_S < c_N^{NS=SS}$), firm N can avoid a loss from FDI by locating in North. When technology spillovers are not large (i.e., $c_N^{NS<SS} < c_S \leq \bar{c}_S$), FDI could result in two market structures: the monopoly by firm N and the duopoly between firm N located in South and firm S located in South. The former arises if $c_M^{SS=N} < c_S \leq \bar{c}_S$ holds, while the latter arises if $c_N^{NS=SS} < c_S < c_M^{SS=N}$. In either market structure, firm N gains from FDI.

Whether firms M and S and consumers actually gain or lose from FDI crucially depends on the size of thresholds. As was shown, we have $c_N < c_N^{NS=SS} < c_N^{N=SS} < c_M^{SS=N} < \bar{c}_S$ (see footnote 25) and $c_M^{SS=NS} < c_M^{SS=N}$. Moreover, we can easily verify $c_N^{NS=SS} < c_S^{SS=NS} (< \bar{c}_S)$.

²⁵Since π_N^{SS*} is increasing with respect to c_S and $\pi_N^{NS*} < \pi_N^{N*}$, we have $c_N^{NS=SS} < c_N^{N=SS}$. As shown in Subsection 3.1, $c_N^{N=SS} < c_M^{SS=N}$ holds. Thus, we obtain $c_N < c_N^{NS=SS} < c_N^{N=SS} < c_M^{SS=N} < \bar{c}_S$.

The appendix shows that $c_N^{NS=SS} < c_M^{SS=NS}$ could hold. In view of Lemmas 5-8, therefore, FDI is actually undertaken and hurts firms M and S and consumers if $c_M^{SS=N} < c_S \leq \bar{c}_S$ holds. In other words, FDI is actually undertaken and benefits firms M and S and consumers only if $c_N^{NS=SS} < c_S < c_M^{SS=N}$.

The above analysis is summarized in the following proposition.

Proposition 2 *Suppose that firm S can serve the market without firm N 's FDI. Firm N has an incentive to invest in South if and only if $c_N^{NS=SS} < c_S \leq \bar{c}_S$. Now suppose $c_N^{NS=SS} < c_S \leq \bar{c}_S$ holds and hence FDI is undertaken. Then FDI forces firm S to exit the market and harms consumers and firms M and S if $c_M^{SS=N} < c_S \leq \bar{c}_S$; FDI benefits firm M if $c_N^{NS=SS} < c_S < c_M^{SS=NS}$, firm S if $c_N^{NS=SS} < c_S < \min\{c_M^{SS=N}, c_S^{SS=NS}\}$, and consumers if $c_N^{NS=SS} < c_S < c_M^{SS=N}$; and FDI results in Pareto gains if $c_N^{NS=SS} < c_S < \min\{c_M^{SS=NS}, c_S^{SS=NS}\}$.*

Figure 4 shows a case in which Pareto gains could occur. FDI is undertaken if $c_S > c_N^{NS=SS}$. As long as $c_N^{NS=SS} < c_S < c_S^{SS=NS}$,²⁶ all producers and consumers gain from FDI. In the presence of FDI, the following trade-off arises for each firm. For firm N , its technology spills over to firm S , but the intermediate-good price falls because of market integration. For firm M , the price discrimination becomes impossible, but technology spillovers increase the derived demand for the intermediate good. For firm S , the intermediate-good price rises, but its technology improves because of technology spillovers. When $c_N^{NS=SS} < c_S < c_S^{SS=NS}$, the positive effect dominates the negative effect for each firm and all firms gain.

In view of Figure 4, it should be pointed out that we can obtain the following proposition.

Proposition 3 *Firm N could benefit from technology spillovers to firm S not only in the potential entrant case but also in the incumbent case.*

To see this, first suppose that technology spillovers are absent in Figure 4. Then firm S 's MC remains \bar{c}_S with FDI. Firm S exits as a result of FDI and firm N 's profits become π_N^{N*} . Now suppose that FDI results in $c_N^{NS=SS} < c_S < c_M^{SS=N}$ because of technology spillovers. Then firm N 's profits, π_N^{SS*} , are larger than π_N^{N*} . That is, firm N 's gain from FDI becomes larger in the presence of technology spillovers. The economic intuition behind this proposition is the same as that in the potential entrant case.

IV Concluding Remarks

We have identified strategic incentives for a North downstream firm to invest in South in vertically related markets. Both the technology spillover effect and the market integration effect play crucial roles. We explore two cases. In the potential-entrant case, the South downstream firm can enter the market only if FDI is undertaken. In the incumbent case, the South downstream firm can serve the market without FDI. In both cases, FDI makes the South downstream firm

²⁶We can easily verify $c_S^{SS=NS} < c_M^{SS=NS}$ holds if $c_N = 0$.

more efficient and changes the derived demand for the intermediate good, which in turn affects the intermediate-good supplier. Although FDI could benefit the North downstream firm in both cases, the causes are somewhat different.

In the potential-entrant case, if FDI induces the potential entrant to enter the market, the intermediate-good price falls because the South entrant is less efficient than the North firm. If this positive effect dominates the negative effect caused by the creation of a new rival, then the North downstream firm is willing to invest in South. Interestingly, all producers and consumers benefit from such FDI. This is basically because the distortion due to double marginalization is weakened. The upstream firm gains, because it has to decrease the intermediate-good price to serve both downstream firms but the derived demand for the intermediate good increases by the entry.

In the incumbent case, FDI makes the South downstream firm more competitive, but leads the upstream firm to set the uniform price. Since the North firm is more efficient than the South firm, the uniform pricing either lowers the intermediate-good price faced by the North firm or forces the South firm to exit the market. If the South firm exits, the North firm gains from FDI but the other firms and consumers lose. Even if the South firm remains to stay, the reduction of the intermediate-good price may benefit the North firm. In this case, FDI could result in Pareto gains. FDI generates technology spillovers to the South firm and hence the South firm can gain even if FDI increases the intermediate-good price faced by it. FDI does not allow the upstream firm to price-discriminate between two downstream firms anymore but technology spillovers to the South firm expand the derived demand for the intermediate good. If the latter effect (i.e., the technology spillover effect) exceeds the former (i.e., the market integration effect), the upstream firm gains.

