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Born to be Global and the Globalisation Process

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1. INTRODUCTION

IN the last decades have we have witnessed a large number of firms become international leaders in a short time. Prominent examples are Google and Facebook which have generated substantial export revenues at impressive speed. Moreover, we observe inventions made by small entrepreneurs being acquired by incumbents which use them to gain a strong competitive advantage in the world market. An example of this type of process is Skype which was acquired first by Ebay and later by Microsoft. The success of these so called 'born global firms' has spurred an interest in the determinants and welfare effects of these types of firms. The purpose of this paper is to contribute to the generation of such knowledge.

The starting point of the paper is the observation that entrepreneurial firms with a global potential face considerable problems when trying to fully exploit the potential value of an invention or business idea internationally. Complementary assets such as distribution networks, marketing channels, financial resources, manufacturing know-how and brand names, that is, assets typically held by large established firms, are often needed, and we observe a significant amount of interfirm technology transfers, ranging from joint ventures and licensing to outright acquisitions of innovations.[1] To understand the phenomena of 'born to be' global firms, we need to understand how the economic environment affects the incentives of business development for sale to incumbents compared with business development for own export.[2]

To this end, we construct a model with the following ingredients: there are several incumbent firms competing in oligopolistic fashion in the world market. Moreover, there is a

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[1] Granstrand and Sjölander (1990) present evidence from Sweden, and Hall (1990) shows that US firms acquire innovative targets to gain access to their technologies. Bloningen and Taylor (2000) find evidence from US high-tech industries of firms making a strategic choice between the acquisition of outside innovators and in-house R&D. In the biotech industry, Lerner and Merges (1998) note that acquisitions are important for know-how transfers.

[2] Andersson and Lööf (2012) examine innovation among very small firms and find that affiliation to a domestically owned multinational enterprise group increases the innovation capacity of small businesses and that small firms' innovation is closely linked to participation in international trade and exports to the G7 countries. Raff and Wagner (2010) examine the relationship between imports and productivity of Germany. They find evidence for a positive impact of productivity on importing, pointing to self-selection of more productive enterprises into imports, but no evidence for positive effects of importing on productivity due to learning-by-importing. Halldin and Braunerhjelm (2012) investigate whether born global firms perform differently compared to other newly founded manufacturing firms. Born global firms are found to have higher growth in employment and sales per employee, but no such effect is found when performance is measured by profitability or labour productivity.

domestic entrepreneur outside this market who invests in an innovative activity that could lead to the creation of a unique business idea (invention), which increases the profit of the possessor and decreases the profits of the rival firms. The interaction takes place in three periods. In the first period, the entrepreneur decides how much to invest in the innovative activity, where more investments increase the probability of a successful business idea (invention). In the second period, the incumbent firms compete to acquire the entrepreneur's business idea (invention) or, if no sale occurs, the entrepreneur either sells only locally in its home country or expands in order to also export to the world market. Finally, in the third stage, firms compete in oligopolistic fashion on the world market and the entrepreneur generates profits locally if she does not sell her business.

The starting point of the analysis is the process of international integration of product and ownership markets in the last few decades, which has been driven both by policy changes such as WTO agreements (e.g. TRIPS) and the EU single market programme and by technological advances that reduce international transportation and transaction costs. How will international market integration affect the commercialisation choice (entry or sale) and incentives to engage in international entrepreneurship?

We first establish that a trade liberalisation (reduction in trade cost), in absence of an acquisition market, implies that it is more likely that an entrepreneurial firm with a successful invention goes global. The reason is that the cost of exploiting the entrepreneurial invention decreases as the cost of trade per unit has decreased.

We then show that despite trade liberalisation implying that the incentives for entrepreneurs to create born to be global firms increase, it is not clear that the number of born global firms increases. The reason is that when product market integration is not complete, the incentives to sell the entrepreneurial firms to incumbents are stronger than those for entering the market. Why? The incumbents have a substantial amount of market power when product markets are not fully integrated and are willing to pay a substantial amount to prevent the entrepreneurial firm from entering the market. When product market integration becomes more complete, the incumbents have less market power and are not willing to pay so much to deter entry. As a result, the entrepreneurial firm will enter the world market. Consequently, only at sufficiently complete product market integration will the number of born global firms increase.

How does a trade liberalisation affect the incentive to create entrepreneurial firms then? The incentives to create born to be global entrepreneurial firms will increase. First, the cost of exploiting the entrepreneurial invention in the world market will decrease since the trade cost per unit of sales decreases. Moreover, even if entry does not occur, the bidding competition among the incumbents over the entrepreneurial invention implies that the entrepreneur will capture the trade cost reduction in the form of a higher sales price of its firm (invention).

We then proceed to examine several other parts of the international market integration process. One is the change in restrictions on foreign acquisitions of domestic firms. The attitude was gradually becoming more positive until the very end of the twentieth century when a return of protectionism could be observed in the policy debate. Large privatisation and liberalisation programmes started in the UK in the late 1970s and spread around the world. Moreover, the development of a well-functioning global capital market in the 1980s and 1990s affected the transaction cost of cross-border acquisitions substantially. We then argue that these developments imply that the transaction costs associated with selling entrepreneurial firms have decreased and then show that these developments in the international market for corporate control reduce the number of born to be global firms that actually go global themselves. The reason being that the number of born to be sold global firms is expanding at the born globals' expense.

Our study is related to the recent theoretical literature on international M&As in oligopolistic markets which, in contrast to the traditional FDI literature, emphasises that greenfield investments and cross-border acquisitions are not perfect substitutes: the entry modes of FDI matter.[3] This literature do not explicitly studies the role played by entrepreneurs as challengers and suppliers to internationally leading incumbents, which is the focus of our study.

Our study is also linked to the theoretical literature on firm heterogeneity and entry modes in foreign markets (see, for instance, Bernard et al. (2003) and Helpman et al. (2004), and Nocke and Yeaple (2007, 2008). We extend this literature by allowing entrepreneurs to expand internationally either by own expansion or by means of selling their business (inventions) to established firms, and by examining how the pattern of own expansion and expansion by sale depends on the degree of international market integration.

While this paper belongs to a large literature on competition and innovations[4] it is, to our knowledge, the first to analyse the effects of international liberalisation on entrepreneurial innovation in a setting where both innovation for export and innovation for sale to incumbents is possible.

This paper can finally be seen as a contribution to the literature on entrepreneurship and innovation.[5] We extend this literature by allowing for the interaction between entrepreneurs and oligopolists in the innovation process and study how trade liberalisation affects the incentive for entrepreneurial innovations.

