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Cross-border Merger, Vertical Structure, and Spatial Competition

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We look at the implications of a cross-border merger upstream in a vertically related industry where no downstream firm can produce all varieties demanded.

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1. Introduction

Our not so distant memory, of the merger boom of this millennium, recorded the value of worldwide mergers sky-rocketing to an all-time high nearly half of which was accounted by cross-border mergers[1]. While the current global crises have dampened this trend, there is a growing consensus[2] that "a new wave" of cross-border mergers will be triggered by the imminent exit of public funds from ailing industries in the immediate aftermath of the crises[3]. With this backdrop, in this paper, we extend[4] the work of Braid (2008) to demonstrate the effect of a cross-border merger between upstream firms on the equilibrium locations of downstream firms selling different varieties of a product.

2. Model and Propositions

Consider a vertically related[5] industry. Let there be two upstream firms, M at home and M^* in a foreign country, producing an intermediate good. Let there be two downstream firms, R at home and R^* in the foreign country, who transform (on a one-to-one basis) the intermediate good into the differentiated final goods and sell to consumers distributed uniformly with unit density on a uni-dimensional (linear) market interval with support [0, 1]. The downstream firms R and R^* are located at x and y, respectively, on this interval. R sells products U and W, and R^* sells products V and W: a fraction c of consumers want to buy product U; a fraction c of consumers want to buy product V; and a fraction b of consumers want to buy product W.[6] Transportation costs are td, where t is a constant and d is distance shipped. There is a maximum reservation price, denoted by k, that consumers (located in a third country) are willing to pay which is sufficiently large so that it comes into play only for product varieties where there is no competition between the two firms.

The game is played in three stages, with perfect monitoring i.e. all past actions become common knowledge at the end of each stage. In the first stage, M and M^* make a take-it-or-leave-it two-part tariff offer to R and R^* respectively: M's offer takes the form (w, F) and M^*'s offer takes the form (w^*, F^*) where w^0 is the marginal wholesale price and F^0 is the fixed fee extracted by an upstream firm from the downstream firm in each country. At the same time, R and R^* simultaneously choose their locations in the retail market. In the second stage, R and R^* simultaneously decide whether or not to accept or decline a contract. If R^0 decides to accept a contract offered, the fixed fee (F^0) is collected by M^0 at this stage. In the third stage, R and R^* engage in spatial price discrimination. In the final stage, quantities are demanded by consumers from the upstream firms at which time the wholesale price has to be paid for each unit that is ordered and then sold in the retail market to consumers.

As usual, the game is solved by backward induction. We can then make a comparison between the pre-merger and post-merger (where the upstream firms merge across borders) equilibria with spatial price discrimination. For expositional convenience, let

$$r = \frac{b}{4(b+c)}.$$

In the pre-merger autarkic equilibrium, each upstream firm will charge a wholesale price w^0 and a fixed fee F^0 that extracts all of the profits from each downstream firm. The profits of R, from selling varieties U and W, are

$$(1) \quad \Pi = \left(c(k-w) - \frac{ct}{2}\left[x^2 + (1-x)^2\right] \right) + \left(\int_0^x b[t(y-x) - w]dz + \int_x^{\left(\frac{x+y}{2}\right)} b[t(x+y-2z) - w]dz \right) - F$$

The profits of R^*, from selling varieties V and W, are

$$(2) \quad \Pi^* = \left(c(k - w^*) - \frac{ct}{2} \left[y^2 + (1-y)^2 \right] \right) + \left(\int_{\left(\frac{x+y}{2} \right)}^{y} b[t(x+y-2z) - w^*] dz + \int_{y}^{1} b[t(x-y) - w^*] dz \right) - F^*$$

Due to the symmetric structure of the game, $w = \tilde{w} = w^*$.

Solving the first order conditions for profit-maximization, we obtain

$$(3) \quad (x, y) = \left(\frac{\left(4c^2 + b^2 + 4bc \right) - b\tilde{w}(b+c)}{4\left(b^2 + 2c^2 + 3bc \right)}, \frac{\left(4c^2 + 3b^2 + 8bc \right) - b\tilde{w}(b+c)}{4\left(b^2 + 2c^2 + 3bc \right)} \right)$$
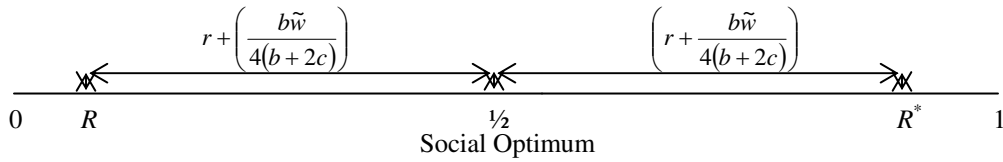

Figure 1. Downstream Location under Autarky

In the pre-merger free-trade equilibrium, the home and the foreign manufacturers of the intermediate good can each make only zero profits on its contract notwithstanding the vertical structure: $\left(w^0, F^0 \right) = (0,0)$. The intuition lies in the classic Bertrand model: under free trade, each upstream firm can always slightly undercut any contract which allows its rival to make a positive profit since upstream firms produce a homogeneous intermediate good and compete in (nonlinear) prices.

