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Strategic investment and industry location in a footloose capital model of economic geography

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Abstract

This paper examines how strategic investment of capitalists affects the industry location in a footloose capital model. We show that the home market effect is robust but is moderated when capitalists strategically invest. That is, the industry location is closer to dispersion when capitalists are strategic than when they are atomic.

JEL classification: F12, R12

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1 Introduction

The footloose capital (FC) model of Martin and Rogers (1995) is a workhorse in New Economic Geography (NEG).¹ Due to its tractability, many fields such as international trade, environmental economics and public economics apply the FC model. This model assumes that capitalists take the capital reward as given, and invest all their capital into the country with the highest reward. This paper discusses this assumption carefully at least for two reasons. First, there is evidence that the capital market is concentrated. Li et al. (2011), for example, report that large foreign shareholders stabilize the stock return in emerging economies. And, Cetorelli et al. (2007) document that concentration in most global over-the-counter (OTC) derivatives markets is rising. Second, it is extreme that capitalists invest their capital into only one country. Risk-averse capitalists diversify portfolio.²

We examine the implication of the imperfectly competitive capital market for industry location. Concretely, we introduce strategic capitalists into the FC model with homogeneous Cournot competition.³ We show that the home market effect is robust, but moderated by the strategic investment. Our conclusion is that the imperfectly competitive capital market does not qualitatively affect the key insight in the FC model, but quantitatively affects it. In other words, the implication in the existing literature continues to be useful even for the case of strategic investment.

This paper belongs to the literature that enriches NEG. Baldwin et al. (2003, pp. 286-294) consider the implication of costly capital movement for the price-lowering protection in the monopolistically competitive FC model. Behrens et al. (2009) examine the implication of the oligopolistic transport industry for industry location in a footloose entrepreneur model. Behrens et al. (2014) show that the results in the core-periphery model survive imperfect competition in the numeraire good sector.

This paper is organized as follows. Section 2 proves the main result. Section 3 concludes.

¹See Baldwin et al. (2003).

²See, for example, Knill (2009) and Bartkus and Hassan (2009) for empirics.

³While NEG usually assumes a monopolistically competitive good market, Ludema and Wooton (2000), Haufler and Wooton (2010) and Thisse (2010) use a homogeneous good Cournot model.

2 Analysis

We extend Hauffer and Wooton's (2010) model. There are θL consumers in Home and $(1 - \theta)L$ consumers in Foreign, where L is the mass of world consumers, and $\theta \in (0, 1)$ is the population share of Home. Each consumer inelastically supplies one unit of labor. One unit of the numeraire good requires one unit of labor. Thus, the wage rate is fixed to one in both countries. The non-numeraire good market is segmented, and exporting incurs per-unit trade cost $\tau > 0$. In Home (resp. Foreign), n (resp. n^*) identical firms produce a homogeneous good, and supply to domestic and foreign consumers. Denote by x_i and x_i^* (resp. y_i and y_i^*) the supply of firm i in Home (resp. Foreign) into the Home and Foreign markets. Then, the inverse demand function of Home and Foreign is given by

$$p = a - \frac{\sum_{i=1}^n x_i + \sum_{i=1}^{n^*} y_i}{\theta L}, \quad p^* = a - \frac{\sum_{i=1}^n x_i^* + \sum_{i=1}^{n^*} y_i^*}{(1 - \theta)L}, \quad a > 0,$$

where p and p^* are the good price in Home and Foreign, respectively.⁴

One unit of capital is needed to set up one firm. Let c be marginal labor requirement and r (resp. r^*) be capital rental in Home (resp. Foreign). Then, firm i in Home (resp. Foreign) chooses x_i and x_i^* (resp. y_i and y_i^*) to maximize profit $(p - c)x_i + (p^* - c - \tau)x_i^* - r$ (resp. $(p - c - \tau)y_i + (p^* - c)y_i^* - r^*$). The symmetric Cournot equilibrium outputs are

$$x = \frac{(\tau n^* + \alpha)\theta L}{n + n^* + 1}, \quad y = \frac{(-\tau n + \alpha - \tau)\theta L}{n + n^* + 1}, \quad x^* = \frac{(-\tau n^* + \alpha - \tau)(1 - \theta)L}{n + n^* + 1}, \quad y^* = \frac{(\tau n + \alpha)(1 - \theta)L}{n + n^* + 1}. \quad (1)$$

