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Abstract

What explains the world-wide trend of pro-entrepreneurial policies? We study entrepreneurial policy in a lobbying model taking into account the conflict of interest between entrepreneurs and incumbents. It is shown that international market integration leads to more pro-entrepreneurial policies, since it is then (i) more difficult to protect domestic incumbents and (ii) pro-entrepreneurial policies make foreign entrepreneurs less aggressive. Using the World Bank Doing Business database, we find evidence that international openness is negatively correlated with the barriers to entry for new entrepreneurs, as predicted by the theory.

JEL codes: L26; L51; O31; F15; D73

Keywords: Entrepreneurship; Regulation; Innovation; Market Integration; Lobbying

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†Robin sadly passed away in August 2009. His friendship, kindness and talent will be deeply missed.

1. Introduction

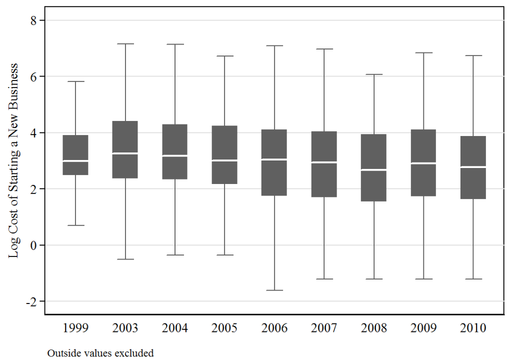
In the last few decades, entrepreneurship has emerged as a key issue in the policy arena.[1] This marks a distinct break against traditional industrial policy which has focused on large established firms. The the shift towards more pro-entrepreneurial policies is revealed in data from the World Bank *Doing Business* project. Figure I uses data for 183 countries over the time period 1999 to 2010. Panel A of Figure 1.1 shows the distribution over time of the log of the official cost incurred in the process of starting up a new firm as a share of the country's GDP per capita, where the median is displayed by a horizontal line and the size of the box depicts the distribution of these costs from the 25th to the 75th percentile. Likewise, Panel B shows the evolution over time for the log of the number of days it takes to start a firm, whereas Panel C shows the number of procedures that an entrepreneur needs to complete in order for the firm to be granted legal status. While there is less of a decline for the official cost of starting a firm, there is a clear pattern that both the number of business days and the number of procedures associated with new entry, have declined over time.

We propose that the shift towards more pro-entrepreneurial policies can be explained by international market integration. The starting point of the analysis is the process of international integration of product and innovation markets in the last few decades, which has been driven both by policy changes such as WTO agreements (e.g. TRIPS), the EU single market program and by technology advances reducing international transportation and transaction costs.

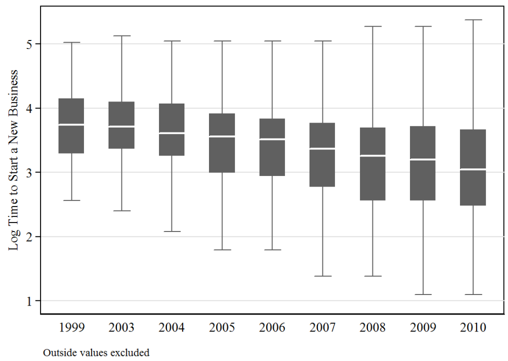
Can international market integration affect entrepreneurship policy? Industrial policy as an endogenous outcome of international integration has previously been studied in the literatures on international R&D competition and lobbying for protection emanating from the seminal contribution by Spencer and Brander (1983). However, this literature has abstracted from the entrepreneur as a source of innovations. We study the effects of international integration on entrepreneurial policies, taking into account the within-country conflict of interest between independent entrepreneurs and incumbent firms. The latter have an incentive to protect their rents on the product market and preserve status quo; they can lobby a policy maker to set a fee (barriers) on entrepreneurial entry.

As a benchmark, we first establish that the maximizing behavior of the government in autarchy will balance two effects of an increase in the entry fee: The first is the (expected) marginal revenue from the entry fee; a higher fee translates into a fee with the probability that the entrepreneur succeeds, but also declines as the entrepreneur will reduce her innovation

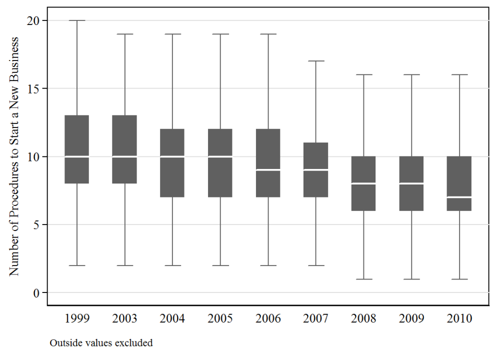
[1] *The Economist* (14th March 2009) published a special report on entrepreneurship, "Global Heroes", describing this phenomenon.



PANEL A:
Log of the official cost of starting a new business as a share of GDP per capita.



PANEL B:
Log of the number of business days to start a new business.



PANEL C:
Number of procedures to start a new business.

Figure 1.1: Illustrating the evolution of entry barriers/regulation using data from the World Bank *Doing Business* project. Panels A, B and C use data for 183 countries and cover the time period 1999, 2003-2010. The median is displayed by a horizontal line and the size of each box depicts the distribution from the 25th to the 75th percentile.

effort, reducing the probability that the fee is collected from the entrepreneur. The second is the (expected) marginal revenue from lobby contributions from incumbents: when the probability of a successful innovation (and hence of entrepreneurial entry) decreases, this will increase the marginal lobbying contributions from incumbents as their expected profits increase.[2]

Then, we examine a situation where local product and innovation markets are integrated with those in a foreign country. We identify two distinct mechanisms that make policy more pro-entrepreneurial as markets integrate internationally.

The first is the *foreign threat effect*. In the presence of the foreign entrepreneur, the marginal revenue from the entry fee will decrease since the foreign entrepreneur might win over the domestic entrepreneur in the case where both are successful. Moreover, the marginal revenues from lobbying contributions from incumbents will decrease. The reason is that the incumbents now benefit less from a increased domestic entry fee since the foreign entrepreneur might be successful when the domestic entrepreneur fails.[3] The foreign threat effect will then push the government towards choosing a lower entry fee under integration.

The change in stance towards a more pro-entrepreneurial policy under integration also arises through a second effect, the *strategic innovation effect*. Integration introduces a strategic interaction between the entrepreneurs in the two countries since the value of an innovation now depends on the potential presence of a rival innovation. When a higher entry fee for the domestic entrepreneur discourages her innovation efforts, the expected reward to innovation increases for the foreign entrepreneur, who responds with a higher innovation effort. This increases the probability of entry and reduces incumbents' willingness to lobby for high entry fees. By encouraging foreign innovation efforts, the fee also reduces the probability that the domestic entrepreneur wins the innovation game (and hence probability that the fee is collected) and thereby the government's incentive to increase the fee.