2. THE MODEL

Consider a market served by n symmetric firms located in their respective home country. Each firm produces two brands of their good. One of the brands is a low (local) quality brand which is produced with local inputs. We assume that each firm is a monopolist in their respective local home market. There is also a high quality brand, with which all firms compete on an integrated world market. To capture globalisation in a simple way, we assume that it is only possible to produce the international brand by using an intermediate input which needs to be imported at a trade cost t.

[3] See, for instance, Blonigen (1997), Bjorvatn (2004), Mattoo et al. (2004), Raff et al. (2009), Bertrand and Zitouna (2006), Head and Ries (2008) or Norbäck and Persson (2008). There is also a small theoretical literature addressing welfare aspects of cross-border mergers in international oligopolistic markets. This literature includes papers by, for example, Head and Reis (1997), Falvey (1998), Horn and Persson (2001), Lommerud et al. (2006), Neary (2007) and Norbäck and Persson (2007).

[4] For overviews of the literature on innovation and competition see, for instance, Motta (2004). See Gilbert and Newbery (1982, 1992), Vickers (1985) and Norbäck and Persson (2012) for studies examining how the intensity of the product market competition affects the incentive to acquire innovations. See Grossman and Helpman (1991), Aghion and Howitt (1992) and Vives (2008) for papers on how the incentive for innovation for entry is affected by competition.

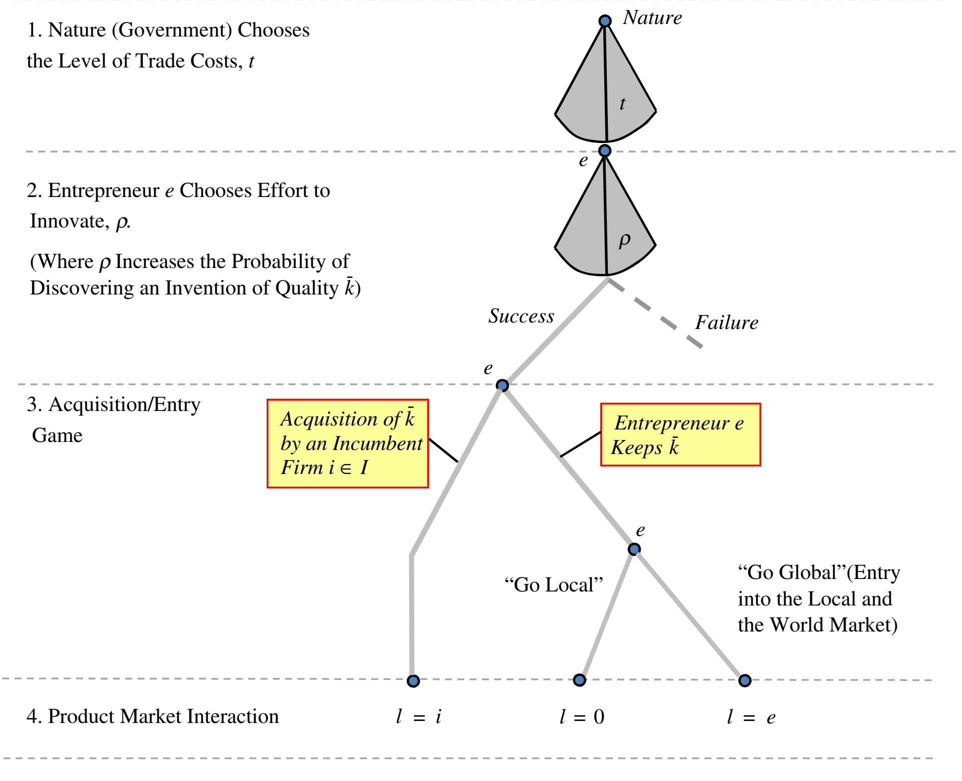
[5] For overviews, see Acs and Audretsch (2005), and Bianchi and Henrekson (2005). For some recent contributions on entrepreneurship and commercialisation mode, see Gans and Stern (2000, 2003), Gans et al. (2002) and Norbäck and Persson (2009).

We then assume that there is an additional country where an entrepreneur, denoted e, invests in an innovative activity that could lead to the creation of a unique productive asset or invention, denoted $\bar{k}$. The entrepreneur can use this asset in the production of the two brands, where again the low quality brand is sold exclusively in the domestic market without foreign competition, and the second, high quality, brand can be sold under competition with the foreign incumbents in the world market.

The interaction is illustrated in Figure 1. In the first stage, the trade cost t is determined by nature (or by government policy). In the second stage, the domestic entrepreneur decides how much to invest in research, thereby affecting the probability of discovering the invention $\bar{k}$. In the first period of the third stage, given successful innovation, one of the incumbents may acquire the entrepreneur's assets $\bar{k}$. If the entrepreneur does not sell the invention, she can enter the domestic market or enter both the domestic and the world market where there is a fixed cost of entry G. Finally, in the fourth stage, firms compete in oligopolistic fashion in the high quality brand integrated world market and sell the low quality brand under monopoly in their domestic market.

The next sections describe the product market interaction, acquisition–entry game and innovation investment.

FIGURE 1
The Sequence of the Game



a. Stage 4: Product Market Interaction

(i) The Integrated Global Market

The global market consists of n integrated countries with one firm located in each. The product market profits in the global market will depend on the (potential) ownership of the innovation $\bar{k}$, given by the acquisition–entry game in Stage 3 and the innovation investment in Stage 2, and the trade cost t determined by nature (or government policy) in Stage 1. To capture this, we will work with the following notation: let the set of firms in the industry be $\mathcal{J} = e \times \mathcal{I}$, where $\mathcal{I} = \{i_1, i_2, \ldots, i_n\}$ is the set of incumbent firms. Let the set of potential ownerships of the innovation, $\bar{k}$, be $l \in \mathcal{L}$, where $\mathcal{L} = \{e, 1, 2, \ldots i \ldots n\}$.