Capital rentals are determined by the zero profit condition as follows.

$$r = \frac{x^2}{\theta L} + \frac{x^{*2}}{(1 - \theta)L} = \frac{(\tau n^* + \alpha)^2 \theta L + (-\tau n^* + \alpha - \tau)^2 (1 - \theta)L}{(n + n^* + 1)^2} \quad (2)$$

$$r^* = \frac{y^2}{\theta L} + \frac{y^{*2}}{(1 - \theta)L} = \frac{(-\tau n + \alpha - \tau)^2 \theta L}{(K + 1)^2} + \frac{(\tau n + \alpha)^2 (1 - \theta)L}{(n + n^* + 1)^2}. \quad (3)$$

In the existing NEG, capitalists take capital rentals as given, and invest all their capital into the country with the higher capital reward. Instead, we assume strategic investment

⁴This inverse demand function is derived from the individual utility function $u = aq - q^2/2 + q_0$, where u is utility, q is consumption of the non-numeraire good, and q_0 is consumption of the numeraire good.

as follows. A third country has a capital endowment K and m identical capitalists, each owning K/m amount of capital. Denoting the investment by capitalist j into Home and Foreign by k_j and k_j^* , respectively, it holds that $k_j + k_j^* = K/m$, $n = \sum_{j=1}^m k_j$, $n^* = \sum_{j=1}^m k_j^*$ and $n + n^* = K$. Capitalist j determines the investment levels by taking into account (2), (3) and these equalities. Then, capitalist j 's problem and the resulting first-order condition are given by⁵

$$\begin{aligned} \max_{k_j} \quad & rk_j + r^* \left(\frac{K}{m} - k_j \right) \\ 0 = \quad & r - r^* + k_j \frac{\partial r}{\partial k_j} + \left(\frac{K}{m} - k_j \right) \frac{\partial r^*}{\partial k_j}. \end{aligned} \quad (4)$$

The system of the first-order conditions yields the symmetric Nash equilibrium investment:

$$k = \frac{2(2\theta - 1)[m(K + 1) - K]\alpha + \{m(K + 1)^2 - 2\theta[m(K + 1) - K]\} \tau}{2m[(m + 1)(K + 1) - K]\tau}.$$

Therefore, the share of Home firms $\lambda \equiv n/K = mk/K$ is

$$\lambda = \frac{2(2\theta - 1)[m(K + 1) - K]\alpha + \{m(K + 1)^2 - 2\theta[m(K + 1) - K]\} \tau}{2K[(m + 1)(K + 1) - K]\tau}. \quad (5)$$

From (5), we have the main result.

Proposition. *When the capital market is imperfectly competitive, the home market effect is moderated and the industry location is more dispersed.*

Proof. Assume $\theta > 1/2$. Contracting θ from λ in (5), we have

$$\lambda - \theta = \frac{(2\theta - 1)\{2[m(K + 1) - K]\alpha - m(K + 1)^2\tau\}}{2K[(m + 1)(K + 1) - K]\tau} > 0,$$

which confirms the home market effect: the share of Home firms is larger than the share of Home consumers.

Next, differentiating (5) with respect to m yields

$$\frac{d\lambda}{dm} = \frac{(2\theta - 1)(2\alpha - \tau)(K + 1)^2}{2\tau k[(m + 1)(K + 1) - K]} > 0.$$

⁵The second-order condition is satisfied because the objective function is strictly concave in k_j .