In concluding this paper, six final remarks are in order. First, both the technology spillover effect and the market integration effect are necessary for the North downstream firm to benefit from FDI in the potential-entrant case, while the market integration effect alone makes the North downstream firm better off in the incumbent case. For the upstream firm and the South downstream firm, the technology spillover effect is beneficial, while the market integration effect is harmful. Thus, the technology spillover effect is necessary for the upstream firm and the South downstream firm to gain. For the North downstream firm, however, the technology spillover effect may or may not be harmful. As pointed out, the technology spillover effect may further increase the benefit for the North downstream firm.

Second, we have assumed that the upstream firm sets the monopoly price for the intermediate good. If the North downstream has the monopsony power instead, the intermediate-good price becomes equal to the constant MC of the upstream firm. Obviously, our result would not hold with the constant intermediate-good price. In fact, with the monopsony power of the North downstream firm,²⁷ FDI may break its monopsony power because of the presence of the South

²⁷The monopsony power of the North downstream firm could be ruled out if the upstream firm exports the intermediate good to other foreign firms.

downstream firm. In this case, FDI is likely to increase the intermediate-good price and our result would not follow. A crucial feature for our result is that FDI induces the upstream firm to lower the price. However, the monopoly in the intermediate-good market is not essential. For example, if a few firms compete in Cournot fashion in the intermediate-good markets, then our main results are still valid.

Third, we have assumed that there is a single downstream firms in South. If non-zero setup FCs are introduced, one could easily construct situations under which only one South downstream firm can enter the market. However, as long as the number of South downstream firms is small, the North downstream firm can still gain from FDI even with more than one South firm.

Fourth, we have focused on FDI spillovers as a channel of technology transfer. We can easily incorporate direct technology transfer or assistance under FDI into the model. The North downstream firm may have an incentive to undertake FDI and voluntarily transfer technology to the South downstream firm if FDI spillovers are absent or too weak.²⁸ However, transferred technology may be too sophisticated for the South downstream firm to handle. The absorptive capacity in our model should be interpreted to include such a bottleneck.

Fifth, we can reinterpret the upstream as labor unions as in Mukherjee et al. (2008). Without FDI, each firm hires workers from a separate labor union (i.e., a labor union in each country). With FDI, however, both (downstream) firms hire workers from a common labor union in South, which sets a uniform wage. We can also reinterpret the upstream as governments that intend to maximize tax revenue.²⁹ Whereas each firm faces a tax rate set by each government without FDI, both (downstream) firms face a common tax rate imposed by the South government with FDI.

Lastly, FDI creates various linkages between MNEs and local firms. Both horizontal and vertical linkages are important. However, the number of empirical studies that investigate the effects of MNEs on local rivals through suppliers is rather limited.³⁰ More empirical investigation of this kind of linkage including one suggested in our analysis is left for future research.

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²⁸In Figures 2 and 4, for example, firm N tries to make $c_S = c_M^{SS=N}$ by transferring technology if $c_S > c_M^{SS=N}$.

²⁹Clausing (2007) finds that a revenue-maximizing corporate income tax rate for OECD countries is about 33%.

³⁰Görg and Strobl (2002) and Barrios et al. (2005) examine the manufacturing sector in Ireland. Altomonte and Resmini (2002) and Kippenberg (2005) deal with Poland and the Czech Republic, respectively.

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Appendix

First, we show that there exist parameter values under which $c_S < c_M^{SS=NS}$ holds. In the incumbent case, firm M gains from firm N 's FDI if $c_N \leq c_S < c_M^{SS=NS}$. We check if there actually exist some parameter values under which $c_N < c_M^{SS=NS}$ holds. Suppose $c_N = 0$. Then, $\Delta\pi_M^I > 0$ if $0 \leq c_S < c_M^{SS=NS} = 2(b - \sqrt{b^2 - b\bar{c}_S + \bar{c}_S^2})$. By recalling footnote 22, $0 < \bar{c}_S < b/2$ for the incumbent case. $c_M^{SS=NS}$ takes the maximum value $(2 - \sqrt{3})b$ at $\bar{c}_S = b/2$ without any constraint. Thus, $0 < c_M^{SS=NS} < (2 - \sqrt{3})b$ holds with $0 < \bar{c}_S < b/2$. This implies that given $\bar{c}_S \in (0, b/2)$ and $c_N = 0$, we can always find some range of c_S which satisfies $0 \leq c_S < c_M^{SS=NS}$.

Second, we show that $c_M^{SS=N}$ could be less than or greater than $c_S^{SS=NS}$. We have

$$c_M^{SS=N} - c_S^{SS=NS} = \frac{1}{7} \left(-4\bar{c}_S - b \left(7\sqrt{3} - 14 \right) + c_N \left(7\sqrt{3} - 10 \right) \right),$$

where $7\sqrt{3} - 14 \approx -1.8756 < 0$ holds. By setting $c_N = 0$, $c_M^{SS=N} > c_S^{SS=NS}$ holds if \bar{c}_S is sufficiently small but $c_M^{SS=N} < c_S^{SS=NS}$ holds if \bar{c}_S is sufficiently close to $b/2$.

By recalling that FDI results in Pareto gains if $c_N^{NS=SS} < c_S < \min\{c_M^{SS=N}, c_S^{SS=NS}\}$, i.e., $(3c_N + 2\bar{c}_S)/5 < c_S < \min\{(2 - \sqrt{3})b + (\sqrt{3} - 1)c_N, (3c_N + 4\bar{c}_S)/7\}$ (see Proposition 2), $c_N^{NS=SS} < c_M^{SS=NS}$ is necessary for Pareto gains. We next show that there exist parameter values under which $c_N^{NS=SS} < c_M^{SS=NS}$ holds. Again, supposing $c_N = 0$, we check the condition under which $c_N^{NS=SS} < c_M^{SS=NS}$ holds. We can easily verify $c_N^{NS=SS} < c_M^{SS=NS}$ if $0 < \bar{c}_S < 5b/8$. By noting $0 < \bar{c}_S < b/2$ for the incumbent case, $c_N^{NS=SS} < c_M^{SS=NS}$ always holds.