Let $\pi_j(\mathbf{q}, \ l) = [P - c_j(l)]q_j$ denote the product market profit of firm j, where $\mathbf{q} = \left(q_e, q_{i_1,\ldots} q_{i_n}\right)$ is the vector of output choices taken by firms in the product market interaction and l keeps track of the identity of the firm owning assets $\bar{k}$. To produce the high quality good for the world market, production requires imports of an intermediate good which is associated with a trade cost t. $c_j(l) = c + t$ is then the marginal cost when firm j does not possess the invention ($j \neq l$) and $c_j(j) = c + t - \bar{k}$ is the marginal cost when firm j possesses the invention ($j = l$). In the world market, we assume that incumbents (or the incumbents and the entrepreneur) face inverse demand

$$P = a - q_j - q_{-j}. \tag{1}$$

Assuming Cournot competition, the Nash quantities in the product market interaction $\mathbf{q}^*(l) = (q_j^*(l), q_{-j}^*(l))$ are given from the first-order conditions, $\partial \pi_j(q_j^*(l), q_{-j}^*(l))/\partial q_j = 0$. Let $\pi_j(l) = [P(\mathbf{q}^*(l)) - c_j(l)]q_j^*(l)$ be the reduced-form profit of firm j, where again, l indicates which firm owns the innovation $\bar{k}$.

The assumption that incumbents $i_1, i_2, \ldots, i_n$ are symmetric before the acquisition takes place implies that we need only distinguish between two types of ownership if the invention is commercialised in the world market: *entrepreneurial* ownership ($l = e$) and *incumbent* ownership ($l = i$). Note that there are three types of firms to keep track of, $h = \{E, A, NA\}$, that is, the entrepreneurial firm (E), an acquiring incumbent (A) and non-acquiring incumbents (NA).

Given that a sale of innovation $\bar{k}$ occurs, $\pi_A(i)$ denotes the acquiring firm's reduced-form product market profit and $\pi_{NA}(i)$ the corresponding profit for a non-acquirer. If no sale occurs and the entrepreneur enters the market, $\pi_E(e)$ denotes the entrepreneurial firm's reduced-form product market profit and $\pi_{NA}(e)$ the corresponding profit for an incumbent. Finally, we let $\pi_{NA}(0)$ denote the incumbent profit if the innovation $\bar{k}$ is not commercialised in the world market.

It can be shown (in the Appendix) that reduced-form profits $\pi_h(l)$ in the world market have the following characteristics, which will be useful in the analysis below:

Lemma 1: *The reduced-form profits in the world market have the following properties: (i) $\pi_A(i) > \pi_E(e)$, $\pi_A(i) > \pi_{NA}(l) > 0$ and $\pi_E(e) > \pi_{NA}(e)$, (ii) $\pi_{NA}(0) > \pi_{NA}(i) > \pi_{NA}(e)$, (iii) $d\pi_h(l)/dt < 0$, and (iv) $d\pi_A(i)/dt < d\pi_{NA}(l)/dt$.*

In part (i), $\pi_A(i) > \pi_E(e)$ shows that an incumbent receives a higher product market profit when acquiring the entrepreneur's innovation than the entrepreneur would receive by entering the market herself. The reason is that the entry by the entrepreneur increases the number of firms in the world market from n firms (the foreign incumbents) to $n + 1$ firms. Moreover, $\pi_A(i) > \pi_{NA}(l) > 0$ and $\pi_E(e) > \pi_{NA}(e)$ capture that the possession of the invention $\bar{k}$ gives a competitive advantage over rivals in the world market.

In part (ii), $\pi_{NA}(0) > \pi_{NA}(l)$ captures that non-acquiring firms are worse off when competition increases once the innovation is introduced by a rival. Non-acquiring rivals face the largest loss under entry by the entrepreneur, since not only do they face a low-cost rival, entry also adds another firm to the market, $\pi_{NA}(i) > \pi_{NA}(e)$.

In part (iii), $\mathrm{d}\pi_h(l)/\mathrm{d}t < 0$, shows that all firms' product market profits decrease when trade costs increase, since all firms' costs then increase. Finally, part (iv) shows that the acquiring incumbent is hurt more than non-acquiring incumbents when trade costs increase, $\mathrm{d}\pi_A(i)/\mathrm{d}t < \mathrm{d}\pi_{NA}(l)/\mathrm{d}t$. The reason is that the acquiring incumbent has larger sales in equilibrium and hence faces a larger direct cost increase

(ii) The Local Market

Each firm will, in its home market, act as monopolist in the low quality brand market, obtaining profit $\Pi_j(x_j, l)$ where x_j is the output. Profit maximisation leads to the reduced-form profit $\Pi_h(l)$. To highlight entry decision into the global market, we simply assume that without the invention the entrepreneur cannot be active in her home market, $\Pi_E(i) < 0$. All firms then make the same profit in their respective home market: $\Pi_D = \Pi_E(e) = \Pi_A(i) = \Pi_{ND}(l) > 0$. Note that the local profit is unaffected by trade costs, $\mathrm{d}\Pi_D/\mathrm{d}t = 0$, since there is no international competition in the market for the local brand.

b. Stage 3: The Acquisition Game

In Stage 3, there is a first period where an entry–acquisition game takes place where the entrepreneur chooses between selling the invention to one of the incumbents in the world market or keeping the invention. If the entrepreneur decides not to sell, then in a second period she faces a choice between entering into the local brand market, or entering both the local brand market and the world market for the high quality brand.

The entry–acquisition game in the first period is depicted as an auction where the I incumbents simultaneously post bids and the entrepreneur then either accepts or rejects these bids, if it rejects the entrepreneur will export to the global market if and only if it is more profitable than only selling the local brand. Each incumbent announces a bid, b_i, for the entrepreneurial firm. $\mathbf{b} = (b_1,\ldots b_i \ldots, b_I) \in R^I$ is the vector of these bids. Following the announcement of **b**, the entrepreneurial firm may be sold to one of the incumbents at the bid price or remain in the ownership of the entrepreneur e. If more than one bid is accepted, the bidder with the highest bid obtains the entrepreneurial firm. If there is more than one incumbent with such a bid, each such incumbent obtains the entrepreneurial firm with equal probability. The acquisition is solved for Nash equilibria in undominated pure strategies. There is a smallest amount, ε, chosen such that all inequalities are preserved if ε is added or subtracted.

To highlight how trade costs affect the entrepreneur's decision to go global, we will assume that commercialisation of the innovation does not affect the number of incumbents already present in the market n. Formally, we will assume that trade costs are limited in size, $t \in [0, t^{\max})$, where $\pi_{NA}(l{:}t^{\max}) = 0$, $l = \{i, e\}$.[6] The entrepreneur's entry into the world

[6] In the Appendix, we show that $t^{\max} = \Lambda = a - c$.

market is costly and requires a fixed cost G. This implies that the entrepreneur will only 'go global' if trade costs are sufficiently low.