The profits of R, from selling varieties U and W, are

$$(4) \quad \Pi = \left(ck - \frac{ct}{2} \left[x^2 + (1-x)^2 \right] \right) + \left(\int_{0}^{x} b[t(y-x)] dz + \int_{x}^{\left(\frac{x+y}{2} \right)} b[t(x+y-2z)] dz \right)$$

The profits of R^*, from selling varieties V and W, are

(5) $\Pi^* = \left(ck - \dfrac{ct}{2}\left[y^2 + (1-y)^2 \right] \right) + \left(\displaystyle\int_{\left(\frac{x+y}{2}\right)}^{y} b\left[t(x+y-2z) \right]dz + \int_{y}^{1} b\left[t(x-y) \right]dz \right)$

Solving the first order conditions for profit-maximization, we obtain

(6) $(x, y) = \left(\dfrac{\left(4c^2 + b^2 + 4bc\right)}{4\left(b^2 + 2c^2 + 3bc\right)}, \dfrac{\left(4c^2 + 3b^2 + 8bc\right)}{4\left(b^2 + 2c^2 + 3bc\right)} \right)$
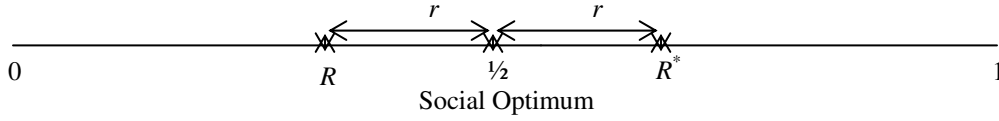

Figure 2. Downstream Location under Free Trade before Merger Upstream

This leads to our second proposition.[7]

Proposition II. Under free trade, the pre-merger Nash equilibrium locations of the two downstream firms, in a vertically related industry, is $\left[\dfrac{1}{2} \pm r \right]$.

If M and M^* merge, under free trade, the merged upstream firm ($\tilde{M}$) will charge a uniform wholesale price $\tilde{w}$ and a fixed fee $\tilde{F}$ that extracts all of the profits from each downstream firm. The profits of R, from selling varieties U and W, are

(7) $\Pi = \left(c(k - \tilde{w}) - \dfrac{ct}{2}\left[x^2 + (1-x)^2 \right] \right) + \left(\displaystyle\int_{0}^{x} b\left[t(y-x) - \tilde{w} \right]dz + \int_{x}^{\left(\frac{x+y}{2}\right)} b\left[t(x+y-2z) - \tilde{w} \right]dz \right) - \tilde{F}$

The profits of R^*, from selling varieties V and W, are

(8) $\Pi^* = \left(c(k - \tilde{w}) - \dfrac{ct}{2}\left[y^2 + (1-y)^2 \right] \right) + \left(\displaystyle\int_{\left(\frac{x+y}{2}\right)}^{y} b\left[t(x+y-2z) - \tilde{w} \right]dz + \int_{y}^{1} b\left[t(x-y) - \tilde{w} \right]dz \right) - \tilde{F}$

Solving the first order conditions for profit-maximization, we obtain

$$(9) \quad (x,y) = \left(\frac{\left(4c^2 + b^2 + 4bc\right) - b\widetilde{w}(b+c)}{4\left(b^2 + 2c^2 + 3bc\right)}, \frac{\left(4c^2 + 3b^2 + 8bc\right) - b\widetilde{w}(b+c)}{4\left(b^2 + 2c^2 + 3bc\right)} \right)$$
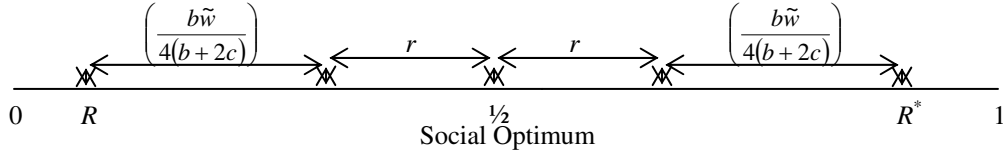
Figure 3. Downstream Location under Free Trade after Merger Upstream

This leads to our final proposition. [8]

Proposition III. The Nash equilibrium locations of the two downstream firms, in a vertically related industry, move to $\left[\dfrac{1}{2} \pm \left(r + \dfrac{b\widetilde{w}}{4(b+2c)}\right)\right]$ *after a cross-border merger upstream.* [9]

3. Conclusion

Our analysis is a natural follow up of continued efforts to assess the consequences of cross-border mergers in industries with a vertical structure[10]. Absent free trade, in a vertically related industry, the downstream firms will not choose the social optimum under spatial price discrimination when none of the downstream firms produce all the varieties that consumers demand. We show that free trade will induce the downstream firms to gravitate toward the social optimum but an upstream merger across borders, under free trade, will pull the downstream firms away from the social optimum back to their autarkic positions.

References

Amador, J., Cabral, S., 2009. Vertical specialization across the world: A relative measure. North American Journal of Economics and Finance 20, 267-80.