Hence, as the capital market is more imperfectly competitive (m falls), λ decreases. The same observation applies to the case of $\theta < 1/2$ by reversing the above argument. Hence, we reach Proposition. ||

Figure 1 illustrates this result when $\theta > 1/2$. The locus gives the right-hand side of (4).⁶ The spatial equilibrium is point E at which $\lambda > \theta > 1/2$ holds. As capitalists have market power (m falls), this locus shifts downward, and hence the spatial equilibrium value of λ falls.

(Figure 1 here)

The intuition behind Proposition is similar to the Cournot oligopoly model and as follows. Suppose that capitalist j raises k_j unilaterally. Then, she marginally increases revenue by r , but decreases revenue by $(\partial r/\partial k_j)k_j$. In other words, marginal revenue of investment decreases as capitalists have stronger market power. Therefore, each capitalist invests less when the capital market is imperfectly competitive than it is perfectly competitive. This is why strategic investment moderates the home market effect. However, we stress that the insight from the existing FC model is still useful: firms agglomerate into the country with the large share of consumers more than proportionally.

3 Conclusion

In order to incorporate evidence that the capital market is concentrated, we have explored the implication of strategic investment in an FC model of NEG. We demonstrate that market power of capitalists moderates the home market effect although it still holds. That is, the agglomeration pattern qualitatively is the same both in perfectly and imperfectly competitive capital markets. We finally note that this result rests on the assumption of costless investment. It is worth reconsidering our result by incorporating costly investment as Baldwin et al. (2003) address.

⁶The locus is negatively-sloped because the capitalist's objective function is strictly concave in k_j .

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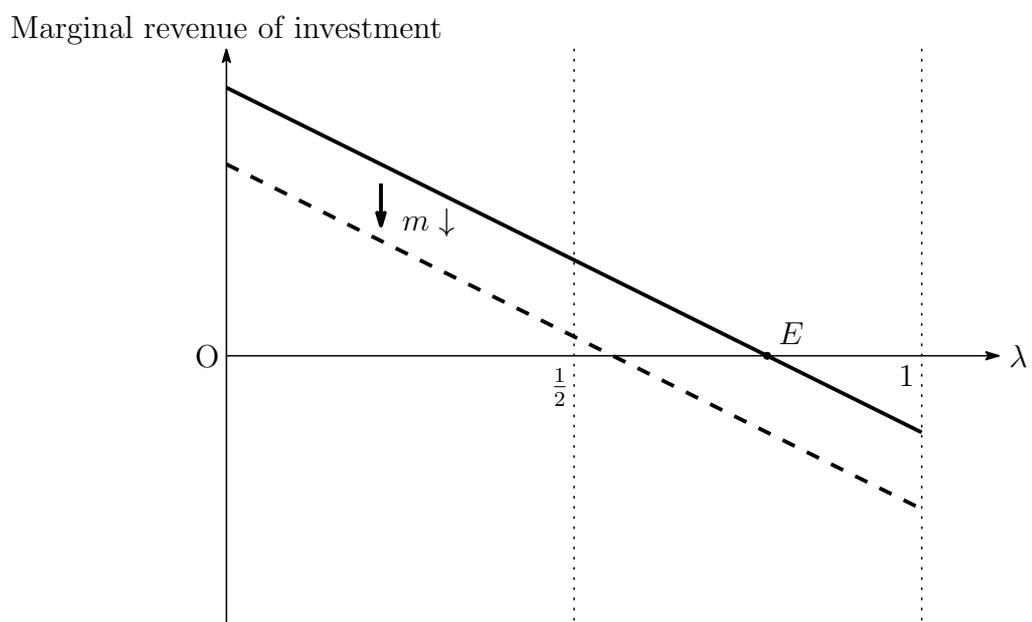


Figure 1: Effect of strategic investment on location ($\theta > 1/2$)