Letter

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Social Efficiency of Entry in an Open Economy

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Abstract: We show that cost asymmetry between the domestic and foreign firms is not necessary for the occurrence of insufficient entry in the domestic country. This result provides a rationale for pro-competitive domestic policies even in the absence of cost asymmetries among the domestic and foreign firms. However, if significant demand comes from foreign countries, and the market structures are determined endogenously in the domestic and foreign countries, domestic-entry in an open economy might not be insufficient, implying that foreign competition might not reduce the importance of anti-competitive domestic policies.

Keywords: excessive entry, foreign competition, insufficient entry

JEL Classifications: F12, L13, L40

1 Introduction

The seminal paper by Mankiw and Whinston (1986), which showed that entry is socially excessive[1] in oligopolistic industries with scale economies due to the "business stealing" effect, created huge interest to uncover the welfare effects of

1 Entry is socially excessive (insufficient) if the free entry equilibrium number of firms is more (less) than the welfare maximising number of firms.

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entry in imperfectly competitive markets.[2] The "excess-entry theorem" provides a rationale for anti-competitive entry regulation policies. However, in oligopolistic industries with scale economies, a strong "business creation" effect makes entry socially insufficient by dominating the business stealing effect and encourages policy makers to adopt pro-competitive policies (De Pinto and Goerke 2020; Ghosh and Morita 2007a, 2007b; Mukherjee 2010, 2012a).[3]

Marjit and Mukherjee (2013) show that even if there is no business creation effect at the industry level, entry of domestic firms can be insufficient for the domestic country in an open economy, if the domestic firms are more cost inefficient than the foreign firms. Hence, they suggest that pro-competitive policies are more likely to be beneficial for the countries facing competition from more cost efficient foreign firms, which is common in today's globalised world where many developing countries are opening up their economies and their domestic firms are facing competition from more cost efficient foreign developed-country firms.

This paper contributes to the literature on social efficiency of entry in an open economy in two ways. First, we show that cost asymmetry between the domestic and foreign firms is not necessary for insufficient entry in an open economy. Second, domestic-entry in an open economy might not be insufficient, implying that foreign competition might not reduce the importance of anti-competitive domestic policies, if significant demand comes from foreign countries, and the market structures are determined endogenously in the domestic and foreign countries.

In what follows, Section 2 considers an economy with free entry of domestic firms and a given number of foreign firms. This may happen when some foreign firms invented technologies to produce a new product and domestic firms can enter the market through non-infringing imitation of the foreign technologies. This is in line with Marjit and Mukherjee (2013) and follows the basic idea of product cycle where new technologies are invented in the developed countries and later flow to the developing countries, often through imitation by the developing-country firms (see, e.g. Glass 1997; Grossman and Helpman 1991; Vernon 1966). Considering symmetric firms and competition in a domestic country, we show that if the number of foreign firms is more than the number of domestic firms,

2 For a representative sample, see Von Weizsäcker (1980), Suzumura and Kiyono (1987), Okuno-Fujiwara and Suzumura (1993), Anderson, de Palma, and Nesterov (1995), Ghosh and Morita (2007a, 2007b), Ghosh and Saha (2007), Stähler and Upmann (2008), Mukherjee (2012a, 2012b), Marjit and Mukherjee (2013), Amir, Castro, and Koutsougeras (2014), Basak and Mukherjee (2016) and De Pinto and Goerke (2019).

3 Even if there is a business stealing effect, entry can be insufficient in the presence of differentiated goods (see, e.g. Mankiw and Whinston 1986, Kendall and Tsui 2011; Gu and Wenzel 2012).

entry of domestic firms can be socially insufficient for the domestic country. Thus, we show that cost asymmetry is not necessary for insufficient domestic entry in the presence of foreign competition. Hence, there can be a rationale for pro-competitive domestic policies even in the absence of cost asymmetries among the domestic and foreign firms.

Entry of the domestic firms creates several effects on domestic welfare. First, a new domestic firm tends to increase domestic welfare through its gross profit. Second, a new domestic firm tends to reduce domestic welfare by stealing business from the existing domestic firms, thus creating a business stealing effect. Since the gross profits of the domestic firms are equal to the entry costs at the free entry equilibrium, the business stealing effect tends to reduce domestic welfare. These effects are similar to the effects discussed in Mankiw and Whinston (1986).[4] However, there is a third effect in our analysis. A new domestic firm tends to increase domestic welfare by extracting profits from the foreign firms, which is a leakage from domestic welfare. If the number of foreign firms is sufficiently more than the free entry equilibrium number of domestic firms, this rent extraction effect dominates the other effects and entry is socially insufficient for the domestic country. Hence, in contrast to Marjit and Mukherjee (2013), where cost asymmetry was affecting the rent extraction effect, the relative number of domestic and foreign firms is affecting it in this paper.