Arozamena, L., Weinschelbaum, F., 2009. Simultaneous vs. sequential price competition with incomplete information. Economics Letters 104, 23-26.

Beladi, H., Chakrabarti, A., Marjit, S., 2010a. Sequential spatial competition in vertically related industries with different product varieties, Economics Letters 106, 112-115.

Beladi, H., Chakrabarti, A., Marjit, S., 2010b. Cross-Border horizontal mergers in vertically related industries, *mimeo*.

Beladi, H., Chakrabarti, A., Marjit, S., 2008. Vertical mergers and downstream spatial competition with different product varieties, Economics Letters 101, 262-264.

Braid, R.M., 2008. Spatial price discrimination and the locations of firms with different product selections or product varieties. Economics Letters 98, 23-26.

Dasgupta, P., Maskin, E., 1986. The existence of equilibrium in discontinuous economic games, II: Applications. Review of Economic Studies 53, 27-41.

Haller, S. A., 2009. The impact of multinational entry on domestic market structure and investment. International Review of Economics and Finance 18, 52-62.

Hoover, E.M., 1937. Spatial price discrimination. Review of Economic Studies 4, 182-191.

Hotelling, H., 1929. Stability in competition. Economic Journal 39, 41-57.

Klomp, J., 2010. Causes of banking crises revisited. North American Journal of Economics and Finance 21, 72-87.

Kurata, H., Ohkawa, T., Okamura, M., 2009. Location choice, competition, and welfare in non-tradable service FDI. International Review of Economics and Finance 18, 20-25.

Lafontaine, F., Slade, M., 2007. Vertical Integration and firm boundaries: The evidence. Journal of Economic Literature 45, 629-85.

Lahiri, S., 2009. Foreign direct investment: An overview of issues. International Review of Economics and Finance 18, 1-2.

Lerner, A., Singer, H., 1937. Some notes on duopoly and spatial competition. Journal of Political Economy 45, 145-186.

Maskin, E., Riley, J. 1984. Optimal auctions with risk averse buyers. Econometrica 52, 1473-1518.

Neary, P., 2007. Cross-border mergers as instruments of comparative advantage. Review of Economic Studies 4, 182-191.

Raff, H. Ryan, M., Stähler, F., 2009. The choice of market entry mode: Greenfield investment, M&A and joint venture. International Review of Economics and Finance 18, 3-10.

Endnotes

[1] See Neary (2007) and Beladi et al. (2010b). Neary (2007) constructed the first general equilibrium model of cross-border mergers where he showed how trade liberalization can trigger international merger waves through bilateral mergers in which it is profitable for low-cost firms to buy out higher-cost foreign rivals. Beladi et al. (2010b) present a theoretical model to capture the role of the vertical structure, of an oligopolistic industry, in the incentives for and implications of cross-border horizontal mergers.

[2] *Source*: World Investment Prospects Survey (*WIPS*) 2009–2011.

[3] See Klomp (2010).

[4] Beladi et al. (2008) extended Braid (2008) to study the relationship between a company's vertical structure and its choice of location under conditions of spatial price discrimination in an industry where none of the downstream firms produce all varieties demanded by consumers. This was extended to a sequential game in Beladi et al. (2010a) which builds on the works of Maskin and Riley (1984) and Arozamena and Weinschelbaum (2009).

[5] See Amador and Cabral (2009).

[6] One can contemplate, following Braid (2007), an equivalent scenario where firm 1 sells product variety G, and firm 2 sells product variety H: a fraction c of consumers wants to buy only variety G; a fraction c of consumers wants to buy only variety H; and a fraction b of consumers is indifferent between varieties G and H. If each firm cannot price discriminate at each location between the different types of consumers who find its own variety desirable, then it might be possible to assume mixed price strategies, but unlike Dasgupta and Maskin (1986), who have a single mixed-strategy Nash equilibrium in mill prices for any given set of firm locations, there would be a different mixed-strategy Nash equilibrium in delivered prices at each consumer location for any given set of firm locations. We maintain that there is spatial price discrimination for product W of the sort first examined in Hoover (1937) and Lerner and Singer (1937), in which there is a Nash equilibrium in delivered price schedules.

[7] This replicates Braid's (2008) key proposition that the equilibrium locations of the products of the two downstream firms are partially centralized to the socially optimal if neither of the downstream firms can produce all varieties demanded.

[8] Our results are likely to have important implications for a firm's inter-temporal choice of entry mode. See, for instance, Haller (2009), Lahiri (2009), Kurata *et al*. (2009) and Raff *et al*. (2009).

[9] Analogous to Beladi *et al*. (2008), notwithstanding the vertical structure of the market, the downstream firms gravitate toward the social optimum if $b = 0$ (i.e. when, in the absence of any demand for W, the downstream firms are reduced to spatial-price-discriminating monopolists choosing uniform delivered prices). This replicates the equilibrium one would expect, á la Hotelling (1929), in the market for a homogeneous product where the (mill) prices of the two firms are exogenous and equal, and consumers pay travel costs.

[10] See Lafontaine and Slade (2007) for an insightful review of the contributions relevant to the related literature.