However, there is also a third effect of integration, which might counter the first two effects, since integration also affects the entrepreneur's and incumbents' market rents and hence, their willingness to put in effort and lobby, respectively. One can then identify several different mechanisms from international market integration that could make policies more anti-entrepreneurial through an increase in this *market-rent effect*. Asymmetries in the industry structure where few large firm can increase their rents through exports may create a large market rent effect. International market integration will also affect the incentives for mergers and exits. For in-

[2] Since the government can exploit incumbents' willingness to pay to prevent entry, the government will set the entry fee in excess of the level that maximizes the expected entry fee.

[3] Put differently, the presence of a foreign entrepreneur drives a wedge between the probability that the domestic entrepreneur will enter the market (affecting expected policy revenues) and the probability that entry will occur at all (affecting incumbents' willingness to lobby).

stance, the implementation of the EU single market program has triggered a large number of mergers. If integration triggers a sufficiently strong market concentration, integration will lead to an increase in entry profits and incumbents' total profits and enhance their willingness to lobby for protection from entrepreneurial entry. The market rent effect will be dominated by the foreign innovation threat effect and the strategic innovation effort effect, as long as the integrated product market does not become too concentrated.

With respect to lobbying, governments differ substantially in how sensitive they are to the interest of less organized agents in the economy, notably consumers. Consumer welfare considerations will induce more pro-entrepreneurial policies, since innovations benefit consumers through lower prices and higher product quality. The importance attached to consumer welfare is shown to have an impact on the effects of international integration; the more weight a government puts on consumer welfare, the weaker is the reduction in entrepreneurial fees due to the integration of markets. The reason is that a government that puts little emphasis on the consumer surplus will have relatively high entry fees in autarchy and such a government will then be more strongly affected by an international integration than a government which already, pre-integration, uses low entry fees to promote competition to secure consumer interests.

We examine the prediction of a negative relationship between barriers to entry for entrepreneurs and international market integration using the *Doing Business* measures of entry regulation shown in Figure 1.1: (A) the log of the official cost to start a firm as a share of GDP per capita, (B) the log of the number of days it takes to start a firm and (C) the number of procedures involved. Our theoretical concept of international integration entails both the integration of product markets and innovation markets. Consistent with this, we draw on a broad index of globalization in the empirical analysis, the KOF Index, provided by the Swiss Federal Institute of Technology in Zurich. This index combines components of trade flows and foreign direct investment (FDI) flows, data on international personal contacts and information flows and involvement in international organizations.

Overall, we find a strong negative correlation between barriers to entry for entrepreneurs and the degree of international integration of the respective countries. That more open countries have lower barriers to entry for new firms is consistent with that the market rent effect is dominated by the foreign innovation and strategic innovation effort effects. The negative correlation between entry regulation and openness is particular strong when entry regulation is measured through the number of days it takes and the number of procedures involved to start a firm, and holds when controlling for a general time trend, and including country-specific measures of general institutional liberalization. We find some evidence that countries with governments that are likely to put less emphasis on consumer welfare (more corrupt countries) reduce their entrepreneurship barriers much more in response to an increase in integration, although these results only hold when entry regulation is measured by the number of procedures.

We should note that while we find a negative correlation between entry regulation and international integration, we cannot establish the direction of this relationship, i.e. reduced entry barriers may affect policy makers' incentive to protect their markets from international competition. However, a large share of the ongoing international market integration is due to "exogenous" medium run changes such as technological breakthroughs from the ICT revolution. Therefore, we are more concerned that our estimates might suffer from omitted variable problems. In particular, institutions may change over time affecting both the level of globalization or the level of openness and the barriers to entry. Observed reductions in entry fees might then simply reflect a general change in institutions towards market orientation and not be driven by international integration. Increased openness may occur simultaneously as a change in government preferences towards reducing taxes, reducing government intervention, or conducting financial deregulation. Entry costs may be reduced due the government's change in stance on market intervention, but may also be directly reduced due to such reforms. To control for this omitted variable problem, we use broad measures intended to capture the extent to which a country's institutions are aligned to free-market solutions. We find that when adding a control for other institutions, the effects of openness are decreased but still highly significant.

Innovations introduced by independent entrepreneurs, and the start-up of new firms, play an important role in an economy's innovation system.[4] Indeed, the entrepreneurship literature has proposed that the entrepreneur has returned as a prominent player in the economy's innovation system in the last few decades (Baumol 2002, 2004; Loveman and Sengenberger, 1991). One of the most frequently cited reasons for the increased importance of entrepreneurship is globalization (e.g. Gilbert *et al.*, 2004). The specific link between globalization and actual policy outcome has nevertheless been neglected. We contribute to this literature by providing a theory explaining the pro-entrepreneurial policy shift as a response to international market integration and providing empirical support for the proposed mechanism.

Our paper relates to the literature on international protection for sale (Grossman and Helpman, 1994; Imai, Katayama and Krishna, 2008; Bombardini, 2008; Goldberg and Maggi, 1999).[5]

[4] Moreover, using a sample period of 1965-1992, Kortum and Lerner (2000) found that VC investments, which support small innovative firms, have a positive impact on patent count at the industry level, and that this positive impact is larger than that of R&D expenditures. Hirukawa and Ueda (2008) find similar results when extending the sample period to 2001.

[5] Our paper is also related to the literature on financial development and internationalization, in particular Rajan and Zingales (2003). They present empirical evidence that openness can explain the development of financial markets over long periods of time. Perotti and Volpin (2007) formally endogenize investor protection in a model with interest groups.

This literature has shown that higher import penetration reduces the incentive for import protection in industries that wield political influence. We differ from this literature by treating the level of trade protection as exogenous. Instead, we focus on the effect of internationalization on incumbents' incentives for protection against domestic entrepreneurial entry. By showing that domestic entry barriers can be reduced due to international integration, we provide an additional channel through which globalization affects economic policy.

Moreover, the paper contributes to an emerging literature on the impact of trade on domestic institutions. Using a Melitz (2003) model of trade with heterogeneous firms and monopolistic competition, Do and Levchenko (2009) show that trade liberalization may worsen domestic institutions (higher entry barriers) if the foreign competition effect of trade liberalization is small, since trade opening also changes the political power in favor of large exporters who, in turn, prefer to install high entry barriers. Our paper shares the focus of Do and Levchenko (2009) on how trade opening (globalization) affects the balance of political power between different types of firms. We differ from their paper by including an interaction between entrepreneurs engaged in international R&D rivalry, allowing for mergers, and by studying an oligopolistic product market. This does not only enable us to identify rent effects (the market rent effect) of the globalization affecting incumbents (which can increase or decrease the entry barriers), but also the strategic reaction effects of foreign firms and entrepreneurs (the foreign innovation threat effect and the strategic innovation effort effect) which push entry barriers down when markets become integrated. Moreover, we show that market integration reduces the barriers to entry as long as the integrated product market does not become too concentrated due to mergers. We also contribute by providing empirical support for the proposed mechanisms.