We extend our analysis in Section 3. Subsection 3.1 shows that domestic entry may not be socially insufficient for the domestic country even in the presence of foreign competition if significant demands come from foreign citizens. The analysis of Subsection 3.2 shows that exports by the domestic firms increase the possibility of excessive entry in the domestic country. Subsection 3.3 shows that domestic entry is excessive under symmetric free entry equilibrium in the domestic and foreign countries when the firms sell to both domestic and foreign countries. Hence, the importance of anti-competitive domestic policies might not be reduced at all in an open economy under significant consumption by the foreign citizens (as shown in Subsection 3.1) and under symmetric endogenous market structures in the domestic and foreign countries (as shown in Subsection 3.3). These aspects are absent in Marjit and Mukherjee (2013).

Our paper is related to Stähler and Upmann (2008), which analyse simultaneous entry regulation policies in domestic and foreign countries (i.e. allowing free entry or limiting the maximum number of firms in each country's jurisdiction) under *simultaneous endogenous entry of foreign and domestic firms*. A major

4 Some of the surplus following the entry of a new domestic firm will also be captured by the consumers. However, this will not be a first-order effect. See, Mankiw and Whinston (1986) or Ghosh and Morita (2007b).

difference between our paper and Stähler and Upmann (2008) is the market structure considered in these papers. While they consider *simultaneous endogenous entry of foreign and domestic firms*, we consider a *fixed number of foreign firms, which is in the market prior to the entry decisions of the domestic firms*.

Hence, all the potential foreign and domestic firms in Stähler and Upmann (2008) have access to the production technologies and can take the entry decisions simultaneously, while the government of a country can choose the number of firms in its jurisdiction to deter entry of firms from other countries. In contrast, our analysis with a fixed number of foreign firms considers a situation like a product cycle where some foreign developed-country firms invented new technologies and entered the market prior to the entry decisions of the domestic developing-country firms, which can imitate the foreign technologies due to lower imitation (or opportunity) costs or relatively weak patent system in the domestic country. However, no foreign developed-country non-innovators find imitating these technologies economically viable due to higher imitation (or opportunity) costs or a strong patent system in the foreign country. Since the foreign innovators are already in the market, the domestic country in our analysis cannot deter entry of the foreign firms by controlling the number of domestic firms.

Our results differ from Stähler and Upmann (2008), which show that if the firms have the same costs, which is comparable to our situation, *competition for firms between countries leads to excessive entry*. In contrast, we show the situations where entry in the domestic country *can be insufficient*, implying that the domestic government may need to take pro-competitive entry policies.

Our analysis with free entry in both countries can be considered similar to Stähler and Upmann (2008) but with segmented markets, while they consider an integrated market. Our result in this situation is similar to theirs, showing excessive entry in the domestic country.

In an early paper, Richardson (1999) shows the effects of trade policies on the welfare maximising number of firms. However, that paper did not consider free entry of firms and therefore, did not address the question of excessive or insufficient entry.

Ghosh, Lim, and Morita (2010) show how social efficiency of entry in the domestic country is affected by *trade policies* – voluntary export restraints, which fix the total outputs of the foreign firms, and tariff protection. In contrast, we consider social efficiency of domestic entry under *free trade*, i.e. with no voluntary export restraints and no tariffs, and show how the number of foreign firms, consumption by foreign citizens, and selling in both countries affect social efficiency of domestic entry. Although after some adjustments one may deduce from Ghosh, Lim, and Morita (2010) the implications of the relative number of domestic and

foreign firms shown in our paper, the implications of the consumption by foreign citizens and selling in both countries are absent in Ghosh, Lim, and Morita (2010).

Further, Ghosh, Lim, and Morita (2010) show under free trade that if there is free entry of domestic and foreign firms and the products of the domestic firms are *differentiated* from the products of the foreign firms, entry in the domestic country is always insufficient. In contrast, we show under free entry of domestic and foreign firms with *homogeneous* products that domestic entry is socially excessive. Hence, as mentioned above, our result under free entry in both countries are similar to Stähler and Upmann (2008) but it is different from Ghosh, Lim, and Morita (2010).

The remainder of the paper is organised as follows. Section 2 describes the model and derives the result. Section 3 extends the analysis to show the implications of consumption by foreign citizens, selling to domestic and foreign countries, and symmetric endogenous entry in domestic and foreign countries. Section 4 concludes.

2 The Model and the Results

There are two countries – domestic and foreign. Consider the domestic country as a developing country and the foreign country as a developed country, which will fit well with the description of our model.

Assume that there is a finite number of foreign firms, $m \geq 1$, which invented technologies to produce a product. These firms are highly productive so that they find exporting to the domestic country profitable. It is well-known in the international trade literature that, due to the fixed cost of exporting,[5] high productive firms find exporting to other countries profitable, low productive firms sell to their own countries only and the least productive firms exit the market (Melitz 2003). Appealing to that literature, we consider that m foreign firms are highly productive and find exporting to the domestic country profitable. For simplicity, we normalise the fixed cost of exporting for these firms to zero. If the fixed cost of exporting is lower than the domestic firm's cost of entry (discussed below), our analysis will go through. Assume that the marginal cost of each foreign firm is c.