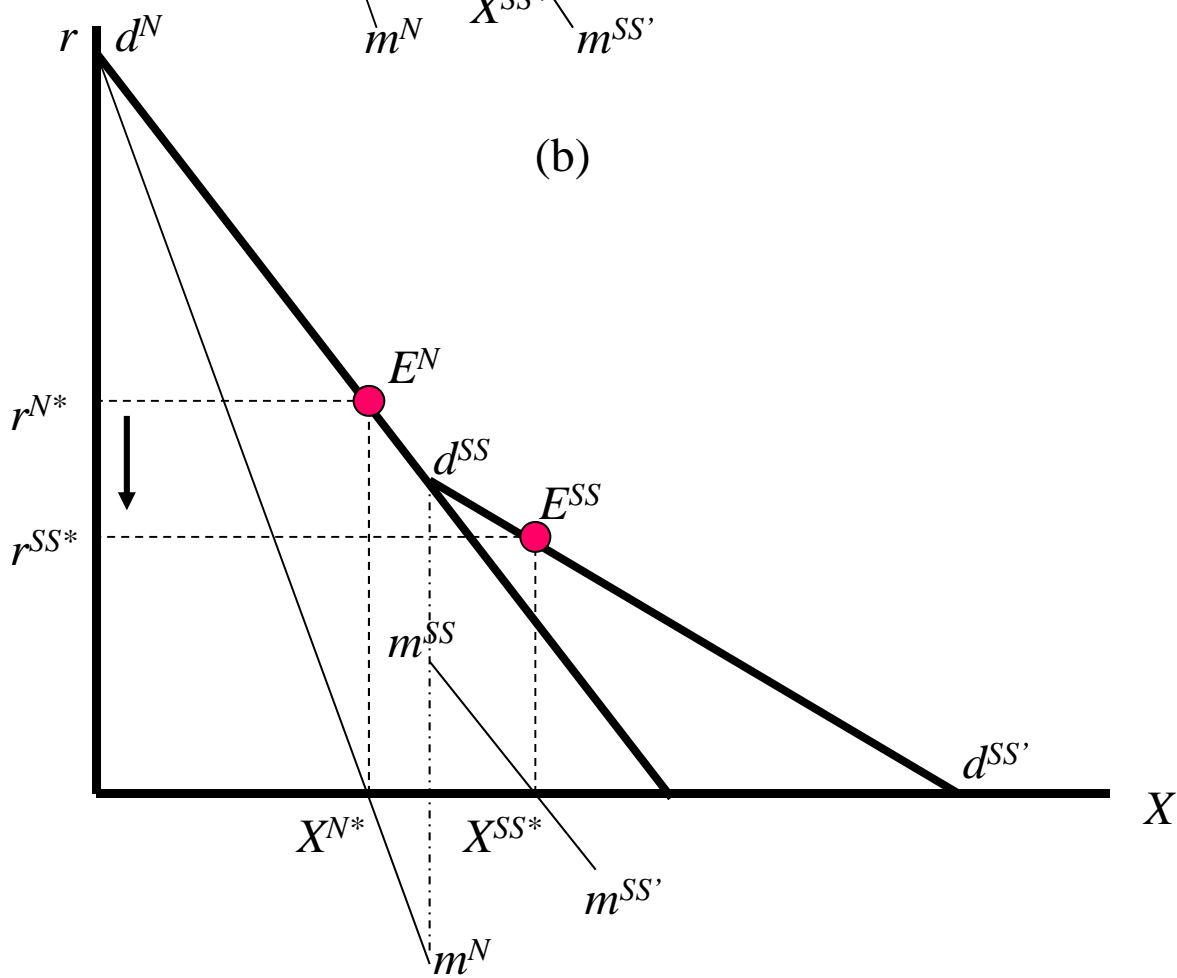
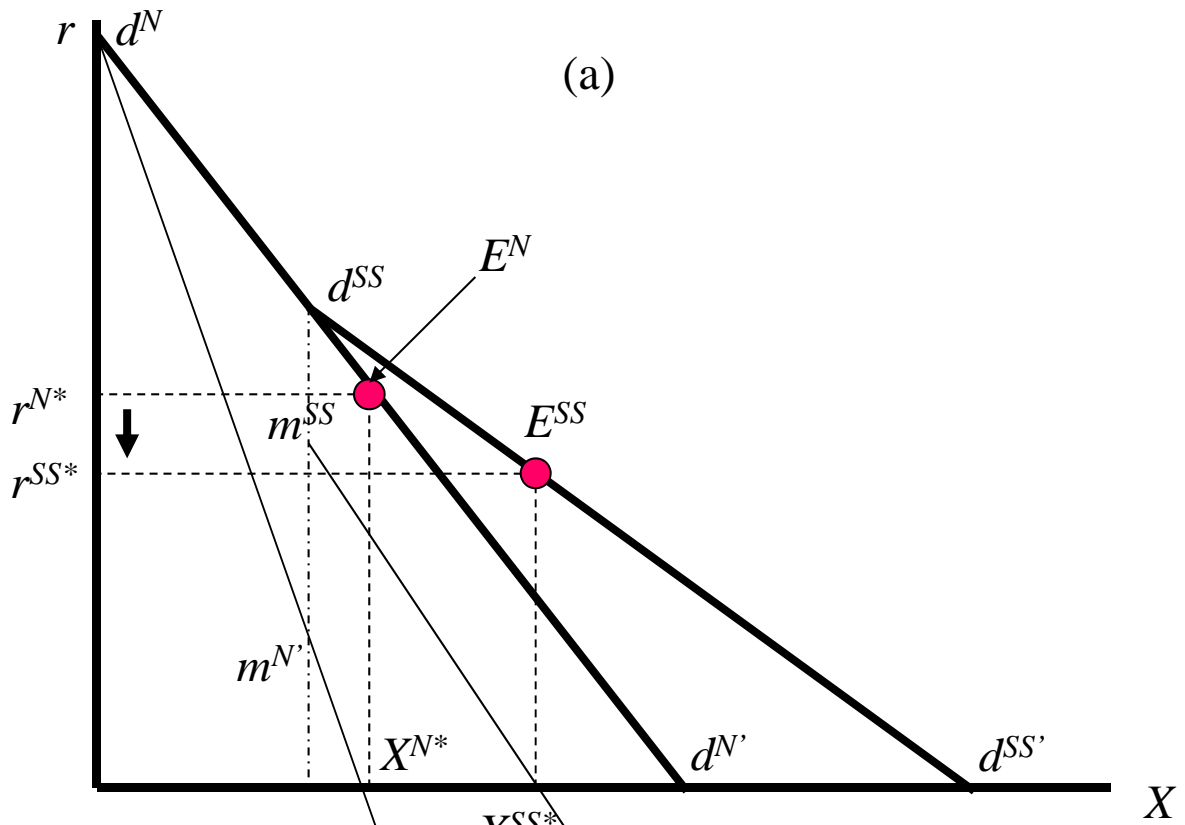