Lemma 2: *Assume that the entry cost G into the world market is not too high. Then, there exists a trade cost* $t^W \in (0, t^{max})$ *such that* $\pi_E(e) = G$ *for* $t = t^W$, $\pi_E(e) > G$ *for* $t < t^W$ *and* $\pi_E(e) < G$ *for* $t > t^W$.

Thus, for high trade cost $t > t^W$, the entrepreneur cannot afford entry into the world market, whereas for low trade costs $t < t^W$ entry into the world market is profitable. Using this information, we can write down the different valuations in the first period which need to be considered to solve the acquisition game.

v_e is the value, for the entrepreneur, of keeping the invention (firm):

$$v_e = \begin{cases} \underbrace{\pi_E(e) - G}_{\text{World market}} + \underbrace{\Pi_D}_{\text{Local}}, & \text{if} \quad \underbrace{t < t^W}_{\text{Entry profitable}} \\ \underbrace{\Pi_D}_{\text{Local}}, & \text{if} \quad \underbrace{t > t^W}_{\text{Entry not profitable}} \end{cases}. \tag{2}$$

This is the *reservation price* of the entrepreneur, that is, lowest price at which the entrepreneur will sell the invention. If trade costs are high $t > t^W$, the entrepreneur cannot make a profit from entering the world market, $\pi_E(e) < G$. Then, the only profit source is the local market that gives the profit Π_D and becomes the reservation price. When trade costs are low, $t < t^W$, entry into the world market is profitable and the reservation price from the local and world market profits adds up, $\pi_E(e) - G + \Pi_D$.

v_{ie} is the value, for an incumbent, of obtaining the entrepreneurial firm, when the entrepreneur would otherwise keep it.

$$v_{ie} = \begin{cases} \underbrace{\pi_A(i) - \pi_{NA}(e)}_{\text{World market}} + \underbrace{2\Pi_D - \Pi_D}_{\text{Local}} - T, & \text{if} \quad \underbrace{t < t^W}_{\text{Entry profitable}} \\ \underbrace{\pi_A(i) - \pi_{NA}(0)}_{\text{World market}} + \underbrace{2\Pi_D - \Pi_D}_{\text{Local}} - T, & \text{if} \quad \underbrace{t > t^W}_{\text{Entry not profitable}} \end{cases}. \tag{3}$$

This 'entry deterring valuation' v_{ie} also depends on whether or not the entrepreneur can enter into the world market. If trade costs are low, $t < t^W$, the entrepreneur would enter the world market when not selling. From Lemma 1(i), the first term $\pi_A(i) - \pi_{NA}(e)$ then captures the increase in profits for the acquiring incumbent in the world market; the second term $2\Pi_D - \Pi_D$ captures the increase in profit in the local market, under the assumption that an acquisition of the invention $\bar{k}$ gives the acquirer access to an additional local market (the 'new' local market in the home country of the entrepreneur); finally, T is a transaction cost paid by the acquirer.

When trade costs are high, $t > t^W$, the entrepreneur cannot enter the world market. If the entrepreneur has not sold her assets, they will only be used in the local market by the entrepreneur, and not in the world market. From Lemma 1(i), the lower line in equation (3), $\pi_A(i) - \pi_{NA}(0)$, then reflects the increase in profits on the world market from an acquisition.

TABLE 1
The Equilibrium Ownership Structure and Acquisition Price

Inequality	*Definition*	*Ownership l**	*Acquisition Price, S**	*Entrepreneurial Reward, R_E*
$I1$	$v_{ii} \geq v_{ie} > v_e$	i	v_{ii}	v_{ii}
$I2$	$v_{ii} > v_e \geq v_{ie}$	i or e	v_{ii}	v_{ii} or v_e
$I3$	$v_{ie} \geq v_{ii} > v_e$	i	v_{ii}	v_{ii}
$I4$	$v_{ie} > v_e \geq v_{ii}$	i	v_e	v_e
$I5$	$v_e \geq v_{ii} > v_{ie}$	e	.	v_e
$I6$	$v_e \geq v_{ie} > v_{ii}$	e	.	v_e

v_{ii} is the value for an incumbent of obtaining the entrepreneurial firm, when a rival incumbent would otherwise obtain the entrepreneurial firm.

$$v_{ii} = \underbrace{\pi_A(i) - \pi_{NA}(i)}_{\text{Profit increase: Export}} + \underbrace{2\Pi_D - \Pi_D}_{\text{Profit increase: Local}} - T. \tag{4}$$

This 'pre-emptive valuation', v_{ii}, does not depend on the entry decision of the entrepreneur since the first term $\pi_A(i) - \pi_{NA}(i)$ depicts the increase in profit for an incumbent firm that buys the entrepreneur's assets when not buying would result in a rival acquisition.

We can now proceed to solve for the equilibrium ownership structure (EOS). Since incumbents are symmetric, valuations v_{ii}, v_{ie} and v_e can be ordered in six different ways, as shown in Table 1. These inequalities are useful for solving the model and illustrating the results. We can state the following lemma:

Lemma 3: *The EOS, the acquisition price and the entrepreneurial reward are described in Table 1:*

Proof: See the Appendix. ■

Lemma 3 shows that when one of the inequalities $I1$, $I3$ or $I4$ holds, k is obtained by one of the incumbents. Under $I1$ and $I3$, the acquiring incumbent pays the acquisition price $S = v_{ii}$ and $S = v_e$ under $I4$. When I_5 or I_6 holds, the entrepreneur keeps her assets. When $I2$ holds, there exist multiple equilibria.

c. Stage 2: Innovation Activity

In Stage 1, entrepreneur e undertakes an effort, ρ, to discover an innovation. Let innovation costs $y(\rho)$ be an increasing convex function in effort, that is, $y'(\rho) > 0$, and $y''(\rho) > 0$. Let the probability of making an innovation be z and the probability of a failure $1-z$, where $z \in [0,1]$ and probability z are an increasing concave function of effort, that is, $z'(\rho) > 0$ and $z''(\rho) < 0$. $\Psi_e(l) = z(\rho(l))R(l) - y(\rho(l))$ is then the expected net profit of undertaking effort for the entrepreneur, where $R(l)$ is the reward for a successful innovation, that is,

$$R(l) = \begin{cases} v_e, & \text{under inequalities } I4, I5, \text{ or } I6, \\ v_{ii}, & \text{under inequalities } I1, I2 \text{ or } I3. \end{cases} \tag{5}$$

The entrepreneur then maximises $\Psi_e(l)$, optimally choosing effort $\rho(l)$. The optimal effort $\rho^*(l)$ is given from the first-order condition, $\mathrm{d}\Psi_e(l)/\mathrm{d}\rho = 0$. Assuming that the associated second-order condition is fulfilled, it is straightforward to show that when the reward to innovation increases, the entrepreneur will provide more effort to innovate and hence the probability of a successful innovation will be higher.

