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E C O N O M I C S   B U L L E T I N

Market integration in network industries

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Abstract

What is the effect of product market integration on the market equilibrium in the presence of international network externalities in consumption? To address this question, we set up a spatial two-country model and we find that the economic forces at work may have an ambiguous effect on prices.

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1 Introduction

European integration and its economic implications constitute important and debated issues. In the general literature, product market integration has been interpreted as a reduction in costs associated with international trade (e.g., transport costs, tariffs, information costs about foreign markets, etc.). More integrated product markets would reduce firms' power and make markets more competitive. As it is widely recognized, and remarked in a recent speech by Jean-Claude Trichet, President of the ECB, "economic integration benefits consumers through lower prices" (Berlin, 13 June 2007).[1] In this short note, we show that once one takes into account goods characterized by "international" network externalities, this need not be the case.

International network externalities arise when consumer's utility increases with the number of consumers adopting the same good or compatible goods regardless of whether they live in their own country or abroad.[2] Indeed, market integration affects not only "traditional" trade barriers but also less visible non-tariff barriers, such as the proportion of foreign network that consumers of one country can enjoy. Namely, international network externalities can be *partial* because of trade policy reasons (where international standardization constitutes a key instrument),[3] or because of technical reasons linked to the good of interest.

Accordingly, we address the following question: what is the effect of product market integration on the market equilibrium in the presence of international network externalities in consumption? We set up a spatial two-country model with two network goods (one per country) and consumers with heterogenous preferences for the local (foreign) good. We find that the economic forces at work may have an ambiguous effect on prices.

As far as we know, there are a few studies about international trade in the presence of consumption externalities. Janeba (2007) studies the benefits from free trade in the context of consumption externalities via a general equilibrium two country-model with perfectly competitive markets. Iwasa and Kikuchi (2007) develop a

[1] http://www.ecb.int/press/key/date/2007/html/sp070613.en.html.

[2] There is a substantial amount of literature on network externalities. The seminal paper is Katz and Shapiro (1985).

[3] Gandal and Shy (2001) study governments' incentives to recognize foreign standards in the presence of network effects and conversion costs.

two-country model with incompatible country-specific hardware technologies which is an extension of Gandal and Shy (1992) closed-economy model. In particular, they study the software provision decision of software firms to hardware firms. Their work thus deals with firms' strategies towards vertically related firms, whereas we focus on horizontal competitors.

2 Model

As far as the *supply side* is concerned, suppose that firm A, installed in country 1, produces network good A and charges price p_A; firm B, installed in country 2, produces network good B and charges price p_B. These two network goods are compatible, that is consumers adopting good A benefit from the number of consumers buying good A as well as from the number of consumers buying good B. Nevertheless, the network effect coming from consumers living abroad is only partial as long as markets are not fully integrated. Product market integration implies cost reductions that we model via an increase in the network effect. As an example, we think of *mobile communication services*. A network operator providing this kind of service usually allows you to communicate with both consumers adopting the same operator and consumers adopting a rival operator regardless of where the consumers live. In other words, we can say that these services are compatible. However, living in one country and communicating with people abroad via a mobile phone is far more expensive than calling people in the same country. The network operator, through roaming agreements which allow it to use the foreign network, can provide its customers abroad with the service. Thanks to market integration, these costs are progressively decreasing. For example, in the European Union, the Regulation on roaming charges within the European Union which is in force since June 30, 2007, is forcing service providers to lower their roaming fees across the 27-member bloc. The new tariffs will be applied by September 30, 2007. Moreover, it has been planned that these “Eurotariffs" will gradually decrease over the next three years.[4]

As for the *demand side*, we assume that each country has a continuum of consumers of mass n indexed by x which are uniformly distributed along the interval $[0, 1]$. Each consumer has a unit demand and can buy either good A or good B. In a standard way, the utility coming from consumption depends on the intrinsic

[4] http://ec.europa.eu/information_society/activities/roaming/roaming_regulation/index_en.htm.

benefit of the good, on the network effect, on the price and on some trade costs to buy the foreign good. Consumers differ in their valuation of the intrinsic benefit as well as in their valuation of the network benefit. In particular, consumers which are "foreign brand-oriented" value little the (intrinsic and network) benefit from buying the local good and viceversa consumers which are "local brand-oriented" value little the (intrinsic and network) benefit from buying the foreign good. We also assume that the degree of product market integration between the two countries affects consumers' utility in three ways: through the intrinsic benefit, the network benefit as well as through the trade costs. Namely, let n_1 and n_2 denote the number of buyers (of either good) in country 1 and 2, respectively. Obviously, $n_i \leq n$, for $i = 1, 2$. A consumer buys at most one good and purchases either one or no unit of any given good. Define $\delta \geq 0$ our inverse measure of product market integration: as δ approaches zero markets become more integrated. The utility of consumer $x \in [0, 1]$ living in country 1 is given by:

$$U^1(x) = \begin{cases} \overline{u} - c(\delta)\, x + \beta\,(n_1 + \gamma(\delta)\, n_2)(1 - x) - p_A & \text{if he buys good } A, \\ \overline{u} - c(\delta)(1 - x) + \beta\,(n_1 + \gamma(\delta)\, n_2)\, x - t(\delta) - p_B & \text{if he buys good } B, \\ 0 & \text{if he buys nothing.} \end{cases}$$