Figure 1: Intermediate-good market

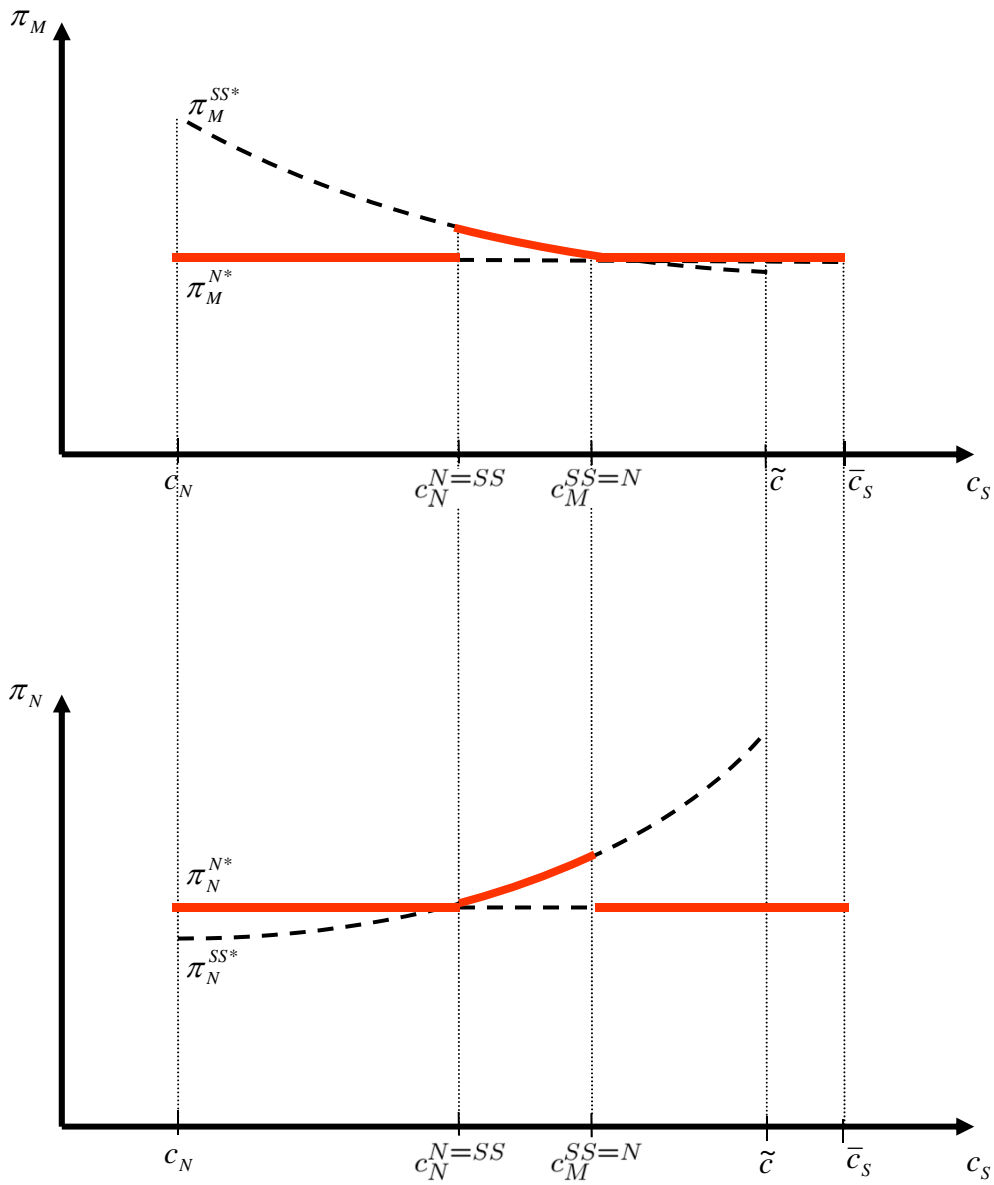


Figure 2: Relationship between profits and marginal cost:
 The potential-entrant case