We can state the following Lemma:

Lemma 4: *The equilibrium effort by the entrepreneur in stage 2, $\rho_E^*(l)$ and hence, the probability of a successful innovation, increases in the reward for an innovation $R_E(l)$, that is,* $\mathrm{d}\rho^*{}_E(l)^*/\mathrm{d}R_E(l) > 0$.

Intuitively, the entrepreneur will try harder to succeed with $\bar{k}$ when there is a higher potential reward from succeeding.

d. Born to be Global and Reductions in Trade Costs

In this subsection, we examine how the mode of commercialisation of the invention is related to trade costs, t. We can then derive the following result.

> **Proposition 1:** *(i) A trade liberalisation will lead to more born to be global firms. (ii) In markets with medium high trade costs, the born to be global firms will be acquired by incumbents, and in markets with low trade costs, the born to be global firms will enter the world market themselves.*

The proposition is illustrated in Figure 2. Figure 2(ii) depicts how trade costs affect the entrepreneur's opportunities to enter the world market, as shown in Lemma 2. Figure 2(ii) depicts the reservation price of the entrepreneur, v_e, an incumbent's entry deterring valuation, v_{ie}, and the incumbent's pre-emptive valuation v_{ii}. We now show how these valuations can be used to prove 1.

The reservation price v_e in equation (2) is downward sloping in trade costs since the export profit $\pi_E(e)$ decreases in trade costs, as shown in Lemma 1. At $t = t^W$, the entrepreneur will not enter the world market. This produces the linear segment where the reservation price equals the profit in the local market Π_D.

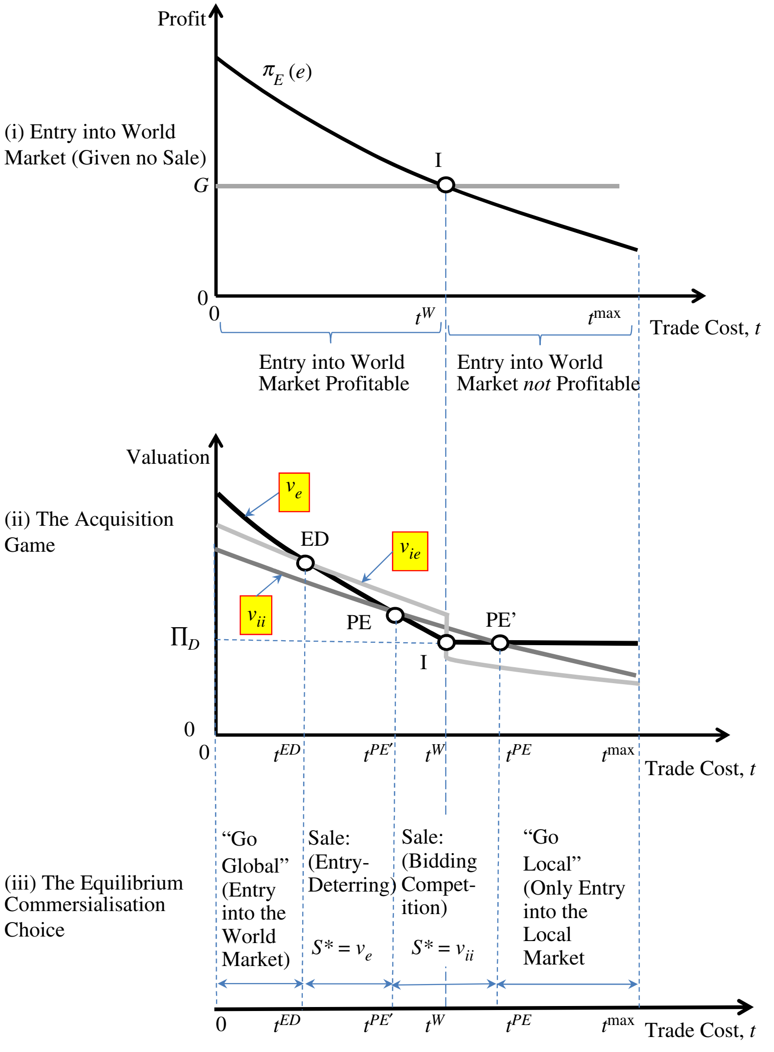
Lemma 1(iii) implies that incumbents' valuations v_{il} in equations (3) and (4) decrease in trade costs,

$$\frac{\mathrm{d}v_{il}}{\mathrm{d}t} = \frac{\mathrm{d}\pi_A(i)}{\mathrm{d}t} - \frac{\mathrm{d}\pi_{NA}(l)}{\mathrm{d}t} < 0.$$

Due to the possession of the invention $\bar{k}$, an acquiring incumbent will face a larger direct loss in its profits than a smaller non-acquiring incumbent when trade costs increase. Using equations (3) and (4) and Lemma 1, we also have:

$$v_{ie} - v_{ii} = \begin{cases} \pi_{NA}(i) - \pi_{NA}(e) > 0, & \text{if} \quad \underbrace{t < t^W}_{\text{Entry is profitable}} \\ \pi_{NA}(i) - \pi_{NA}(0) < 0, & \text{if} \quad \underbrace{t > t^W}_{\text{Entry not profitable}} \end{cases}. \tag{6}$$

FIGURE 2
Solving the Model



Equation (6) tells us that when the entrepreneur can enter the world market at low trade costs $t < t^W$, an incumbent is willing to pay more to deter entry than to pre-empt a rival, $v_{ie} > v_{ii}$. The reason is that an incumbent can freeride on the market concentration effect of a rival's acquisition: the profit as non-acquirer under a rival acquisition is higher, $\pi_{NA}(i) > \pi_{NA}(e)$, as shown in Lemma 1(ii). However, when the entrepreneur cannot enter the world market at high trade costs $t > t^W$, the incumbent's willingness to pay to deter entry is lower than the pre-emptive valuation, $v_{ie} < v_{ii}$. As was explained in Lemma 1(ii), this is because when the innovation is not used in the world market the profit for the non-acquirer is high, $\pi_{NA}(0) > \pi_{NA}(i)$. From equation (3), we also note that the high profit for the non-acquirer when the innovation is not commercialised $\pi_{NA}(0) > \pi_{NA}(e)$ will imply that the entry deterring valuation v_{ie} will jump down at the critical trade cost $t = t^W$.