There is a large number of potential domestic firms, which can enter the domestic market by incurring a fixed entry cost, K, that may be due to the investment in non-infringing imitation of the foreign technologies.[6] If a domestic firm enters the market, like the foreign firms, it can produce the product at the marginal

5 See Das, Roberts, and Tybout (2007) for fixed cost of exporting.

6 Patent reforms in developing countries not necessarily eliminate imitation but raise the costs of imitation (Lai and Qiu 2004; Yang and Maskus 2009). Like the domestic firms, there may be

cost of production c. We consider the same marginal costs for the domestic and foreign firms to eliminate the effects of cost asymmetry shown in Marjit and Mukherjee (2013).

The number of domestic firms entering the market is determined endogenously through the zero profit condition, i.e. the domestic firms enter as long as the net profit of a domestic firm is non-negative. Thus, we ignore the integer constraint that helps to eliminate the reason for insufficient entry shown in Mankiw and Whinston (1986).

Assume that the domestic and foreign firms compete in the domestic country like homogeneous Cournot oligopolists. The consideration of homogeneous products helps to eliminate the reason for insufficient entry created by product differentiation, as discussed in Mankiw and Whinston (1986). Hence, like many other papers in the literature explaining insufficient entry (see, e.g. Ghosh and Morita 2007a, 2007b; Marjit and Mukherjee 2013; Mukherjee 2012a), we consider homogeneous products.

Assume that the inverse market demand function is $P = P(Q)$, where P is price and Q is the total output. The inverse market demand function is continuous in Q, twice continuously differentiable, with $\frac{\partial P}{\partial Q} \equiv P' < 0$, $P'' \leq 0$, $c < P(0)$, and there exists a $\overline{Q} \in (0, \infty)$ such that $P(Q) = 0$ for $Q \geq \overline{Q}$. We assume that $P(Q)$ is log-concave, which ensures that unique and symmetric Cournot equilibrium exists, as shown in Amir and Lambson (2000) and Cowan (2004), and considered in Amir, Castro, and Koutsougeras (2014).

We consider the following game. At stage 1, the domestic firms decide whether to enter the market. At stage 2, the domestic firms, which entered the market, compete with the foreign firms like Cournot oligopolists and the profits are realised. We solve the game through backward induction.

If n domestic firms entered the market, the ith firm maximises $\underset{q_i}{\text{Max}}(P(Q) - c)q_i$, $i = 1, \ldots, n+m$, to determine its output, where $Q = \sum_{i=1}^{n+m} q_i$. The first order condition for profit maximisation is:

$$P - c + q_i P' = 0, \quad i = 1, \ldots, n+m. \tag{1}$$

The second order condition for profit maximisation is $2P' + q_i P'' < 0$.

We get the equilibrium outputs by solving $(n+m)$ first order conditions. Since the firms face the same demand and marginal costs, the symmetric equilibrium

potential imitators in the foreign country. However, implementation of a relatively stricter patent laws, higher resource costs and higher opportunity costs might prevent the potential foreign imitators from imitating the technologies of the foreign innovators.

outputs are $q_1^* = \ldots = q_n^* = q_{n+1}^* = \ldots = q_{n+m}^* = q^*$. The net equilibrium profit of each foreign firm is $\pi_f^* = (P(Q^*) - c)q^*$ and that of each domestic firm is $\pi_d^* - K = (P(Q^*) - c)q^* - K$, where $Q^* = (n+m)q^*$.

Differentiating (1) with respect to n and using symmetric equilibrium outputs, we get $\frac{\partial q^*}{\partial n} = -\frac{q^*(P' + q^*P'')}{P' + (n+m)(P' + q^*P'')} < 0$. Since $Q^* = (n+m)q^*$, we get $\frac{\partial Q^*}{\partial n} = \frac{q^*P'}{P' + (n+m)(P' + q^*P'')} > 0$, implying that $\frac{\partial P(Q^*)}{\partial n} < 0$ as $P' < 0$. Since these relationships hold for any n, they will also hold for the free entry equilibrium number domestic firm, n^e.

The free entry equilibrium number of domestic firms, n^e, is given by the zero profit condition $\pi_d^* - K = 0$ or $(P(Q^*) - c)q^* = K$. We assume that m and K are such that at least one domestic firm enters the market.