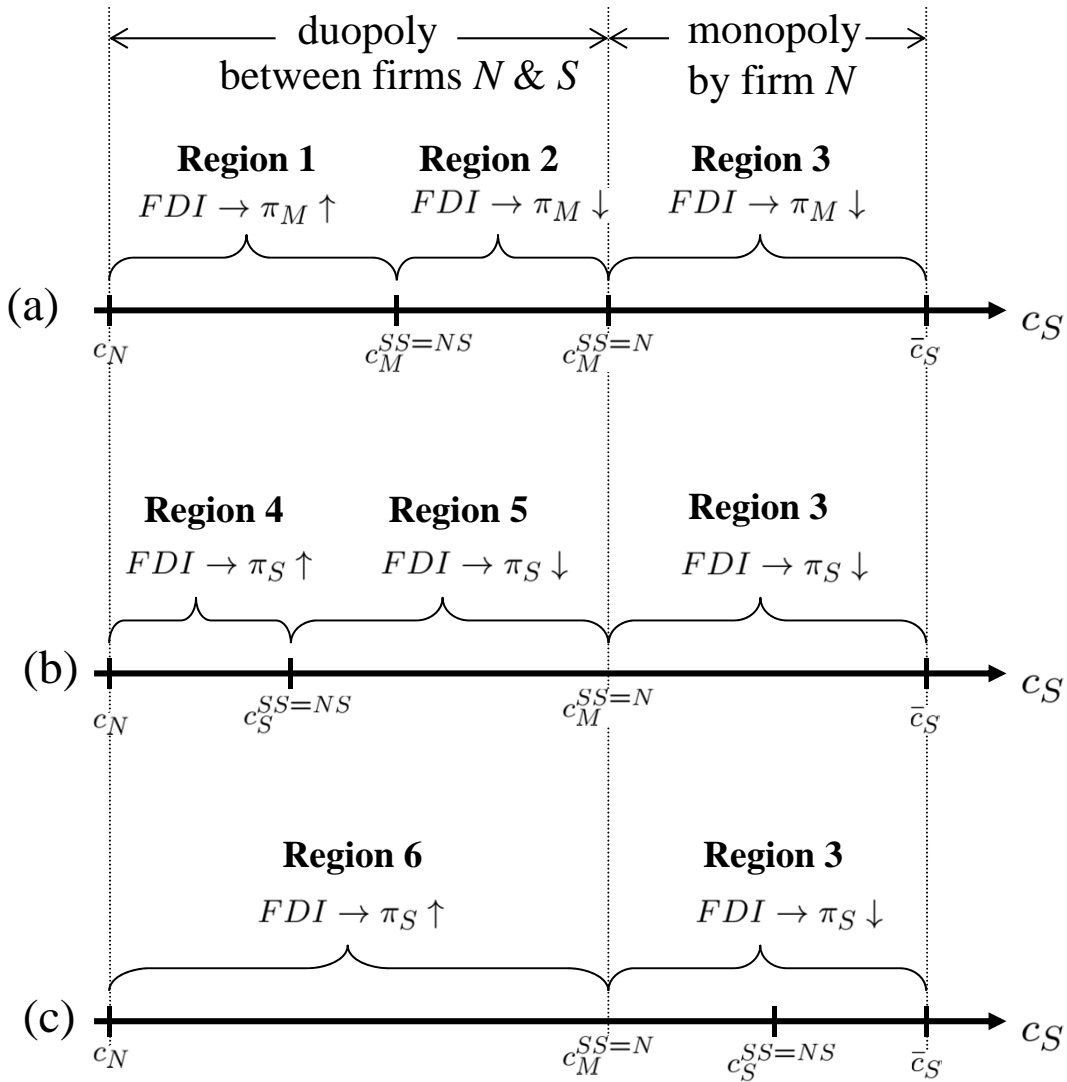


Figure 3: Relationship between profits and marginal cost:
The incumbent case

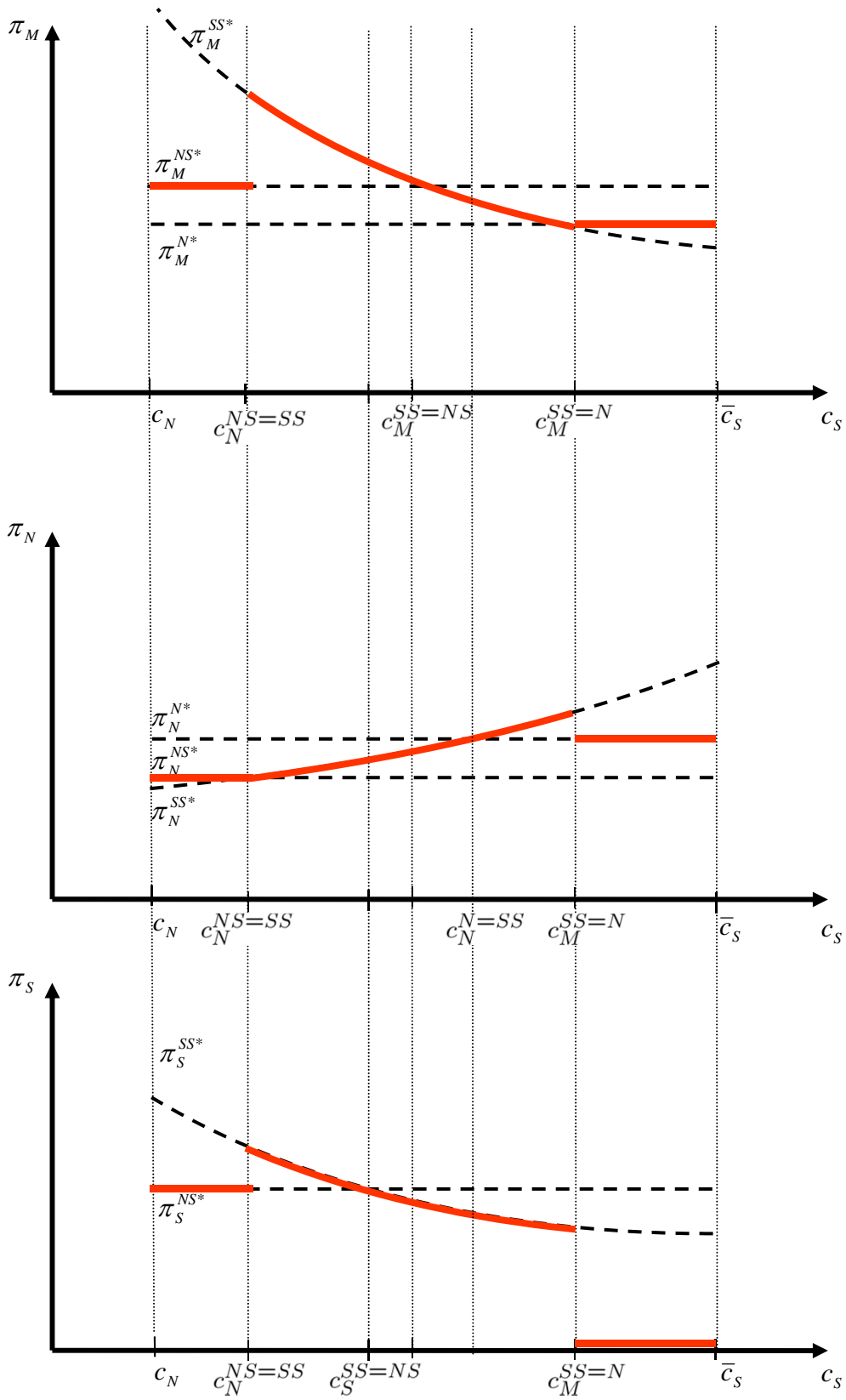