This paper also contributes to the literature on international R&D policy competition (e.g. Brander and Spencer, 1983; Eaton and Grossman, 1986; Grossman and Helpman, 1991; Haaland and Kind, 2008; Leahy and Neary, 2008). This literature has explored how international competition affects the incentives for governments to subsidize incumbent R&D and has identified a "business stealing effect" that increases the incentive for R&D subsidies when international competition increases. We differ from that literature by examining the effects of R&D policy when R&D is conducted by independent entrepreneurs rather than incumbents.[6] Then, we add

[6] An exception is Impullitti (2010) which, to our knowledge, is the only paper in the endogenous growth literature studying how R&D subsidies (policy) are affected by international competition, and which allows both entrants and incumbents to undertake R&D. Focusing on long-run dynamic effects, the author solves the model by calibration and shows that increased foreign competition (more foreign firms) increases R&D subsidies due to a business stealing effect (our strategic innovation effort effect) and a growth effect. We differ by focusing on the direct effect which enables us to derive analytical solutions and empirically testable predictions. Moreover, studying the effects of both product market and innovation market integration enables us to identify four different effects of international integration: a foreign innovation threat effect and a strategic innovation effort effect, which increase R&D subsidies, and a market size effect and a consumer welfare free-riding effect that may reduce R&D

to this literature by showing that international market integration can increase the incentive for pro-entrepreneurial policies (e.g. R&D subsidies) due to a foreign innovation threat effect and a strategic innovation effort effect (similar to the business stealing effect) and by providing empirical support for the proposed mechanisms.

To the best of our knowledge, this paper provides the first theoretical and empirical work explaining the variation in formal entry barriers over time. The data on entry regulation from the World Bank's Doing Business survey has been extensively used in the literature (for an overview, see the Appendix, Table A.2). Primarily, it has been used to study the effect of institutions on growth (Freund and Bolaky, 2008), corruption (Svensson, 2005) and industrial structure and dynamics (Klapper, Laeven and Rajan, 2006; Barseghyan, 2008; Ciccone and Papaopannou, 2007).[7] Although the correlation between openness and entry barriers has been noted in earlier literature, the entry costs have been treated as an exogenous underlying institutional feature.

The model under autarchy is spelled out in Section 2. Section 3 studies how international market integration affects the incentive to set entrepreneurial policy. In Section 4, we examine a government which takes consumer effects into account. In Section 5 we examine how results change if we allow for incumbent innovation. We extend the base model in Section 6. First, we examine the case where both the incumbents and the entrepreneur lobby to affect entry barriers. Second, we examine multi-entrepreneur entry and non-innovation entry. Third, we discuss a setting with multiple incumbents innovating. Fourth, we allow for a global incumbent lobbying group that can simultaneously give contributions to the domestic and the foreign policy maker. Fifth, we study the case of entrepreneurial innovation for sale. The empirical analysis is then conducted in Section 7. Section 8 concludes the paper.

2. Entrepreneurship policy in autarchy

We begin by considering an industry in autarchy and then turn to examining the effect of globalization. Consider a closed oligopolistic industry with n domestic incumbents and a domestic entrepreneur who can potentially enter the market. In stage 1, the incumbents lobby in order to influence a policy maker. The implemented policy affects the profitability of entrepreneurial ventures through an entry fee. The policy maker's objective is to maximize lobbying contributions and revenues from the entry fee (subsidy). In stage 2, the entrepreneur expends effort to increase the probability of making an innovation with a fixed quality $k > 0$. In stage 3, a

subsidies.

[7] Helpman, Melitz and Rubinstein (2008) used entry barriers to construct an instrumental variable for the existence of bilateral trade between two partners. They argue that high entry costs in two countries substantially reduce the probability of the two countries exporting to each other.

successful entrepreneur enters the market and in stage 4, the entrepreneur competes with incumbents on the oligopolistic product market. If the entrepreneur is not successful, incumbents remain in status quo. We proceed by solving the game backwards.

2.1. Product market interaction (stage 4)

Firms (potentially asymmetric) are indexed $j \in \mathcal{I} \cup E$ where the entrepreneurial firm is assigned the index $j = E$ and the set of index numbers for domestic incumbent firms is $j = i \in \mathcal{I}$. The product market profit of firm j is represented by $\pi_j(\mathbf{x} : k)$, where $k > 0$ is the inherent quality of the innovation used by an entrepreneurial firm. Vector $\mathbf{x}$ contains actions for all firms selling to the product market. Firm j chooses an action $x_j \in R^+$ to maximize its product market profit $\pi_j(\mathbf{x} : k)$. We assume there to exist a unique Nash-Equilibrium defined as:

$$\pi_j(\tilde{x}_j, \tilde{x}_{-j} : k) \geq \pi_j(x_j, \tilde{x}_{-j} : k), \tag{2.1}$$

where $\tilde{x}_{-j}$ is the set of optimal actions taken by j's rivals. From (2.1), we can define a reduced-form product market profit for a firm j,

$$\pi_j(k) \equiv \pi_j(\tilde{x}_j(k), \tilde{x}_{-j}(k) : k). \tag{2.2}$$

There are two types of firms: one is the entrepreneurial firm which is making a profit $\pi_E^{Aut}(k) \geq 0$, and the other is an incumbent firm with a profit $\pi_i^{Aut}(k) \geq 0$. When no entry takes place, incumbents have the profit $\pi_i^{Aut}(0) \geq 0$. The argument $k = 0$ indicates that the entrepreneur has not entered the market.

The innovation enables the entrepreneur to enter the market and make a profit, $\pi_E(k) > F > \pi_E(0)$, where F is the entry cost faced by the entrepreneur when entering the product market. This entry cost consists both of the cost of building up production and undertaking marketing. But entry will also reduce the incumbents' profits. As the quality of the innovation improves, the entrepreneurial firm will strengthen its position vis-à-vis incumbent firms, which will further reduce the incumbents' profits and possibly lead to exit. Let $\Pi_I(0) = \sum_i^n \pi_i(0)$ be the aggregate incumbent profit without entry. Moreover, let $\Pi_I(k) = \sum_i^n \pi_i(k)$ be the aggregate incumbent profit with entry. We then assume that incumbents' aggregate profits are reduced by entrepreneurial entry, $\Pi_I^{Aut}(0) > \Pi_I^{Aut}(k)$. This yields incentives for incumbents to lobby against innovation.

2.2. Entry by entrepreneur (stage 3)

In stage 3, a successful entrepreneur enters the market if the fixed cost of entry F is lower than the subsequent product market profit. In what follows, we will assume k to be sufficiently large so that entry always occurs when the entrepreneur succeeds with its innovation, $\Pi_E^{Aut}(k) = \pi_E^{Aut}(k) - F > 0$.

2.3. Innovation (stage 2)

The entrepreneur undertakes an effort, e, to discover an innovation with fixed quality, k. Let innovation costs $y(e)$ be an increasing convex function in effort, i.e. $y_e', y_e'' > 0$. The probability of making an innovation is given by a function $z(e) \in [0,1]$, where z is an increasing but strictly concave function in own effort, $z_e' > 0$, $z_e'' < 0$. The entrepreneur makes an effort decision given an entry fee policy τ set by the government policy in stage 1. The policy reduces the profit by a fixed amount τ, if the entrepreneur innovates successfully.[8]

The entrepreneur then solves the following problem,

$$\max_e : V_E = z(e)\left[\Pi_E^{Aut}(k) - \tau\right] - y(e), \tag{2.3}$$

with the first-order condition:

$$\frac{dV_E}{de} = z_e'\left[\Pi_E^{Aut}(k) - \tau\right] - y_e' = 0, \tag{2.4}$$

where $z_e'\left[\Pi_E^{Aut}(k) - \tau\right]$ is the marginal expected profit from increasing the effort and y_e' is the marginal effort cost. The second-order condition $\frac{d^2V_E}{de^2} < 0$ is fulfilled due to our assumptions $z_e'' < 0$ and $y_e'' > 0$.