Now consider the domestic welfare maximising number of firms. Following the literature (see, e.g. Ghosh, Lim, and Morita 2010; Marjit and Mukherjee 2013; Mukherjee 2012a, 2012b; Stähler and Upmann 2008), we assume that the objective of the domestic government is to maximise welfare of the domestic country with respect to the number of domestic firms for a given number of foreign firms, when the firms behave like Cournot oligopolists. Hence, given the number of foreign firms exporting to the domestic market, we are interested to look at the domestic competition policy that determines the domestic welfare maximising number of domestic firms. Even if the domestic government may control the number of domestic firms through its competition policy, it cannot control the firms' behaviour in the product market.

Following the literature (see, e.g. Ghosh, Lim, and Morita 2010; Marjit and Mukherjee 2013; Mukherjee 2012; Stähler and Upmann 2008), we assume that the utility of the consumers is additively separable and domestic welfare, which shows the domestic residents' aggregate utility, is the sum of consumer surplus and total net domestic profits. Hence, the domestic welfare is given by

$$W = \int_0^{(n+m)q^*} P(Q)\mathrm{d}Q - mP(Q)q^* - ncq^* - nK. \tag{2}$$

We get

$$\frac{\mathrm{d}W}{\mathrm{d}n} = P(Q^*)\left[q^* + (n+m)\frac{\partial q^*}{\partial n}\right] - m\left[P(Q^*)\frac{\partial q^*}{\partial n} + q^*\frac{\partial P(Q^*)}{\partial n}\right] - c\left[q^* + n\frac{\partial q^*}{\partial n}\right] - K$$

$$= [(P(Q^*) - c)q^* - K] + (n+m)P(Q^*)\frac{\partial q^*}{\partial n}$$

$$- m\left[P(Q^*)\frac{\partial q^*}{\partial n} + q^*\frac{\partial P(Q^*)}{\partial n}\right] - nc\frac{\partial q^*}{\partial n}$$
$$= [(P(Q^*) - c)q^* - K] + n(P(Q^*) - c)\frac{\partial q^*}{\partial n} - mq^*\frac{\partial P(Q^*)}{\partial n}. \quad (3)$$

Evaluating (3) at the free entry equilibrium number of domestic firms, we get

$$\frac{\mathrm{d}W}{\mathrm{d}n} = n^{\mathrm{e}}(P(Q^{e^*}) - c)\frac{\partial q^{e^*}}{\partial n} + mq^{\mathrm{e}^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n}. \quad (4)$$

Since $(P(Q^{\mathrm{e}^*}) - c)q^{\mathrm{e}^*} = K$, where we use the superscript e to denote that it is evaluated at the free entry equilibrium number of domestic firms n^{e}.

If $m = 0$, it follows from (4) that $\frac{\mathrm{d}W}{\mathrm{d}n} = n^{\mathrm{e}}(P(Q^{e^*}) - c)\frac{\partial q^{e^*}}{\partial n} < 0$, implying that entry is excessive in the domestic country, which is due to the business stealing effect shown in Mankiw and Whinston (1986).

If $m \geq 1$ and finite, the first term in the right hand side (RHS) of (4), $n^{\mathrm{e}}(P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{e^*}}{\partial n} < 0$, shows the negative effect of domestic entry on domestic welfare due to its business stealing effect on the domestic firms, and this effect increases with n^{e}. This is similar to Mankiw and Whinston (1986). The second term in the RHS of (4), $mq^{\mathrm{e}^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n}$, is a new effect and shows that a higher n reduces the revenues of the foreign firms due to price reduction, thus reducing the leakage from domestic welfare, and this effect increases with m. If the second effect is stronger than the first effect, which occurs if the number of foreign firms (m) is sufficiently larger than the free entry equilibrium number of domestic firms (n^{e}), domestic-entry is insufficient for the domestic country.

We summarise the above discussion in the following proposition.

Proposition 1. *Given the finite number of foreign firms, assume that at least one domestic firm enters the market. Entry of domestic firms is insufficient (excessive) for the domestic country if* $mq^{e^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n} > (<) n^{e}(P(Q^{e^*}) - c)\frac{-\partial q^{e^*}}{\partial n}$, *i.e. business stealing from the domestic firms is less (more) than the foreign firms' loss of revenues due to price reduction, which happens if the number of foreign firms is sufficiently larger (not sufficiently larger) than the free entry equilibrium number of domestic firms.*

One can relate the condition (4) with Lerner index. Re-writing (4), we get $\frac{\mathrm{d}W}{\mathrm{d}n} \gtreqless 0$ if

$$\frac{m}{n^{\mathrm{e}}} \gtreqless \frac{(P(Q^{\mathrm{e}^*}) - c)\left(-\frac{\partial q^{\mathrm{e}^*}}{\partial n}\right)}{q^{\mathrm{e}^*}\left(-\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n}\right)} = \frac{(P(Q^{\mathrm{e}^*}) - c)}{P(Q^{\mathrm{e}^*})}\left(\frac{-(\partial q^{\mathrm{e}^*}/q^{\mathrm{e}^*})/(\partial n/n)}{-(\partial P(Q^{\mathrm{e}^*})/P(Q^{\mathrm{e}^*}))/(\partial n/n)}\right), \quad (5)$$

where $\frac{(P(Q^{\mathrm{e}^*}) - c)}{P(Q^{\mathrm{e}^*})}$ is the well-known Lerner index and $\frac{-(\partial q^{\mathrm{e}^*}/q^{\mathrm{e}^*})/(\partial n/n)}{-(\partial P(Q^{\mathrm{e}^*})/P(Q^{\mathrm{e}^*}))/(\partial n/n)}$ is the proportional effects of entry on per-firm output relative to price.