Let us now solve for the equilibrium commercialisation pattern. Note that Lemma 2 implies that a sale takes place if and only if $v_{il}-v_e > 0$. That is, to acquire the innovation, an incumbent's willingness to pay must at least be as high as the reservation price. To proceed, define $v_{ie} - v_e$ as the *net value for an incumbent of deterring entry*, and $v_{ii} - v_e$ as the *net value for an incumbent of pre-empting a rival* from obtaining the entrepreneur's invention.

(i) High Trade Costs ($t > t^W$)

For high trade costs, $t > t^W$, equations (3) and (4) gives:

$$v_{il} - v_e = \begin{cases} v_{ie} - v_e = \pi_A(i) - \pi_{NA}(0) - T, & \text{if } t > t^W \\ v_{ii} - v_e = \pi_A(i) - \pi_{NA}(i) - T, & \text{if } t > t^W. \end{cases} \tag{7}$$

From Lemma 1(iv), higher trade costs reduce the profit for the acquirer $\pi_A(i)$ more than the profit for the non-acquirer $\pi_{NA}(l)$. It then follows that the net value of an acquisition $v_{il}-v_e$ is decreasing in trade costs:

$$v'_{il,t} - v'_{e,t} = \underset{(-)}{\frac{\mathrm{d}\pi_A(i)}{\mathrm{d}t}} - \underset{(-)}{\frac{\mathrm{d}\pi_{NA}(l)}{\mathrm{d}t}} < 0, \quad \text{if } t > t^W, \tag{8}$$

where we use v'_t as the notation for the derivative, $(\mathrm{d}v)/(\mathrm{d}t)$. This is illustrated in Figure 2(ii) in the region $t > t^W$, where incumbents' valuations v_{ie} and v_{ii} decrease in trade costs, whereas the reservation price v_e is not affected by trade costs. It then follows that if the transaction costs T are sufficiently high, incumbents willingness to pay v_{il} will be lower than the reservation price v_e at very high trade costs. Define the level of trade costs t^{PE} such that $v_{ii} = v_e$ holds. Then, as also shown in Figure 2(ii), there will be a region $t \in (t^{PE}, t^{\max})$ where $v_e > v_{ii} > v_{ie}$ holds, which implies that the entrepreneur will not sell the innovation. Since $t > t^W$ it also follows from Figure 2(i) that the innovation is only commercialised in the home market. This is summarised in Figure 2(iii).

What happens if trade costs t are reduced? From equation (8), we know that incumbents willingness to pay v_{il} will increase, whereas the reservation price v_e remains constant (Π_D). When the trade costs are reduced (slightly) below t^{PE}, the pre-emptive valuation v_{ii} will exceed the reservation price, $v_{ii} > v_e$. However, the entry deterring valuation remains below the reservation price $v_e > v_{ie}$. One the one hand, an incumbent is then willing to pay more than the reservation price if she thinks a rival would otherwise obtain the invention. On the other hand, she is willing to pay less than the reservation price if she thinks that the entrepreneur would otherwise keep the invention and only use it in the local market.

From Table 1, we note that the inequality $I2$ or $v_{ii} > v_e > v_{ie}$ implies that there are multiple Nash equilibria in the acquisition game. If an incumbent thinks that the entrepreneur will not sell to a rival, no acquisition takes place and the innovation is only commercialised in the local market. However, if the incumbent believes that a rival would buy the innovation if she does not, the fact that a rival will use the invention in the product market will increase the incumbent's willingness to pay above the reservation price, $v_{ii} > v_e$. The latter induces a bidding war between the foreign incumbents and the acquisition price is driven up to $S^* = v_{ii}$. The invention 'goes global' – but it is commercialised by the incumbent rather than the entrepreneur.

(ii) Low Trade Costs ($t < t^W$)

If trade costs decreased even further, we know that at the trade cost t^W the entrepreneur will face profitable entry into the world market. Realising that the entrepreneur can now enter the world market profitably, the entry deterring valuation increases discretely at $t = t^W$ and for a slightly lower trade cost than t^W, the entry deterring valuation v_{ie} will exceed the reservation price v_e as well as the pre-emptive valuation v_{ii}. As explained above, the inequality $v_{ie} > v_{ii}$ follows since an incumbent is better off as a non-acquirer under a rival acquisition, where it can freeride on a more concentrated market. But then with both incumbent valuations exceeding the reservation price, $v_{ie} > v_{ii} > v_e$, an incumbent acquisition must be the unique equilibrium. Since the value of pre-empting a rival acquisition is higher than the reservation price, it also follows that bidding competition drives up the price to $S^* = v_{ii}$.

In Figure 2(iii), it is now shown that incumbent acquisitions will occur at the price $S^* = v_{ii}$ in the region $t \in (t^{PE'}, t^W)$ and at the reservation price $S^* = v_e$ in the region $t \in (t^{ED}, t^{PE'})$. To see this, first note equations (3) and (4) imply that the net value of an acquisition for low trade costs becomes:

$$v_{il} - v_e = \pi_A(i) - \pi_E(e) - \pi_{NA}(l) + G - T, \quad \text{if } t < t^W. \tag{9}$$

Differentiating the net value $v_{il} - v_e$ in trade costs t, it can be shown since trade costs are low:[7]

$$v'_{il,t} - v'_{e,t} = \underset{(-)}{\frac{d\pi_A(i)}{dt}} - \underset{(-)}{\frac{d\pi_E(e)}{dt}} - \underset{(-)}{\frac{d\pi_{NA}(l)}{dt}} > 0. \tag{10}$$

For low trade costs, incumbents' willingness to pay for the invention is less sensitive to trade costs than the entrepreneur's reservation price. As shown in Figure 2(ii), this implies that if trade costs t decrease incumbents' willingness to pay, v_{il} will increase less than the reservation price v_e. To see why, note that lower trade costs imply that the term $\pi_A(i)$ in $v_{il} = \pi_A(i) - \pi_E(e) - \pi_{NA}(l) + \Pi_D - T$ increases in similar magnitude as the term $\pi_E(e)$ decreases in $v_e = \pi_E(e) - G + \Pi_D$. However, the profit of a non-acquirer $\pi_{NA}(l)$ in v_{il} also increases when trade costs decrease, which implies a smaller increase in the incumbents willingness to pay.