Similarly, the utility of consumer x living in country 2 is:

$$U^2(x) = \begin{cases} \overline{u} - c(\delta)\, x + \beta\,(n_2 + \gamma(\delta)\, n_1)(1 - x) - p_B & \text{if he buys good } B, \\ \overline{u} - c(\delta)(1 - x) + \beta\,(n_2 + \gamma(\delta)\, n_1)\, x - t(\delta) - p_A & \text{if he buys good } A, \\ 0 & \text{if he buys nothing.} \end{cases}$$

Thus, $x \in [0, 1]$ measures the consumer's valuation of the foreign good. A high consumer type ($x \to 1$) is "foreign brand-oriented"; on the other hand, a low consumer type ($x \to 0$) is "local brand-oriented". Notice that indeed consumers living closer the border may prefer a foreign good since they are likely to have more connections with foreign residents.[5]

As far as the *intrinsic benefit* is concerned, a consumer living in country 1 (in country 2) has a utility of $\overline{u} - c(\delta)\, x$, if he buys the good A (B) produced in his country, and a utility of $\overline{u} - c(\delta)(1 - x)$, if he buys the good B (or A) produced in the other country. The intrinsic benefit increases with product market integration (i.e., $c'(\delta) > 0$): the more the two countries are integrated, the higher the quality

[5] Think of people living in Trentino (an Italian region located in the extreme north) versus people living in Sicily (extreme south).

of mobile phones because of a higher mobility of high skilled workers (experts in the field).[6] In order to purchase the foreign good, a consumer has to bear the additional cost $t(\delta)$ which is a function of the degree of product market integration and represents the level of administrative costs for buying abroad. We posit $t(\delta) \geq 0$ and $t'(\delta) \geq 0$.

As for the *network benefit*, a consumer living in country $i = \{1, 2\}$ and buying good $l = \{A, B\}$ has a utility of $\beta(n_i + n_j\gamma(\delta))(1 - x)$, if he buys the local good l, and a utility of $\beta(n_i + \gamma(\delta) n_j) x$, if he buys the foreign good (with $j \neq i$ and $j = \{1, 2\}$). $\gamma(\delta) \in (0, 1)$ is the proportion of foreign network that a consumer can enjoy; it depends on product market integration: $\gamma'(\delta) < 0$. The parameter $\beta \geq 0$ measures the importance of the network size effect for consumers. Therefore, the network benefit also increases with product market integration: the more markets are integrated the more consumers of one country benefit from the number of consumers of the other country adopting the same network good or compatible goods. If we think again of the mobile communication services example, product market integration reduces the roaming costs and in turn makes the network benefit higher. Also, market integration makes more accessible to consumers complementary products, like post-purchase services.

Overall, consumer's utility is increasing in product market integration.

2.1 Demands

In order to solve the model, we assume that the market is fully covered, i.e., $\overline{u}$ is large enough so that each consumer buys one unit of either good.[7] Formally, market coverage means that $n_1 = n_2 = n$. We first analyze the *decision problem of consumers* which choose between the goods maximizing their net surplus (for any level of prices). In this maximization problem they take as given the decisions of the other consumers.

In each country, consumer type x buys the local good l rather than the foreign good k if and only if $U_l^i(x) \geq U_k^i(x)$. Solving this inequality for both countries, we determine the indifferent consumer in country 1 and 2, denoted by x_{1A}^C and x_{2B}^C,

[6] We could think of $c(\delta)$ as a learning cost which decreases with product market integration and in turn makes higher the intrinsic benefit of the good.

[7] We assume that $\overline{u} - c(\delta)$ approaches zero: consumer type $x = 1$ never prefers the local over the foreign good.

respectively:

$$U_A^1(x) - U_B^1(x) \geq 0 \Leftrightarrow x \leq \frac{1}{2} + \frac{t(\delta) + (p_B - p_A)}{2(\beta n(1+\gamma(\delta)) + c(\delta))} \equiv x_{1A}^C,$$
$$U_A^2(x) - U_B^2(x) \geq 0 \Leftrightarrow x \geq \frac{1}{2} + \frac{t(\delta) + (p_A - p_B)}{2(\beta n(1+\gamma(\delta)) + c(\delta))} \equiv x_{2B}^C.$$