Figure 4: The incumbent case with Pareto gains

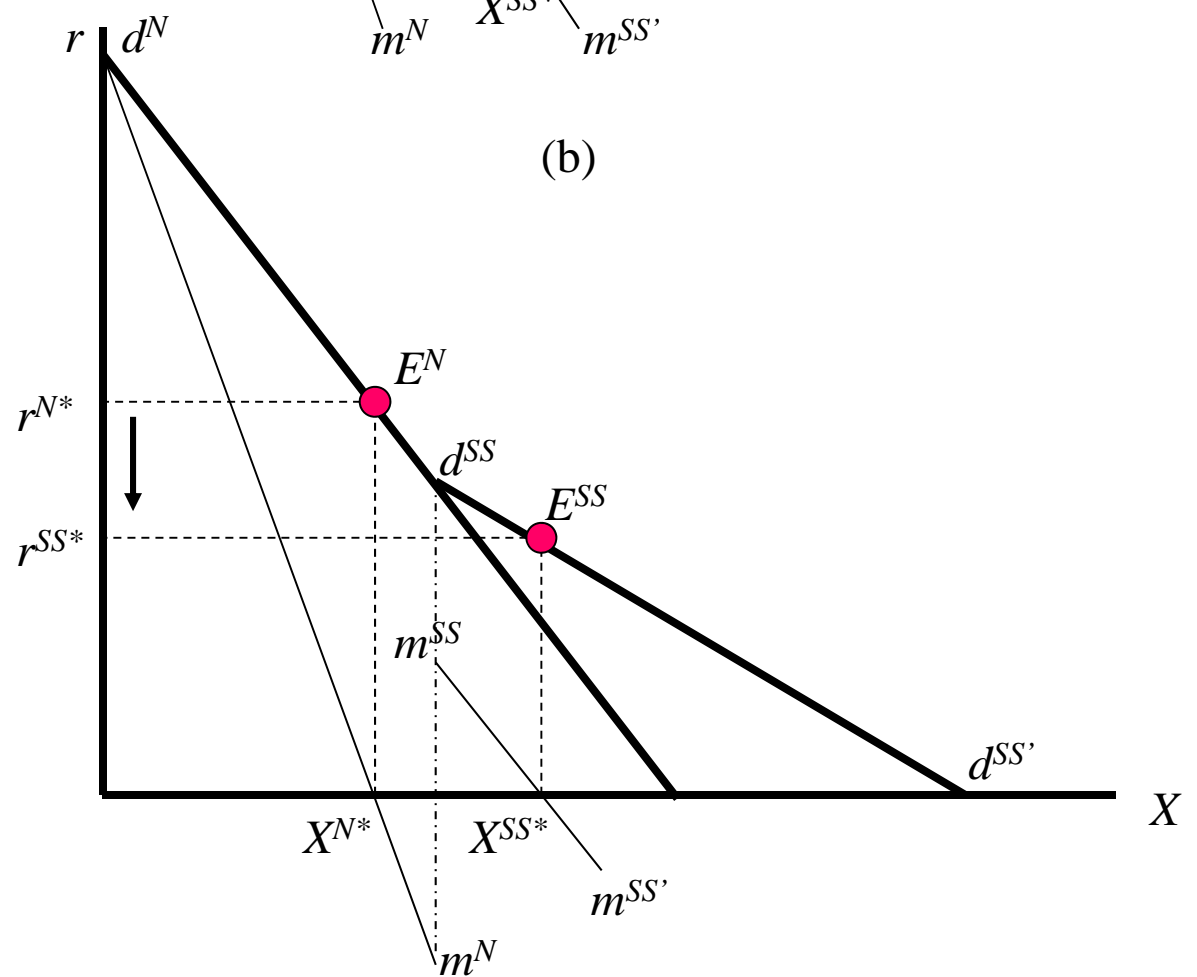
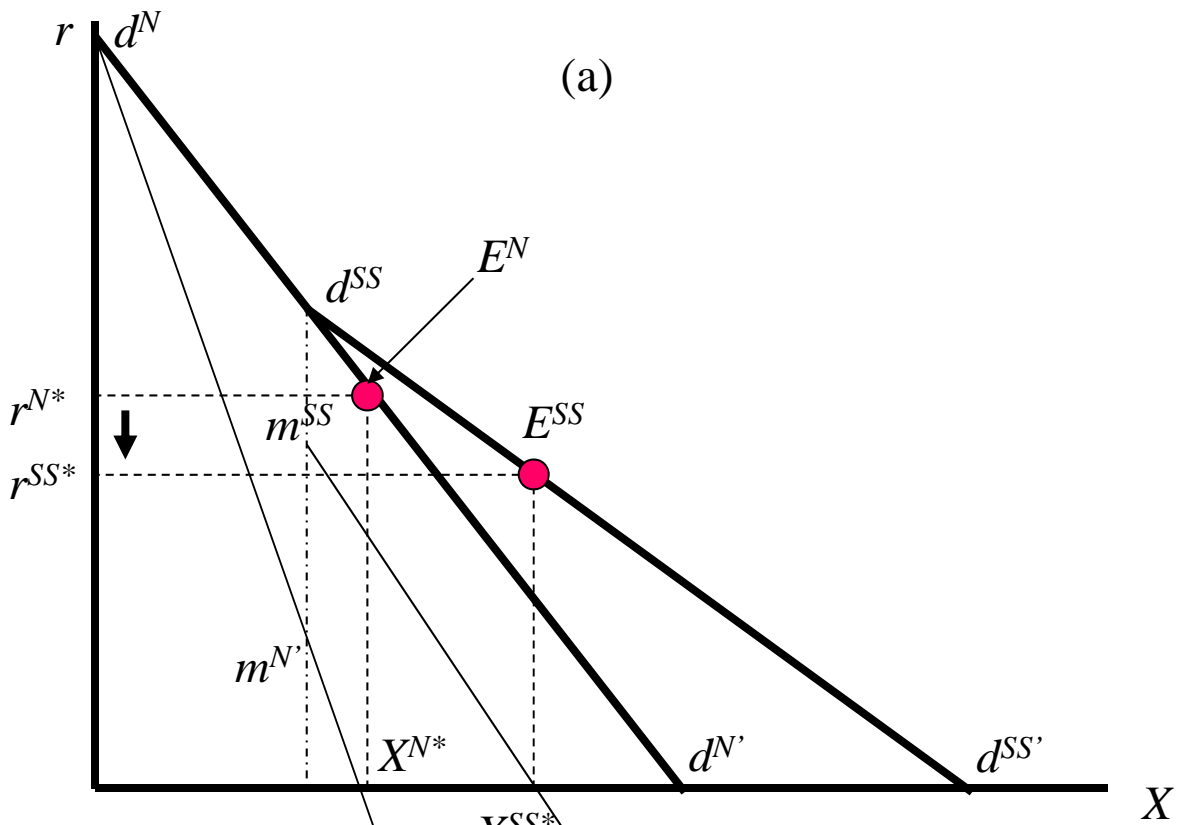