Since the entry deterring valuation v_{ie} is larger than the pre-emptive valuation v_{ii}, and since the incumbent valuations increase by less than the reservation price v_e when trade costs t are reduced, the entry deterring valuation v_{ie} will intersect with the reservation price v_e at a unique trade cost t^{ED} and the pre-emptive valuation will intersect with the reservation price at a unique trade cost $t^{PE'} > t^{ED}$. As shown in Figure 2(iii), in the region $t \in (t^{PE'}, t^W]$, the equilibrium is an incumbent acquisition under bidding competition $S^* = v_{ii}$, since both incumbent valuations exceed the reservation price $v_{ii} > v_{ie} > v_e$. However, when trade costs are reduced even further into the region $t \in (t^{ED}, t^{PE'}]$, the pre-emptive valuation is below the reservation price, $v_{ii} < v_e$. Since the entry deterring valuation is still higher than the reservation price $v_{ie} > v_e$, one incumbent will buy the invention at the reservation price v_e. Other incumbents will not attempt to pre-empt a rival acquisition since the net value of pre-emption is negative, $v_{ii} - v_e < 0$. As shown in Figure 2(iii), the entrepreneur will then commercialise by sale $(l^* = i)$ at price $S^* = v_{ii}$ in this region.

Finally, when trade costs are reduced below the level t^{ED} incumbents valuations will be below the reservation price, $v_{il} < v_e$. As shown in Figure 2(iii), the entrepreneur will not sell the invention but commercialise it on the world market. Hence, for sufficiently low trade costs $t \in [0, t^{ED})$, the entrepreneur 'goes global' commercialising the invention on her own.

[7] It can be shown that there exists unique trade costs, t^{ED} and $t^{PE'}$, such that $0 < t^{ED} < t^{PE'}$. While helpful to provide intuition, this proof does not require that equation (10) holds for all values of t.

(iii) Innovation Incentives

Let us now turn to how a trade liberalisation, a reduction in trade costs t, affects the incentive for entrepreneurs to bring innovations to the market. It follows immediately from Lemma 1(iii) that the entry profit $\pi_e(e)$ will increase when trade costs t are reduced.

Turning to the effect of trade liberalisation on innovation incentives under innovation for sale, we can use Lemma 1(iv) to get:

$$\frac{\mathrm{d}R_E(i)}{\mathrm{d}t} = \frac{\mathrm{d}S^*}{\mathrm{d}t} = \frac{\mathrm{d}v_{ii}}{\mathrm{d}t} = \frac{\mathrm{d}\pi_A(i)}{\mathrm{d}t} - \frac{\mathrm{d}\pi_{NA}(i)}{\mathrm{d}t} < 0.$$

In equilibrium, the acquisition price S^* of the invention is a non-acquiring incumbent's willingness to pay v_{ii}, which consists of two profit terms: the product market profit for this firm if it were instead to obtain the invention $\pi_A(i)$, and the corresponding profit when not buying, $\pi_N(i)$, that is, $S^* = \pi_A(i) - \pi_N(i)$. The first term increases more from an decrease in trade cost than does the second term according to Lemma 1(iv), and thus, the reward to innovate for sale increases when trade costs decreases.

Proposition 2: *Trade liberalisation increases the incentive for innovation for entry by reducing the cost of exploiting the new invention on the world market and increases the incentive for innovation for sale by increasing the bidding competition over the invention for sale.*

e. Deregulation of the Market for Corporate Control

Restrictions on foreign acquisitions of domestic firms are still common (Mattoo et al., 2004). However, the attitude was gradually becoming more positive until the very end of the twentieth century when a return of protectionism could be observed in the policy debate. Large privatisation and liberalisation programmes started in the UK in the late 1970s and spread around the world.[8] The deregulation of financial markets in many countries and the development of a well-functioning global capital market in the 1980s and 1990s have also made cross-border acquisitions less complicated and costly relatively to greenfield investments.

Lemma 3 states that an acquisition takes place if and only if $v_{il} - v_e > 0$. Then, from equations (2), (3) and (4), it follows that v_{il} decreases in transaction costs T and v_e is independent of T. This in turn implies that the reward from innovation for sale is decreasing in T and the incentive for innovation for entry is independent of T.

Consequently, we can state the following result:

Proposition 3: *A reduction in takeover transaction costs will (i) make sale more likely over entry and (ii) increase the incentives for innovation for sale.*

3. CONCLUDING DISCUSSION

In this paper, we shown that the ongoing globalisation process increases the incentive for international entrepreneurship by reducing the cost of exploiting good business ideas

[8] In Sweden, for instance, the restrictions on foreign acquisitions were rigorous in the 1970s, but were basically abolished by the first half of the 1990s; see Henrekson and Jakobsson (2003).

worldwide. However, our analysis also suggests that the means by which the entrepreneurial firm will commercialise its business idea (invention), by entering the world market or by selling its business to incumbents, depends on how complete the international market process becomes. In partly integrated markets the entrepreneurs might prefer selling their business since incumbents are then willing to pay high prices to protect their market power. In more integrated markets incumbents, market power is lower and it is more profitable for entrepreneurs to commercialise by entry.

Our results also show that international market integration will increase the incentive for entrepreneurship by increasing the reward for entrepreneurs through lower trade costs and through a more efficient market for corporate control.

These results suggest that the ongoing international market integration process spurs international entrepreneurship and thereby growth in the world economy. Consequently, further policies aiming at abolishing international barriers would not only likely benefit consumers through lower prices but also through new products developed by entrepreneurs all over the world.

These results can be related to existing policies that support entrepreneurship in the European Union and elsewhere. The Small Business Act for Europe (European Commission, 2008, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0394:FIN:EN:PDF), for example, focuses on supporting entrepreneurial firms to expand their business. These developments are in general likely to be warranted since entrepreneurial activity is associated with large asymmetric information problems and with positive externalities on society. However, our analysis also suggests that focusing on 'born global entrepreneurs' can be counterproductive since 'born to be sold global entrepreneurs' can be more beneficial to society, by avoiding large entry costs.

In the analysis, we have assumed that the seller could only sell the innovation exclusively to one buyer. In many cases, when the innovation to a large extent consists of indivisible assets in terms of capital or human capital, such a setting is self-evident. However, in some situations, several buyers might hold a licence to utilise the innovations. In such situations, the seller might consider how many licences to sell. This issue is studied in the literature on patent licensing. Kamien and Tauman (1986) assumes that the independent innovator acts as a standard monopolist, by posting a price and allowing the buyers to decide whether to buy a licence. Then, they show that the number of licences falls in the quality of the innovation in such a setting. Allowing the seller to commit to the number of licences it will sell, Katz and Shapiro (1986) show that there exists an equilibrium where some potential buyers are left without a licence.