The first-order condition (2.4) implicitly defines an optimal effort level $e(\tau)$. Since the entry profit $\Pi_E^{Aut}(k) - \tau$ is decreasing in the entry fee, the optimal effort level is also decreasing in the entry fee, $e_\tau' < 0$. Defining $z(\tau) = z(e(\tau))$, with $z_\tau' = z_e' e_\tau' < 0$, the probability of a successful innovation must also decrease in the entry fee. This is illustrated in Figure 2.1, where Figure 2.1(i) depicts the probability of succeeding as a function of the effort, $z(e)$. Figure 2.1(ii) illustrates how an increase in the entry fee from τ to $\tilde{\tau}$ reduces the marginal expected profit and, therefore reduces the equilibrium choice of effort from $e(\tau)$ to $e(\tilde{\tau})$. In Figure 2.1(i), this leads to a lower success probability, $z(\tau) < z(\tilde{\tau})$.

For the use in the policy stage, define a reduced-form expected profit for the entrepreneur

[8] A fixed τ is assumed since it fits our empirical data. Alternatively, we could set τ to be proportional to entrepreneurial profits. This adds a scaling effect, but does not change any signs of our results. Derivations are available from the authors upon request.

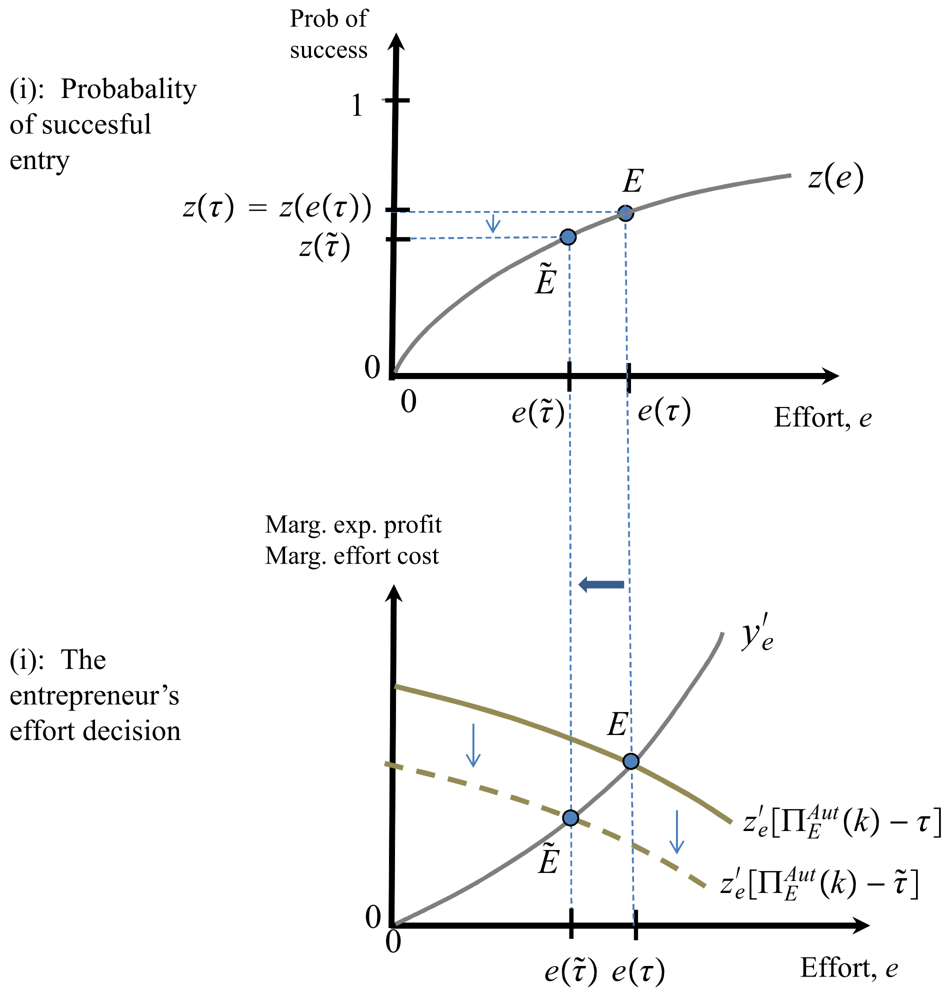


Figure 2.1: Illustrating the domestic entrepreneur's effort choice in stage 2 under autarchy.

and the incumbents as a function of the entry fee, τ, as:

$$\begin{cases} V_E^{Aut}(\tau) = z(\tau)\left[\Pi_E^{Aut}(k) - \tau\right] - y(\tau), \\ V_I^{Aut}(\tau) = \Pi_I^{Aut}(0) - z(\tau)\left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)\right]. \end{cases} \tag{2.5}$$

where $z(\tau)\left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)\right]$ represents the expected loss for incumbents from entry.

2.4. Entrepreneurial policy (stage 1)

In modeling the lobbying game, we will follow Grossman and Helpman (1994). The objective function of the policy maker G is the sum of expected income from expected entry fees $T(\tau)$ and the lobbying contributions from the incumbents $L_I(\tau)$:

$$G(\tau) = T(\tau) + L_I(\tau), \tag{2.6}$$

We assume that the expected entry fee $T(\tau) = \tau z(\tau)$ is strictly concave with a unique entry fee which maximizes $T(\tau)$, i.e. $\hat{\tau} = \arg\max_\tau T(\tau)$. Moreover, we assume that incumbent firms can organize themselves as an interest group and make a joint lobbying contribution. The incumbent lobbying group gives the government a contribution schedule $L_I(\tau)$. For all values of τ, these schedules give the lobbying contribution the party is willing to pay. Following Grossman and Helpman (1994), we restrict the lobbying contributions to be "regret free" or "truthful". From the assumption of truthful contribution schedules the lobbying contribution of the incumbents then becomes $L(\tau) = V_I^{Aut}(\tau) - \bar{\Omega}_I^{Aut}$, where $V_I^{Aut}(\tau)$ is the reduced-form expected profits for the incumbents defined in (2.5) and the term $\bar{\Omega}_I^{Aut}$ implies that the incumbents' will receive at least the net expected profit they would receive when convincing the government to set the incumbents' first best entry fee.