Figure 1: Intermediate-good market

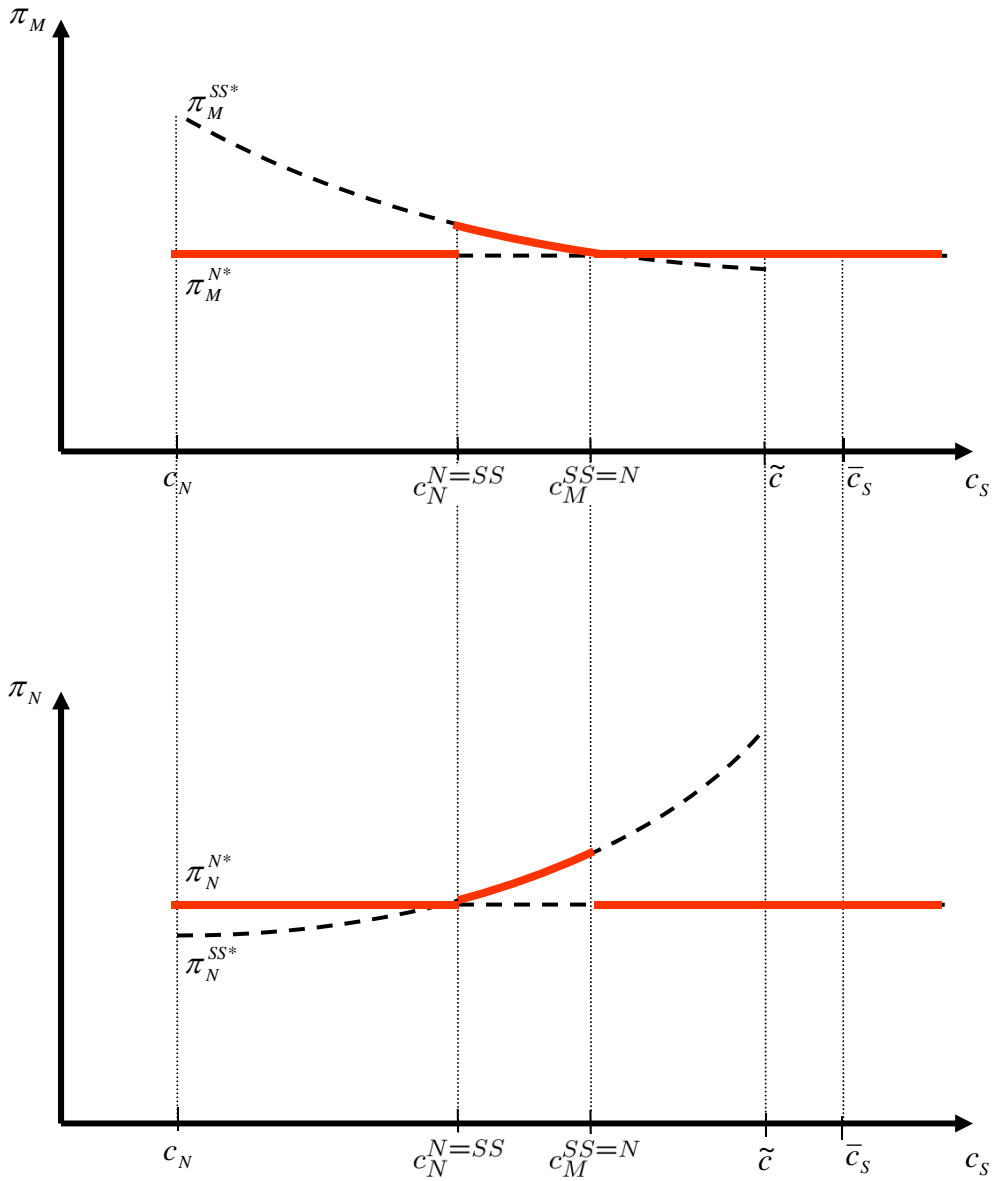


Figure 2: Relationship between profits and marginal cost:
The potential-entrant case