We have considered above that the number of foreign firms is finite and at least one domestic firm entered the market. Now assume that m is finite but large enough so that it is not profitable for any domestic firm to enter the market, implying $n^e = 0$. Hence, if we evaluate $\frac{dW}{dn}$ at the free entry equilibrium number of domestic firms, we get from (4) $\frac{dW}{dn} = -mq^{e^*}\frac{\partial P(Q^{e^*})}{\partial n} > 0$, since $n^e = 0$ and $[(P(Q^*) - c)q^* - K] = 0$ (as there is neither production nor fixed cost incurred by the domestic firms).

If $m \to \infty$, with a finite Q^* and $n^e = 0$, we get $q^{e^*} = \frac{Q^*}{m} \to 0$, and therefore, $\frac{dW}{dn} \to 0$. In this situation, private and social incentives are fully aligned for the domestic country.[7]

2.1 An Example

Assume that the linear inverse demand function is $P = a - Q$. Straightforward calculation shows that if there are $(n + m)$ number of Cournot oligopolists, the equilibrium net profit of each foreign firm is $\pi_f^* = \frac{(a-c)^2}{(n+m+1)^2}$ and that of each domestic firm is $\pi_d^* - K = \frac{(a-c)^2}{(n+m+1)^2} - K$. The free entry equilibrium number of domestic firm is determined by $\frac{(a-c)^2}{(n+m+1)^2} = K$.

Since $\frac{(a-c)}{(n+m+1)}$ is the equilibrium output of each domestic firm and each foreign firm, welfare of the domestic country is $W = n[\frac{(a-c)^2}{(n+m+1)^2} - K] + \frac{1}{2}[\frac{(n+m)(a-c)}{(n+m+1)}]^2$. Differentiating W with respect to n and evaluating it at the free entry equilibrium number of domestic firms, we get $\frac{dW}{dn} = \frac{(a-c)^2(m-n^e)}{(n^e+m+1)^3} \gtreqless 0$ for $\frac{m}{n^e} \gtreqless 1$ if m is finite and at least one domestic firm enters the market.

Condition (4) shows that domestic entry is excessive or insufficient for the domestic country depending on the sign of $n^e(P(Q^{e^*}) - c)\frac{\partial q^{e^*}}{\partial n} - mq^{e^*}\frac{\partial P(Q^{e^*})}{\partial n}$. In the linear demand case, $(P(Q^{e^*}) - c) = q^{e^*} = \frac{a-c}{n^e+m+1}$ and $\frac{\partial q^{e^*}}{\partial n} = \frac{\partial P(Q^{e^*})}{\partial n} = \frac{-(a-c)}{(n^e+m+1)^2}$, which is the reason for the condition $\frac{m}{n^e} \gtreqless 1$.

If m is finite but large enough so that $n^e = 0$, we get $\frac{dW}{dn} = \frac{(a-c)^2 m}{(m+1)^3} > 0$. However, if $m \to \infty$, we get $\frac{dW}{dn} \to 0$.

3 Extensions[8]

We consider in this section that m is finite and at least one domestic firm finds it profitable to enter the market.

7 We thank a referee for highlighting this point.

8 We thank a referee and the editor for encouraging us to look at these issues.

3.1 Consumption by Foreign Citizens

Now we consider a situation where the entire demand is not coming from domestic consumers. Assume that $(1-\alpha)$ fraction of demand is coming from foreign consumers. If foreign consumers purchase some outputs, it does not affect the free entry equilibrium number of domestic firms determined in Section 2, but it affects welfare of the domestic country. If $(1-\alpha)$ fraction of consumer surplus is generated by the foreign consumers, welfare of the domestic country is

$$\begin{aligned} W &= \alpha\left(\int_0^{(n+m)q^*} P(Q)\mathrm{d}Q - (n+m)P(Q)q^*\right) + nP(Q)q^* - ncq^* - nK \\ &= \alpha\left(\int_0^{(n+m)q^*} P(Q)\mathrm{d}Q\right) + (1-\alpha)nP(Q)q^* - \alpha mP(Q)q^* - ncq^* - nK. \end{aligned} \tag{6}$$

Differentiating (6) with respect to n and evaluating that expression at the free entry equilibrium number of firms, we get

$$\begin{aligned} \frac{\mathrm{d}W}{\mathrm{d}n} = &\underbrace{\left(n^{\mathrm{e}}(P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} + mq^{\mathrm{e}^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n}\right)}_{\text{Like Eq. (4)}} \\ &+ \underbrace{(1-\alpha)(n^{\mathrm{e}}+m)q^{\mathrm{e}^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n}}_{\text{New effect due to foreign consumption}}, \end{aligned} \tag{7}$$

since $(P(Q^{\mathrm{e}^*}) - c)q^{\mathrm{e}^*} = K$, where we use the superscript e to denote that it is evaluated at the free entry equilibrium number of firms n^{e}.