The policy maker sets a fee τ so as to maximize $G(\tau)$ and thereby, the sum of the expected entry fee $T(\tau)$ and the lobbying contributions of the incumbent firms $L_I(\tau)$. The first-order condition is:

$$\frac{dG}{d\tau} = \underbrace{z + z'_\tau \tau}_{\text{MR from entry fee, } T'(\tau)} \quad \underbrace{-z'_\tau\left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)\right]}_{\text{MR from lobbying, } L'(\tau)} = 0. \tag{2.7}$$

The first expression in (2.7) is the *marginal revenue from the entry fee,* $T'(\tau)$: An increase in the entry fee τ first raises the expected policy revenue with the probability that the entrepreneur succeeds, z, since it is only when the entrepreneur succeeds that the fee is collected. However, as shown in Figure 2.2(i), the government also internalizes that a higher entry fee reduces

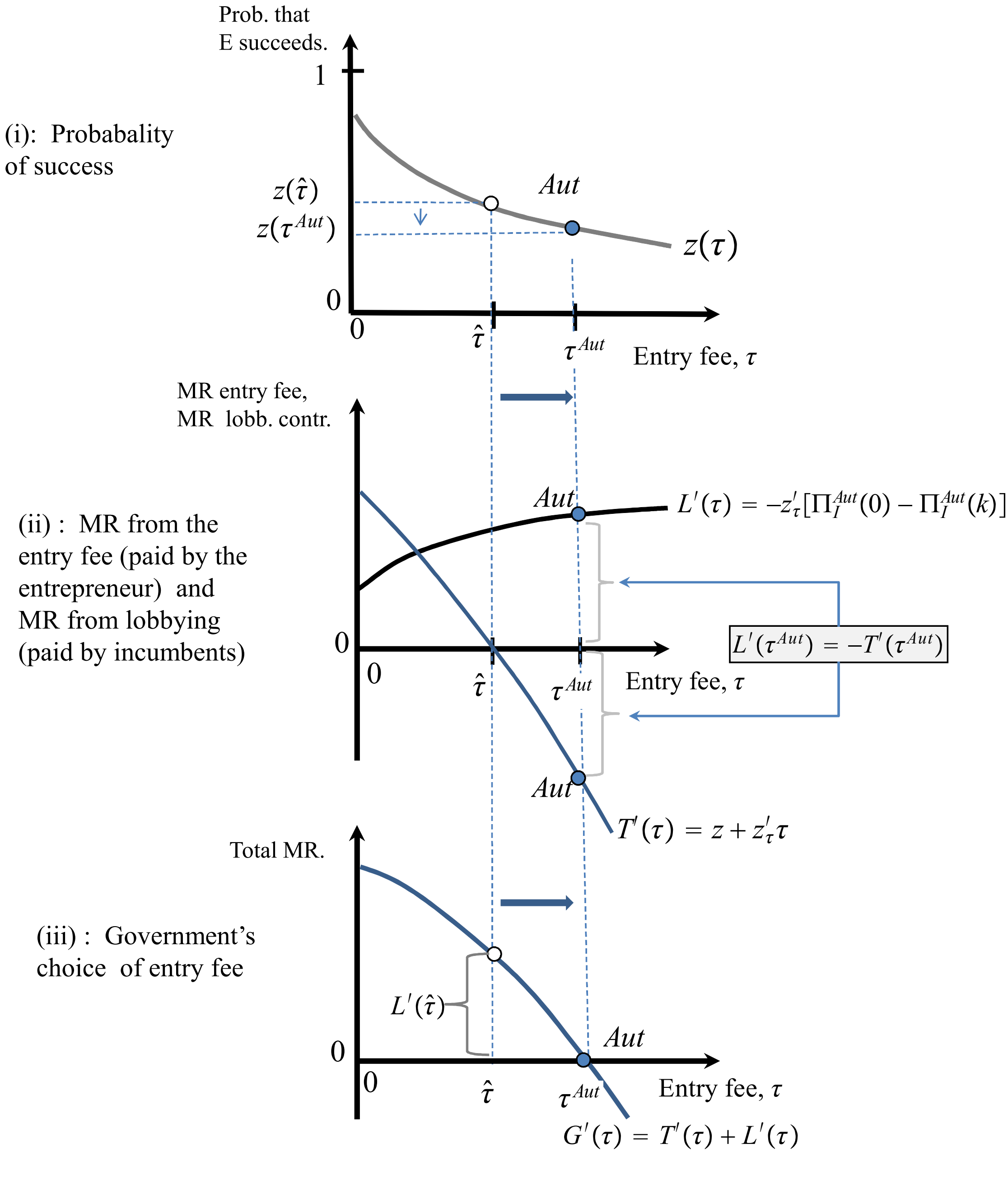


Figure 2.2: Illustrating the government's choice of entry fee in stage 1 under autarchy.

entrepreneurial effort and the probability of a successful innovation, $z'_\tau = z'_e e'_\tau < 0$, which reduces expected policy revenues, $z'_\tau \tau < 0$. The locus of the marginal revenue from the entry fee $T'(\tau) = z + z'_\tau \tau$ is illustrated in Figure 2.2(ii). It is downward-sloping from the strict concavity of $T(\tau)$.

The second expression in (2.7) is the *marginal revenue from lobbying contributions,* $L'(\tau)$: Since the probability of a successful innovation (and hence the probability of entrepreneurial entry) declines with the entry fee, $z'_\tau < 0$, a higher entry fee increases the incumbents' expected gain and their lobbying contributions, $L'(\tau) = -z'_\tau \left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)\right] > 0$. The locus of the marginal revenue from lobbying contributions is the upward-sloping locus in Figure 2.2(ii).[9]

From (2.7) the autarchy fee will be set so that the sum of the marginal revenues from the entry fee and lobbying contributions equal zero. This is shown in Figure 2.2(iii). From the incentive to exploit incumbents' willingness to pay to prevent entry, the government will then set the entry fee in excess of the level that maximizes the expected entry fee, i.e. $\tau^{Aut} > \hat{\tau} = \arg\max_\tau T(\tau)$, since (2.7) implies $L'(\tau^{Aut}) = -T'(\tau^{Aut}) < 0$. The latter is illustrated in Figure 2.2(ii). Finally, as shown in Figure 2.2(i), the incentive to use the entry fee to extract lobbying contributions from incumbents, must then result in a success probability which is lower than the one that maximizes the expected entry fee, $z(\tau^{Aut}) < z(\hat{\tau})$.

The optimal entry fee under autarchy It is also instructive to derive an explicit expression for the optimal entry fee under autarchy. Rewriting (2.7), we obtain:

$$\tau^{Aut} = \frac{\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)}{1 - 1/\varepsilon(\tau^{Aut})}, \tag{2.8}$$

where $\varepsilon(\tau^{Aut}) = -z'_\tau \frac{\tau^{Aut}}{z} > 1$ is the elasticity of the success probability with regard to the entry fee. In other words, the entry fee will be set proportional to the loss of incumbents caused by entry, $\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k) > 0$, where the term $1 - 1/\varepsilon(\tau^{Aut})$ takes into account how sensitive the probability of success it to a rise in the entry fee.