In words, in country 1, consumer types $x \in \left[0, x_{1A}^C\right]$ prefer the local good A and in contrast consumer types $x \in (x_{1A}^C, 1]$ prefer the foreign good B. Similarly, in country 2, consumer types $x \in \left[0, x_{2B}^C\right]$ prefer the local good B and consumer types $x \in (x_{2B}^C, 1]$ prefer the foreign good A.[8] We can thus find the total demands for the two goods, say q_A and q_B, as the sum of the demands in the two countries:[9]

$$q_A = n\left(x_{1A}^C + 1 - x_{2B}^C\right) = n\left(1 + \frac{(p_B - p_A)}{n\beta(1+\gamma(\delta)) + c(\delta)}\right),$$
$$q_B = n\left(x_{2B}^C + 1 - x_{1A}^C\right) = n\left(1 + \frac{(p_A - p_B)}{n\beta(1+\gamma(\delta)) + c(\delta)}\right).$$

As we can see from the expressions above, quantities are independent of the administrative costs $t(\delta)$ as they are the same in both countries. Moreover, at the same price, $p = p_A = p_B$, both firms enjoy a positive demand, in particular, $q_A = q_B = n > 0$ because of the presence of horizontal differentiation.[10] We can also reasonably assume that the demand for the local good increases with δ, as a result, there will exist an upperbound for δ, that is the degree of product market integration at which countries are perfectly separated, i.e. $x_{1A}^C = x_{2B}^C = 1$.

2.2 Price competition

Let Π_l be the profit of firm $l = \{A, B\}$. Both firms are producing without incurring any production cost. Then, firm l's maximization problem becomes: $\max_{p_l} \Pi_l =$

[8] As in most "location" models, goods should be sufficiently differentiated in order to have interior equilibria. In particular, we here focus on the market coverage case and so we have: x_{1A}^C and x_{2A}^C belong to the interval $[0,1]$ if $p_A - p_B \in [t(\delta) - (\beta n(1+\gamma(\delta)) + c(\delta)), (\beta n(1+\gamma(\delta)) + c(\delta)) - t(\delta)]$, which is a non-empty interval if $c(\delta) > t(\delta) - \beta n(1+\gamma(\delta))$.

[9] We rule out market segmentation which means that the price of each brand is the same anywhere in the world.

[10] This does not mean that there is no trade when prices are equal. Indeed, if $(p_B - p_A) = 0$, we obtain that $x_{1A}^C = x_{2B}^C = x_l^C \leq 1 \Leftrightarrow t(\delta) < (\beta n(1+\gamma(\delta)) + c(\delta))$ which means that trade occurs as long as trade costs are sufficiently low.

$\max_{p_l} p_l q_l$. This optimization problem results in the following equilibrium prices and quantities:

$$p_A^C = p_B^C = p^C = c(\delta) + \beta n (1 + \gamma(\delta)),$$
$$q_A^C = q_B^C = q^C = n.$$

As in a standard linear city model, the price positively depends on what we can interpret to be the transportation cost, $c(\delta)$. However, it also depends on the network effect. We have that $\partial p^C / \partial \delta \geq 0 \Leftrightarrow c'(\delta) \geq -\beta n \gamma'(\delta)$.

Proposition 1 *When consumers have heterogeneous preferences towards a local and a foreign good, an increase in market integration has an ambiguous effect on prices in presence of international network externalities. The higher (smaller) β is the more likely an increase in market integration will increase (decrease) prices.*

Thus, product market integration has an ambiguous effect on equilibrium prices due to the presence of two opposite forces: $c'(\delta) > 0$ and $\gamma'(\delta) < 0$. As markets become more separated, on the one hand, firms' market power increases so that they can set higher prices; on the other hand, the reduction in network benefit induces consumers to value less both goods, that is their willingness to pay decreases which in turn has a negative effect on prices.

3 Concluding comments

We have shown that market integration may have an ambiguous effect on prices in presence of international network externalities. This result depends on the assumption about the compatibility between the local and foreign good. This is reasonable if we think of mobile phones: they allow you to communicate with both consumers adopting the same operator and consumers adopting a rival operator. However, this result does not hold under *incompatible goods*. Indeed, developing the same model as before but assuming that what matters for consumers' choice is only the number of users choosing the same good in both countries, it can be shown that, the price only depends on $c(\delta)$ and the effect of δ is then clearly positive. Comparing compatible vs incompatible goods, we can make the following remarks. As far as the equilibrium variables are concerned, the important difference is that when goods are compatible, the *network size* is the same for both goods, as a result the network has a positive effect on their values for consumers and in turn a positive effect on their prices, which indeed are increasing in β. On the other hand, when goods are not compatible, competition is tougher because firms try to conquer as many consumers as possible in order to get a higher network than the rival firm and in turn more consumers which, for a given intrinsic benefit, value just their own network size. As a consequence, firms price their good at the lowest possible value, i.e. as if $\beta = 0$.

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