Comparing (7) with (4) (which is $\frac{\mathrm{d}W}{\mathrm{d}n} = n^{\mathrm{e}}(P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} - mq^{\mathrm{e}^*}\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n}$), we find that the possibility of $\frac{\mathrm{d}W}{\mathrm{d}n} < 0$, i.e. excessive entry, is higher for (7), since $(1-\alpha)(n+m)q^{\mathrm{e}^*}\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n} < 0$, which shows the benefit of entry is leaking to foreign consumers through reduced price. As seen in the previous section, the presence of foreign firms creates the incentive for insufficient entry since more domestic firms helps to steal higher market share from the foreign competitors. However, if the foreign consumers extract some of that benefit from the domestic country through reduced price, it reduces the possibility of insufficient entry or increasing the possibility of excessive entry.

With our example of the linear demand function $P = a - q$, we get the free entry equilibrium number of firms by $\frac{(a-c)^2}{(n+m+1)^2} = K$, and $\frac{\mathrm{d}W}{\mathrm{d}n}$ at the free entry

equilibrium number of firms is $\frac{dW}{dn} = \frac{(a-c)^2(m-n^e)}{(1+m+n^e)^3} - \frac{(a-c)^2(m+n^e)(1-\alpha)}{(1+m+n^e)^3}$. We get $\frac{dW}{dn} > (<)0$ for $\alpha > (<)\alpha^* \equiv \frac{2n^e}{m+n^e}$, where $0 < \alpha^* < 1$ for a finite m and $m > n^e$. Hence, entry is insufficient (excessive) for $\alpha > (<)\alpha^*$. In contrast to the condition derived in Subsection 2.1, this condition suggests that domestic-entry can be excessive even if $m > n^e$ but $\alpha < \alpha^*$, implying that the *critical number of domestic firms above which domestic-entry is excessive is lower with foreign consumers compared to no foreign consumers.*[9]

We can write the following result from the above discussions.

Proposition 2. *Given the finite number of foreign firms, assume that at least one domestic firm enters the market. Domestic-entry can be excessive if α is low, i.e. significant amount of demand is coming from foreign citizens.*

The analysis of this subsection is similar to a situation with an integrated world market, where consumers in a single market are from domestic and foreign countries. Thus, it can be related to the unilateral regulation part of Stähler and Upmann (2008), where they assumed that the domestic firms have lower costs than the foreign firms and there is free entry of foreign firms. They found excessive domestic entry in this situation, since the domestic country wants to have the minimum number of domestic firms to induce all foreign firms to exit the market and new domestic firms have the incentive to enter the market at this point since they still earn positive profits as their costs are lower than the foreign firms' costs. In contrast, we consider a fixed number of foreign firms and the firms have the same costs. Hence, the domestic country cannot induce the foreign firms to exit the market in our analysis, and business stealing from the foreign firms may create insufficient domestic entry if the demands from foreign citizens are not significant.

3.2 Competition in Both Countries with Given Foreign Firms

Now we consider a situation where the domestic firms export and the firms sell in both countries, having the same demand functions. We consider in this subsection that there is a finite number of foreign firms, m, but free entry in the domestic country. We will consider free entry in both countries in the next subsection.

Assume that each domestic firm needs to incur one entry cost, and after entering the market, domestic firms, which entered the market, can expand their

9 To compare with the condition derived in Subsection 2.1, we can write the condition $\alpha > (<)\alpha^* \equiv \frac{2n^e}{m+n^e}$ as $\frac{m}{n^e} > (<)\left(\frac{2}{\alpha} - 1\right)$ where $\left(\frac{2}{\alpha} - 1\right) > 1$.

businesses to both countries without incurring further cost. In this situation, the equilibrium number of domestic firms, n^{e}, is given by $2\pi_d^* - K = 0$ or $2(P(Q^*) - c)q^* = K$. We assume that m and K are such that at least one domestic firm enters the market.