3. Globalization and barriers to entrepreneurship

Let us now examine the impact of globalization on the optimal entry fee, τ. For expositional reasons, we take the entrepreneurial policy in the rest of the world as given, $\bar{\tau}^*$. We capture

[9] Since $L'(\tau) = -z'_\tau \left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)\right]$, the slope of $L'(\tau)$ is determined from the sign of z''_τ. The sign of z''_τ cannot be determined unless we make further assumptions on $z(e)$ and $y(e)$. However, the second-order condition is $\frac{d^2G}{d\tau^2} = T'' + L'' < 0$, or $L'' < -T''$. Since $T'' < 0$ from the concavity of $T(\tau)$, it follows that the second-order condition is fulfilled when $L(\tau)$ is strictly concave, $L'' < 0$, that is, when $z(\tau)$ is convex, $z''_\tau > 0$. This the case we have depicted in Figure 2.2(i). The second-order condition $\frac{d^2G}{d\tau^2} = T'' + L'' < 0$ can be fulfilled if $z(\tau)$ is not too concave. If $z(\tau)$ is concave, then $L'(\tau)$ will be downward sloping.

globalization as an integration of product and innovation markets. Product market integration is modeled as competition between firms, domestic and foreign, on an integrated product market. Innovation market integration is captured by competition between domestic and foreign entrepreneurs for making innovations. We will assume that entrepreneurial entry on the integrated product market requires a global patent for the innovation, k. Even if entrepreneurs from both countries are successful, only one of them will obtain a global patent (and enter the product market). The patent right is then allocated by a 50-50 lottery. This would thus correspond to a situation where an exclusive patent is given to the inventor. We discuss the the effect of allowing both entrepreneurs to enter the market in case both are successful with their inventions in the robustness section 6.

Other assumptions that we impose are that neither incumbents nor entrepreneurs can engage in cross-border lobbying and that the policy makers in the two countries are not able to cooperate. The effects of cross-border lobbying are discussed in Section 6.4.

3.1. Integration of product markets (stage 4)

In the integrated product market, let the set of indices for foreign incumbents and the entrepreneur be denoted $\mathcal{I}^*$ and E^*, while $\mathcal{I}$ and E represent domestic incumbents and the entrepreneur, respectively. Product market competition may then entail firms indexed $j \in \mathcal{I} \cup \mathcal{I}^*$, $j \in \mathcal{I} \cup \mathcal{I}^* \cup E$ or $j \in \mathcal{I} \cup \mathcal{I}^* \cup E^*$. In either case, the Nash-equilibrium is given as:

$$\pi_j^{Int}(\tilde{x}_j, \tilde{x}_{-j} : k) \geq \pi_j^{Int}(x_j, \tilde{x}_{-j} : k), \tag{3.1}$$

from which we define a reduced-form profit $\pi_j^{Int}(k) \equiv \pi_j^{Int}(\tilde{x}_j(k), \tilde{x}_{-j}(k) : k)$. We assume that incumbents' aggregate expected profits are reduced by entry, i.e. $\Pi_I^{Int}(0) > \Pi_I^{Int}(k)$.

3.2. Entry (stage 3)

In stage 3, a successful entrepreneur enters the market at a fixed cost. It is once more assumed that $\Pi_E^{Int}(k) = \pi_E^{Int}(k) - F > 0$ if the domestic entrepreneur is successful, and $\Pi_{E^*}^{Int}(k) = \pi_{E^*}^{Int}(k) - F^* > 0$ if a foreign entrepreneur is successful.

3.3. Entrepreneurial innovation (stage 2)

The domestic and the foreign entrepreneur both expend effort to innovate. Let the effort by the foreign entrepreneur be denoted e^*. The foreign entrepreneur's probability of success is determined by the same function as that of the domestic entrepreneur, $z(\cdot)$. We can then write the probability that the domestic entrepreneur successfully enters as $z_E^{win}(e,e^*) = z(e)\left[1 - z(e^*)\right] + 0.5z(e)z(e^*)$, where $z(e)\left[1 - z(e^*)\right]$ is the probability of entry if the domestic entrepreneur alone is successful and $0.5z(e)z(e^*)$ is the probability of the domestic entrepreneur winning the lottery in case of simultaneous successful innovations.

Simplifying, we obtain $z_E^{win}(e,e^*) = z(e)\left[1 - 0.5z(e^*)\right]$. The probability of the foreign entrepreneur entering the integrated market is symmetric, $z_{E^*}^{win}(e,e^*) = z(e^*)\left[1 - 0.5z(e)\right]$. In the integrated market, we can then write the entrepreneurs' maximization problems as follows:

$$\max_e V_E = z_E^{win}(e,e^*)\left[\Pi_E^{Int}(k) - \tau\right] - y(e), \tag{3.2}$$

$$\max_{e^*} V_{E^*} = z_{E^*}^{win}(e,e^*)\left[\Pi_E^{Int}(k) - \bar{\tau}^*\right] - y(e^*). \tag{3.3}$$

The Nash-equilibrium in efforts is given from:

$$\frac{\partial V_E}{\partial e} = z_{E,e}^{win\prime}\left[\Pi_E^{Int}(k) - \tau\right] - y_e' = 0, \tag{3.4}$$

$$\frac{\partial V_{E^*}}{\partial e^*} = z_{E^*,e^*}^{win\prime}\left[\Pi_{E^*}^{Int}(k) - \bar{\tau}^*\right] - y_{e^*}' = 0. \tag{3.5}$$

where $z_{E,e}^{win\prime}\left[\Pi_E^{Int}(k) - \tau\right]$ and $z_{E^*,e^*}^{win\prime}\left[\Pi_{E^*}^{Int}(k) - \bar{\tau}^*\right]$ are is the marginal expected profit for the domestic- and foreign entrepreneur, respectively. By calculation $z_{E,e}^{win\prime} = z_e'(1 - 0.5z^*)$ and $z_{E^*,e^*}^{win\prime} = z_{e^*}'(1 - 0.5z)$, which implies that the second-order conditions, $\frac{\partial^2 V_E}{\partial e^2} < 0$ and $\frac{\partial^2 V_{E^*}}{\partial e^{*2}} < 0$ hold from our assumptions on $z(.)$ and $y(.)$.

The interaction is illustrated in Figure 3.1. Figure 3.1(i) shows that the presence of the foreign entrepreneur, drives a wedge between the probability that the entrepreneur succeeds and probability that the domestic entrepreneur successfully enters the market, $z_E^{win}(e,e^*) \leq z(e)$. If the foreign entrepreneur abstains from innovation effort these probabilities are the same, i.e. $z_E^{win}(e,0) = z(e)$. Figure 3.1(ii), then shows that integration will increase the marginal expected profit from innovating if the reward to be successful is higher under integration, $\Pi_E^{Int}(k) > \Pi_E^{Aut}(k)$. This is a likely scenario since the entrepreneur can sell to both domestic and foreign consumers under integration. The chosen effort level is then given by e^{Int^0} in Figure 3.1(ii), where $e^{Int^0} > e^{Aut}$ holds.