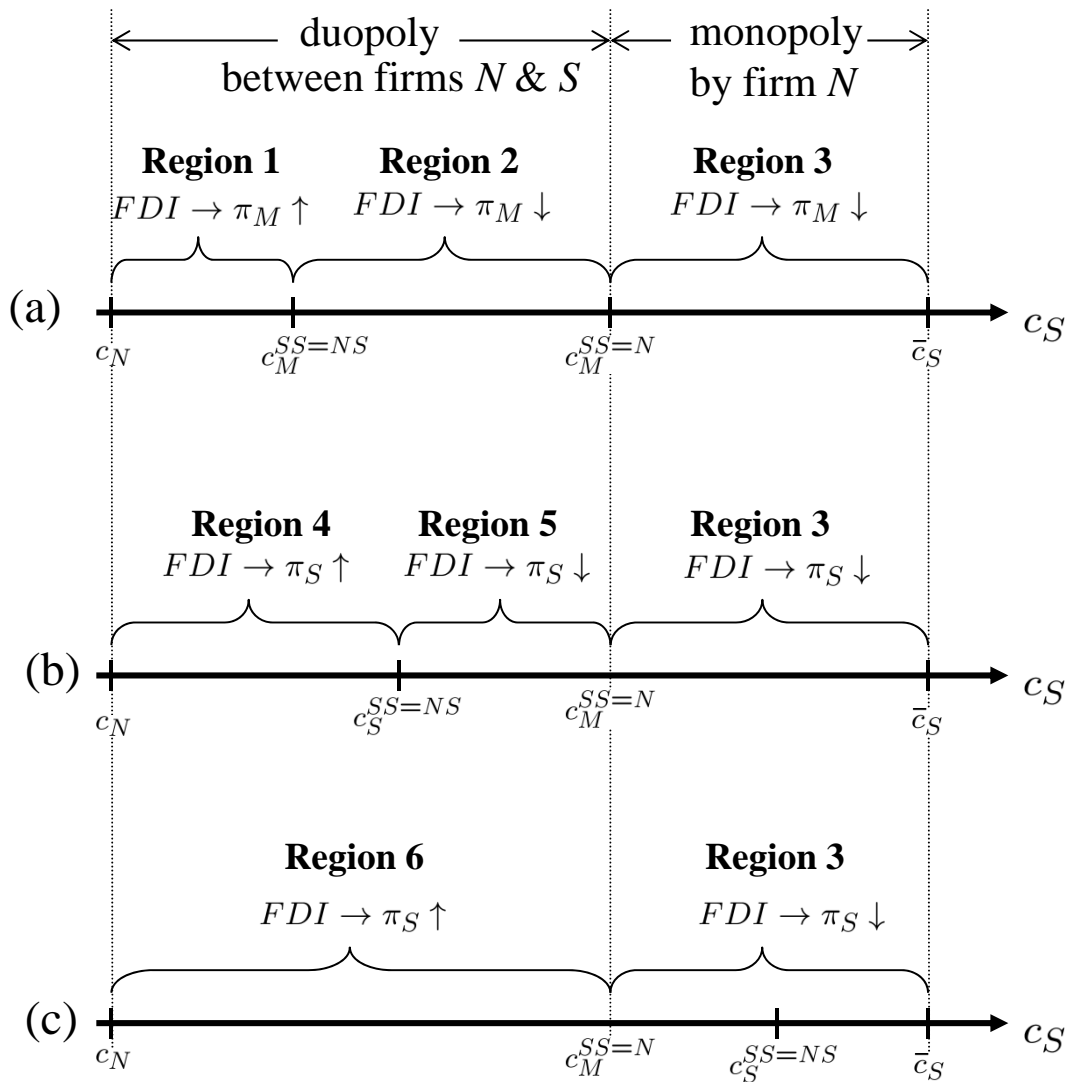


Figure 3: Relationship between profits and marginal cost:
The incumbent case

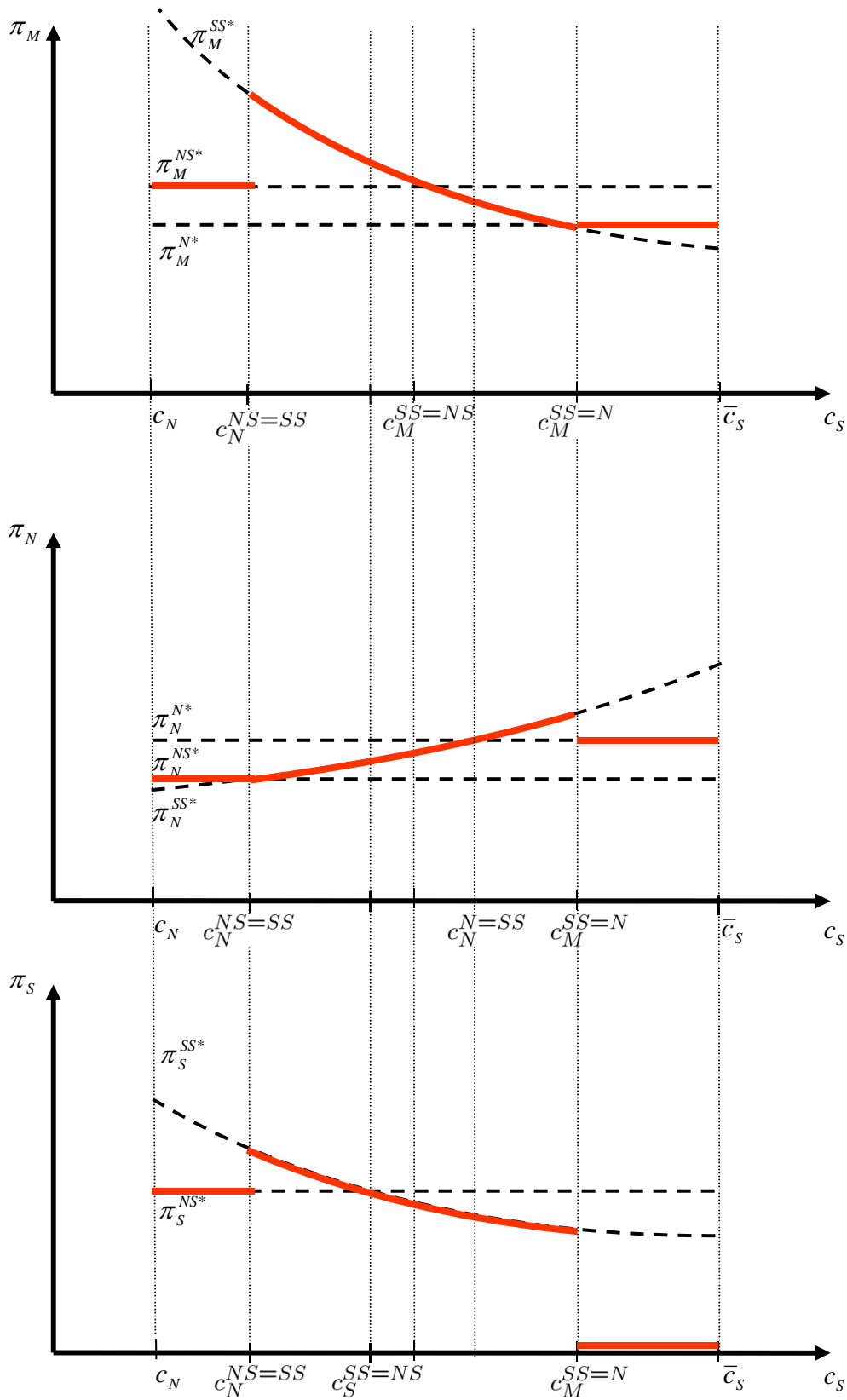


Figure 4: The incumbent case with Pareto gains