Now consider domestic welfare maximising number of firms. Domestic welfare is

$$W = \underbrace{\int_0^{(n+m)q^*} P(Q)\mathrm{d}Q - mP(Q)q^* - ncq^* - nK}_{\text{Like Eq. (2)}} + \underbrace{n(P(Q^*) - c)q^*}_{\text{Profits from the foreign market}} . \tag{8}$$

Differentiating (8) with respect to n and evaluating that expression at the free entry number of equilibrium firm, we get

$$\frac{\mathrm{d}W}{\mathrm{d}n} = \underbrace{n^{\mathrm{e}}(P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} + mq^{\mathrm{e}^*}\frac{-\partial P(Q^{\mathrm{e}^*})}{\partial n}}_{\text{Like Eq. (4)}}$$
$$+ \underbrace{n^{\mathrm{e}}\left((P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} + q^{\mathrm{e}^*}\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n}\right)}_{\text{New effect due to selling to the foreign market}}, \tag{9}$$

since $2(P(Q^{\mathrm{e}^*}) - c)q^{\mathrm{e}^*} = K$, where we use the superscript e to denote that it is evaluated at the free entry equilibrium number of firms n^{e}.

Since $n\left((P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} + q^*\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n}\right) < 0$, comparing (9) with (4) (which is $\frac{\mathrm{d}W}{\mathrm{d}n} = n^{\mathrm{e}}(P(Q^{\mathrm{e}^*}) - c)\frac{\partial q^{\mathrm{e}^*}}{\partial n} - mq^{\mathrm{e}^*}\frac{\partial P(Q^{\mathrm{e}^*})}{\partial n}$), we find that the possibility of excessive domestic-entry is higher under (9) compared to (4).

With our example of the linear demand function $P = a - q$, we get the free entry equilibrium number of firms by $\frac{2(a-c)^2}{(n+m+1)^2} = K$, and $\frac{\mathrm{d}W}{\mathrm{d}n}$ at the free entry equilibrum number of firms is $\frac{\mathrm{d}W}{\mathrm{d}n} = \frac{(a-c)^2(m-3n^{\mathrm{e}})}{(n^{\mathrm{e}}+m+1)^3} \gtreqless 0$, suggesting that entry in the domestic country is insufficient (excessive) for $\frac{m}{n^{\mathrm{e}}} > (<)3$. Comparing this condition with the condition derived in Subsection 2.1 for the linear demand case, we get that the critical number of domestic firms above which domestic-entry is excessive is lower under exporting by the domestic firms than when they sell in the domestic country only.

If the domestic firms sell to both countries by incurring K, along with the effects mentioned in Section 2, entry of a new domestic firm creates a further effect on domestic welfare by reducing the profits of the domestic firms in the foreign country. This new effect increases the possibility of excessive entry under selling by the domestic firms to both countries compared to the situation where

the domestic firms sell only in the domestic country. Hence, the critical number of domestic firms above which domestic-entry is excessive reduces under exporting by the domestic firms than when they sell in the domestic country only.

The above result can be explained in another way.[10] Since the free entry equilibrium number of domestic firms is higher when the domestic firms sell to both markets by incurring K compared to the situation where the domestic firms sell to the domestic market only, the effect due to the domestic firms' ability to sell to both markets by incurring K is akin to a lower entry cost in Section 2, implying a higher n^e in Eq. (4), which, in turn, increases the possibility of excessive entry in the domestic country.

We summarise the above discussion in the following proposition.

Proposition 3. *Given the finite number of foreign firms, assume that at least one domestic firm enters the market. The critical number of domestic firms above which domestic-entry is excessive is lower under exporting by the domestic firms than when they sell in the domestic country only.*

We have assumed above that the domestic firms incur one entry cost. However, it is easy to see that Proposition 3 will not change if firms incur market specific entry costs. In this situation, the free entry equilibrium number of domestic firms is given by $2[(P(Q^*) - c)q^* - K] = 0$. If we evaluate the derivative of the domestic welfare with rescpect to n at the free entry equilibrium number of domestic firms, we will get a conditon similar to (9) since $2[(P(Q^*) - c)q^* - K] = 0$.

If there is a market specific entry cost, the free entry equilibrium number of domestic firms remains the same when the domestic firms sell to both countries and when the domestic firms sell to the domestic market only. Hence, the effect under the market specific entry cost is akin to an increase in demand in Section 2 such that the effect of n on the per-firm output increases compared to the effcet of n on the price. Hence, the relative effect of business stealing from the domestic firms gets stronger, and increases the possibility of excessive entry in the domestic country.

The mechanisms for the results derived in this subsection can be related to Goerke (2020), although the economic scenario considered in that paper is different from ours. Goerke (2020) considered a two-period model to see the welfare effects in an open economy under foreign direct investments (FDIs). FDI allows more firms to enter the market by helping them to spread the fixed costs over multiple markets, which, in turn, increases business stealing and creates

10 We thank a referee for this line of thinking and for the next intuition.

excessive entry. Similar effects are in force in our analysis. Exports by the domestic firms encourage more domestic firms to enter the market, which, in turn, increases business strealing from the domestic firms and the posssibility of excessive entry.