Since $\frac{\partial^2 V_E}{\partial e \partial e^*} < 0$ and $\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} < 0$, entrepreneurial efforts e and e^* are strategic substitutes: a higher effort by the foreign (domestic) entrepreneur will then reduce the marginal expected profit for the domestic (foreign) entrepreneur. This implies that the reaction functions are downward-sloping, $\mathcal{R}_E'(e) < 0$ and $\mathcal{R}_{E^*}'(e) < 0$, as shown in Figure 3.1(iii), where we also note that the reaction function of the domestic entrepreneur $\mathcal{R}_E(e)$ ends at the point Int^0 with effort e^{Int^0}. The Nash-equilbrium in efforts occurs at the point Int in Figure 3.1(iii) where the reaction functions intersect. We will assume that the usual stability criteria of the Nash-equilibrium is fulfilled.[10]

From (3.4) and (3.5), the optimal efforts in the Nash-equilibrium are implicit functions of the domestic entry fee, $e^{Int}(\tau)$ and $e^*(\tau)$. It is easy to see that an increase in the entry fee, will decrease the marginal expected profit for the domestic entrepreneur, $z_{E,e}^{win\prime}\left[\Pi_E^{Int}(k)-\tau\right]$, which will shift this locus down in Figure 3.1(ii), which, in turn, will shift down the reaction function of the domestic entrepreneur $\mathcal{R}_E(e)$ in Figure 3.1(iii) (not drawn). Thus, an increase in the entry fee must reduce the optimal effort by the domestic entrepreneur, while increasing the optimal effort of its foreign rival, $e'_\tau<0$ and $e^{*\prime}_\tau>0$. Defining $z^{Int}(\tau)=z(e^{Int}(\tau))$ as the reduced-form probability that the domestic entrepreneur succeeds and $z^*(\tau)=z(e^*(\tau))$ as the corresponding probability for the foreign entrepreneur, we then have the following result:

Lemma 1. *Increasing the entry fee τ for the domestic entrepreneur increases the effort by the foreign entrepreneur (and the probability of successful foreign innovation), while decreasing the effort of the domestic entrepreneur (and the probability of successful domestic innovation), $z'^*_\tau=z'_{e^*}e^{*\prime}_\tau>0$ and $z^{Int\prime}_\tau=z'_e e'_\tau<0$.*

Proof. See the Appendix. ■

For the policy stage in the next section, let $z_E^{win}(\tau)$ be the reduced-form probability that the domestic entrepreneur wins and let $z^{entry}(\tau)$ be the reduced-form probability that either the domestic or the foreign entrepreneur enters the product market:

$$\begin{cases} z_E^{win}(\tau)=z^{Int}(\tau)\left[1-0.5z^*(\tau)\right] \\ z^{entry}(\tau)=1-\left[1-z^*(\tau)\right]\left[1-z^{Int}(\tau)\right]. \end{cases} \tag{3.6}$$

From (3.6), we can then define a reduced-form expected profit for the entrepreneur and the incumbents as a function of the entry fee, τ:

$$\begin{cases} V_E^{Int}(\tau)=z_E^{win}(\tau)\left[\Pi_E^{Int}(k)-\tau\right]-y(\tau), \\ V_I^{Int}(\tau)=\Pi_I^{Int}(0)-z^{entry}(\tau)\left[\Pi_I^{Int}(0)-(\tau)\Pi_I^{Int}(k)\right]. \end{cases} \tag{3.7}$$

where $z^{entry}(\tau)\left[\Pi_I^{Int}(0)-(\tau)\Pi_I^{Int}(k)\right]$ is the loss from entry for the domestic incumbents under integration.

[10]This essentially requires that the reaction function of the domestic entrepreneur is steeper than the one of the foreign entrepreneur, which is the case in Figure 3.1(iii). See the Appendix for a more formal treatment

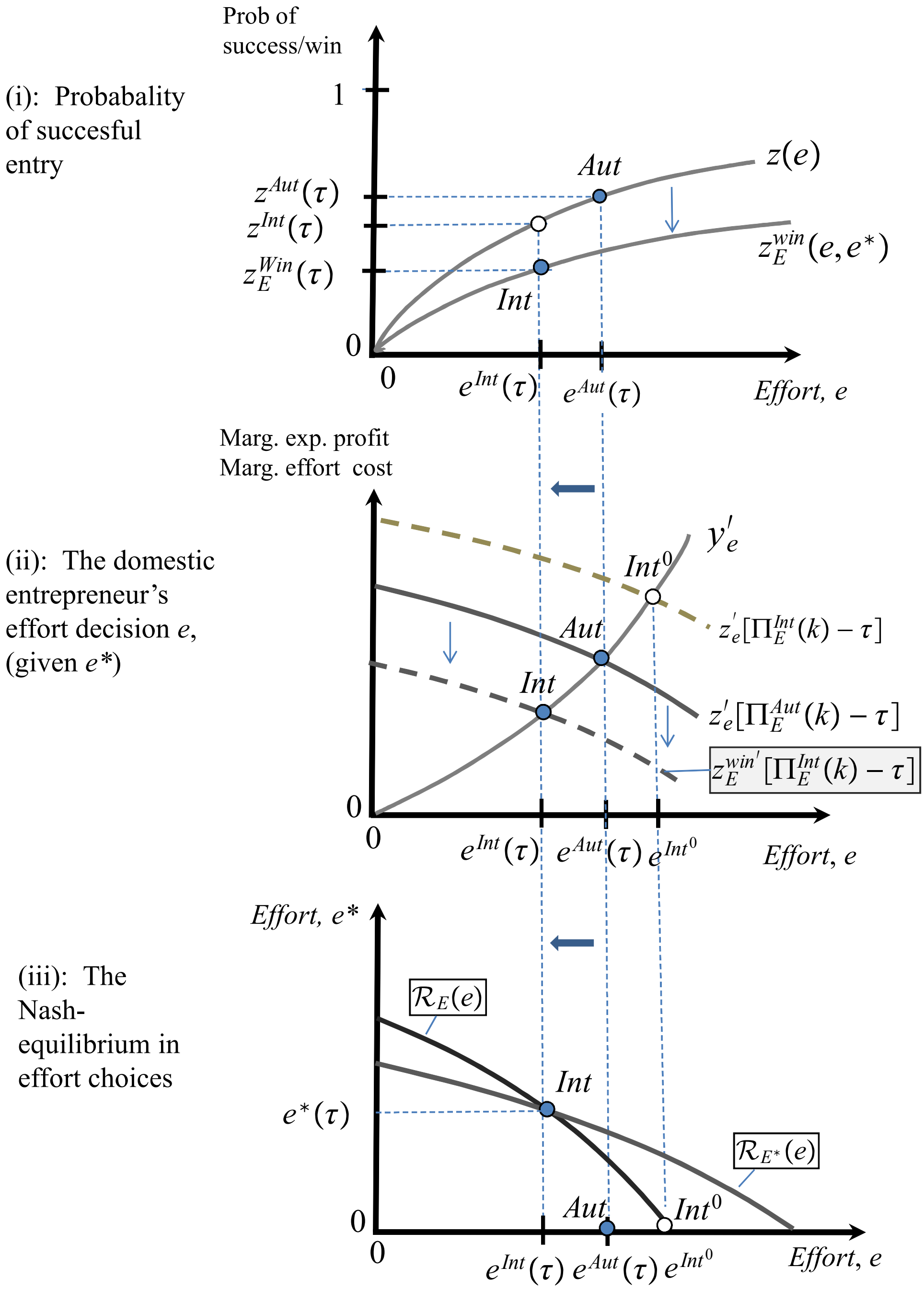


Figure 3.1: Illustrating the interaction between the domestic entrepreneur and the foreign entrepreneur in stage 2 under integration.