A possible extension would be to undertake a fully fledge welfare analysis taking into account effects on consumers, firm owners and labour. Another extension would be to introduce a more complex set of contractual arrangements between entrepreneurs and financiers, where the incentives for all agents may be distorted by asymmetric information. For instance, heavy reliance on debt financing can lead to excessive risk-taking by entrepreneurs. Finally, the analysis could be extended to a dynamic model, to capture the growth-promoting effect that is a core reason for the policy support afforded to entrepreneurship.

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APPENDIX

COURNOT WITH LINEAR DEMAND AND INNOVATION

The profit of firm j is:

$$\pi_j = \left[P - c_j - t\right] q_j. \tag{A1}$$

Demand

$$P = a - Q, \tag{A2}$$

where $Q = \sum_{j=1}^{n} q_j$. The first-order condition (firms take consumers expectations as given):

$$P - c_j - t - q_j^* = 0. \tag{A3}$$

Then (A3) becomes:

$$a - Q - c_j - t - q_j^* = 0. \tag{A4}$$

Define $\Lambda_j = a - c_j - t$ and rewrite

$$\Lambda_j - Q - q_j^* = 0. \tag{A5}$$

Sum over all (n) firms and solve for Q^*

$$\sum_j \Lambda_j - nQ^* - Q^* = 0. \tag{A6}$$

We then get:

$$Q^* = \frac{\sum_j \Lambda_j}{n+1} = \frac{\bar{\Lambda}}{n+1}. \tag{A7}$$

From (A5), we now have:

$$q_j^* = \Lambda_j - Q^*. \tag{A8}$$

and finally from (A1) and (A3):

$$\pi_j^* = \left[q_j^*\right]^2. \tag{A9}$$

Let $\Lambda_0 = a - c$. Then from (A7), we have (noting that there are $n + 1$ firms under entry)

$$Q^*(i) = \frac{n(\Lambda_0 - t) + k}{n+1},\ Q^*(e) = \frac{(n+1)(\Lambda_0 - t) + k}{n+2} \text{ and } Q^*(0) = \frac{n(\Lambda_0 - t)}{n+1}. \tag{A10}$$

From (A8), we obtain equilibrium outputs:

$$q_A(i) = \Lambda_0 - t + k - Q^*(i), q_N(i) = \Lambda_0 - t - Q^*(i), q_E(e) = \Lambda_0 - t + k - Q^*(e), \tag{A11}$$

$$q_N(e) = \Lambda_0 - t - Q^*(e), q_N(0) = \Lambda_0 - t - Q^*(0). \tag{A12}$$

From equation (9), we have $\pi_h(l) = [q_j^*]^2$. From the information in (A10), (A11) and (A12) it is now straightforward to prove Lemma 1.

a. Proof of Lemma 3

First, note that $b_j \geq \max v_{ml}$, $l = \{\text{e, i}\}$ is a weakly dominated strategy, since no incumbent will post a bid equal to or above its maximum valuation of obtaining the assets and that firm e will accept a bid in Stage 2, iff $b_j > v_e$.

(i) Inequality I1

Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_2^*, \ldots, yes)$. Then, $b_w^* \geq v_{ii}$ is not an equilibrium since firm w would then benefit from deviating to $b_w = v_{ii} - \varepsilon$. If all other incumbents have posted a bid below $v_{ii} - \varepsilon$, w obtains the assets but pays a lower price. If any other incumbent posts a bid above $v_{ii} - \varepsilon$, w is better off not obtaining the innovation. $b_w^* < v_{ii} - \varepsilon$ is not an equilibrium since firm $j \neq w,e$ then benefits from deviating to $b_j = b_w^* + \varepsilon$, since it will then obtain the assets and pay a price lower than its valuation of obtaining them. If $b_w^* = v_{ii} - \varepsilon$, and $b_s^* \in [v_{ii} - \varepsilon, v_{ii} - 2\varepsilon]$, then no incumbent has an incentive to deviate. By deviating to *no*, firm e's payoff decreases, since it foregoes a selling price exceeding its valuation, v_e. Accordingly, firm e has no incentive to deviate and thus, b^* is a Nash equilibrium.

Let $b = (b_1,\ldots,b_M, no)$ be a Nash equilibrium. Firm e will then say *no* iff $b_h \leq v_e$. But incumbent j will then have the incentive to deviate to $b' = v_e + \varepsilon$ in 01, since $v_{ie} > v_d$. This contradicts the assumption that $\mathbf{b}$ is a Nash equilibrium.

(ii) Inequality I2

Consider the equilibrium candidate $\mathbf{b}^* = (b_1^*, b_2^*, \ldots, yes)$. Then, $b_w^* > v_e$ is not an equilibrium since firm w would then benefit from deviating to $b_w = v_e$. $b_w^* < v_e$ is not an equilibrium, since firm e would then not accept any bid. If $b_w^* = v_e - \varepsilon$, then firm w has no incentive to deviate. By deviating to $b_j' \leq b_w^*$, firm j's, $j \neq w,e$, payoff does not change. By deviating to

$b'_j > b^*_w$, firm j's payoff decreases since it must pay a price above its willingness to pay v_{ii}. Accordingly, firm j has no incentive to deviate. By deviating to *no*, firm e's payoff decreases since it foregoes a selling price above its valuation v_e. Accordingly, firm e has no incentive to deviate and thus, b^* is a Nash equilibrium.

Let $b = (b_1,\ldots,b_m, no)$ be a Nash equilibrium. Firm e will then say *no* iff $b_h \leq v_e$. But incumbent $j \neq e$ will have the incentive to deviate to $b' = v_e + \in$ in Stage 1, since $v_{ie} > v_e$, which contradicts the assumption that **b** is a Nash equilibrium.

(iii) Inequalities I3

Consider the equilibrium candidate $b^* = (b^*_1, b^*_2, \ldots, no)$, where $b^*_j < v_e \ \forall j \neq e$. It then directly follows that no firm has an incentive to deviate and thus, b^* is a Nash equilibrium.

Then, note that firm e will accept a bid iff $b_j \geq v_e$. But $b_j \geq v_e$ is a weakly dominating bid in these intervals, since $v_e > \max\{v_{ii}, v_{ie}\}$. Thus, the assets will not be sold in these intervals.