3.3 Competition in Both Countries with Endogenous Entry in Both Countries

Now we consider a situation similar to Subsection 3.2 with the exception that there is free entry in both countries. Assume that each domestic and foreign firm needs to incur an entry cost, and after entering the market, the firms can expand their businesses to both countries without further cost.

Given the symmetry of our framework, consider *symmetric free entry equilibrium*, where the number of firms at the symmetric free entry equilibrium, n^e and m^e, satisfies $n^e = m^e$ and $2(P(Q^*) - c)q^* = K$. Assume that the entry cost, K, is such that at least one firm enters in each country.

Now consider the welfare maximising number of firms for the domestic country, while the foreign government is passive. The domestic country maximises the following expression to maximise its welfare:

$$\max_n W^d = \int_0^{(n+m)q^*} P(Q)\mathrm{d}Q - mP(Q)q^* - ncq^* - nK + n(P(Q^*) - c)q^*. \tag{10}$$

Maximising (10) with respect to n and evaluating the expression at the symmetric free entry equilibrium number of firms, $n^e = m^e$, we get

$$\frac{\mathrm{d}W}{\mathrm{d}n} = 2n^e(P(Q^*) - c)\frac{\partial q^*}{\partial n} < 0, \tag{11}$$

since $2(P(Q^*) - c)q^* = K$.

The expression (11) suggests that entry is excessive from the domestic country's point of view at the symmetric free entry equilibrium.

Entry by the domestic firms reduces the foreign firms' revenues due to price reduction, i.e. $mq^* \frac{-\partial P(Q^*)}{\partial n}$, and the domestic firms' revenues in the foreign market due to price reduciton, i.e. $nq^* \frac{\partial P(Q^*)}{\partial n}$. Entry will be excessive if the economic conditions are such that these two effects are the same, which will happen trivially for a symmetric model. Hence, the complete symmetry of our model makes the two effects same, and business stealing from the domestic firms creates excessive entry at $n^e = m^e$.

We summarise the above discussion in the following proposition.

Proposition 4. *If the market structure in both contries are determined endogenously, entry in the domestic country is excessive at the symmetric free entry equilibrium.*

We have considered the foreign government as a passive player in the above discussion. If the foreign government also maximises its welfare with respect to m, following the above reason, the foreign government will have the incentive to reduce m at $n^{\mathrm{e}} = m^{\mathrm{e}}$, which, in turn, will affect n. If both the domestic and foreign governments are active in maximising their welfare with respect to n and m respectively, we need to solve a complete game with both countries' maximisation problems subject to the free entry equilibrium. This type of analysis will extend Stähler and Upmann (2008) in segmented markets, which we leave for future research.

We have considered above that the domestic country is only maximising its welfare. It is intuitive that if we consider socal efficiency of global welfare maximising number of firms, i.e. the number of firms which will maximise the total welfare of the domestic and foreign countries, entry will be excessive. If the global welfare maximising number of firms is determined, it will be determined by maximising

$$\underset{n^{\mathrm{G}}}{\mathrm{Max}}\, W^{\mathrm{G}} = 2\left(\int_0^{n^{\mathrm{G}}q^*} P(Q)\mathrm{d}Q - n^{\mathrm{G}}cq^*\right) - n^{\mathrm{G}}K,$$

where W^{G} is the global welfare and $n^{\mathrm{G}} = (n+m)$. In a symmetric equilibrium, $n^{\mathrm{G}} = 2n$. This problem is similar to a problem in a closed economy, and as in Mankiw and Whinston (1986), entry will be excessive for the global welfare.[11]

4 Conclusions

This paper contributes to the literature on the social efficiency of entry in an open economy. With a fixed number of foreign firms, we show that if the firms sell only in the domestic country, domestic-entry is socially insufficient for the domestic country when the number of foreign firms is sufficiently larger than the free

11 The free entry equilibrium number of firms is given by $2\left(P(Q^*) - c\right) = K$. Evaluating $\frac{\mathrm{d}W}{\mathrm{d}n^{\mathrm{G}}}$ at the free entry equilibrium number of firms, we get $\frac{\mathrm{d}W}{\mathrm{d}n^{\mathrm{G}}} = 2\left(P(Q^*) - c\right) n^{\mathrm{G}} \frac{\partial q^*}{\partial n} < 0$.

entry equilibrium number of domestic firms. Entry is insufficient for the domestic country because the business stealing effect will be transferring business from the foreign firms to the domestic firms. This result provides a rationale for pro-competitive domestic policies, and unlike the existing literature, we show that insufficient domestic-entry occurs in an open economy even if the domestic and foreign firms are symmetric in costs.

We further show that insufficient domestic-entry may not occur in an open economy, implying that foreign competition might not reduce the importance of the anti-competitive domestic policies, if significant demand comes from foreign countries, and the market structures are determined endogenously in the domestic and foreign countries.

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