3.4. Entrepreneurial Policy (Stage 1)

As previously mentioned, for expositional reasons, we first model the optimal entry fee in one country taking the entrepreneurial policy in the rest of the world as given, $\bar{\tau}^*$. To highlight the effects of globalization, we also assume that only domestic firms can lobby against the domestic policy maker. We discuss the effects of relaxing these assumptions in the robustness section 6.

The lobbying game then has the same structure as in autarchy. We can thus rewrite the objective function (2.6) proceeding as in Section 2.4. Then, in integrated markets, the objective function of the policy maker in (2.6) now becomes:

$$G(\tau) = T^{Int}(\tau) + L^{Int}(\tau), \tag{3.8}$$

The expected entry fee is $T^{Int}(\tau) = z_E^{win}(\tau)\tau$ and assumed to be strictly concave in τ, where the probability $z_E^{win}(\tau)$ defined in (3.6) reflects that the entry fee is only collected when the domestic entrepreneur is the winner in the innovation stage. We will once more restrict the lobbying contributions to be "regret free" or "truthful", so that the lobbying contributions from incumbents becomes $L^{Int}(\tau) = V_I^{Int}(\tau) - \bar{\Omega}_I^{Int}$, where $V_I^{Int}(\tau)$ is given from (3.7).

The policy maker's first-order condition under integration is then:

$$\frac{dG}{d\tau} = \underbrace{z_E^{win} + z_{E,\tau}^{win'}\tau}_{\text{MR entry fee: } T^{Int'}(\tau)} \qquad \underbrace{-z_\tau^{Entry'}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right]}_{\text{MR lobbying contrib: } L^{Int'}(\tau)} = 0 \tag{3.9}$$

Again, the entry fee is set so that the marginal revenue from the entry fee and from lobbying contributions sum to zero. This occurs at the point Int in Figure 3.2(iii), where $G'(\tau^{Int}) = 0$. As shown in Figure 3.2(ii), the optimal fee then fulfils the condition $L^{Int'}(\tau^{Int}) = -T^{Int'}(\tau^{Int}) < 0$. The locus of the marginal revenue from the entry fee, $T^{Int'}(\tau) = z_E^{win} + z_{E,\tau}^{win'}\tau$, is downward-sloping in Figure 3.2(ii), since the expected entry fee is assumed to be strictly concave, whereas the locus of marginal revenue from incumbent lobbying, $L^{Int'}(\tau^{Int}) = -z_\tau^{Entry'}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right]$ is upward-sloping.[11] As drawn, note that the marginal revenue from the entry fee as well as the marginal revenue from lobbying contributions, is lower under integration, i.e. $T^{Int'}(\tau) < T'(\tau)$ and $L^{Int'}(\tau) < L'(\tau)$. Since the total marginal revenue is smaller under integration, this leads to a lower entry fee under integration, $\tau^{Inte} < \tau^{Aut}$, as shown in Figure 3.2(iii).

To explain the pattern in Figure 3.2(ii), first use (3.6) to calculate how a higher entry fee under integration affects the probability that the domestic entrepreneur successfully enters z_E^{win}

[11] See the discussion in footnote 9.

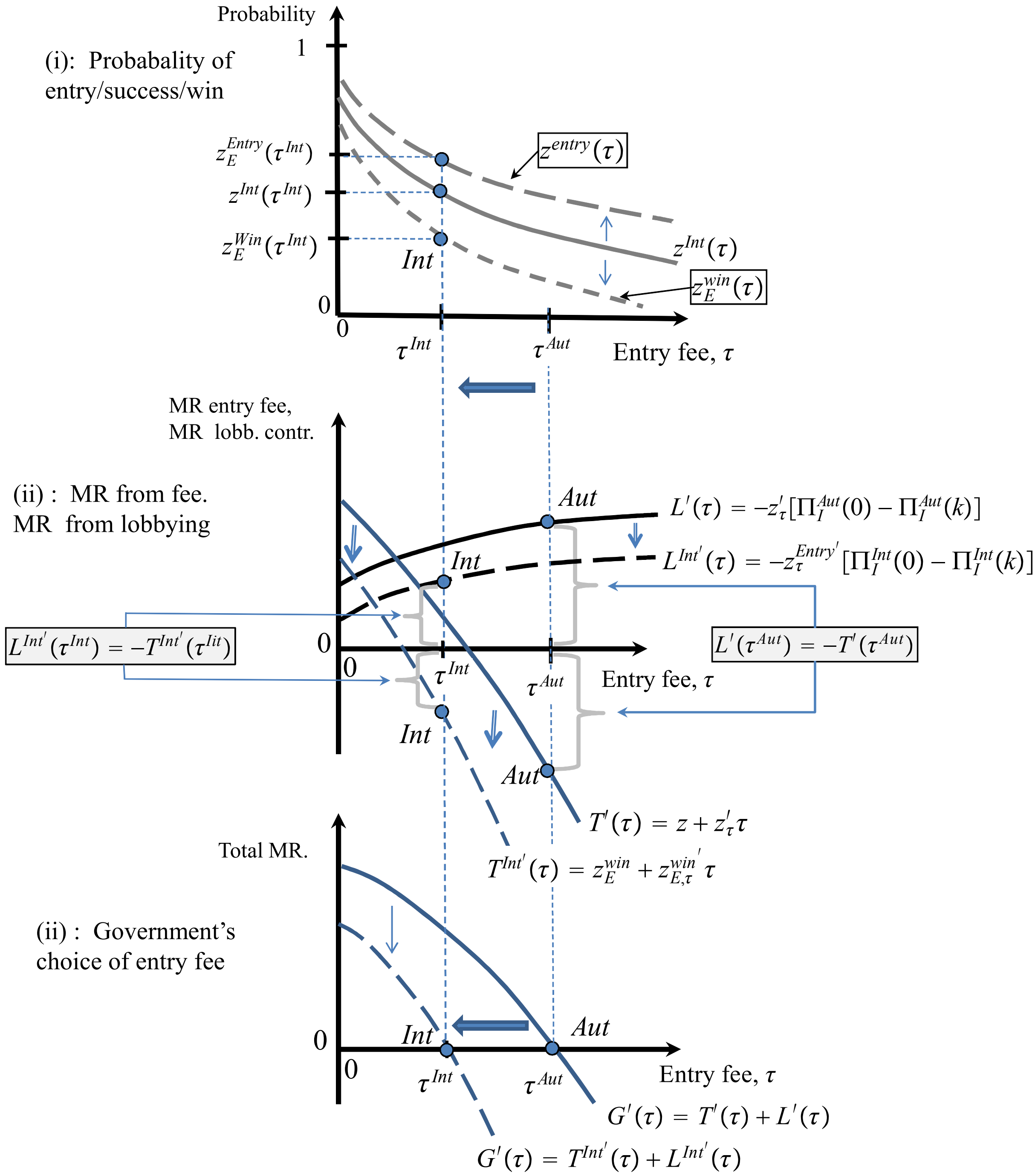


Figure 3.2: The government's optimal entry fee in stage 1 under integration and autarchy. The figure illustrates a case where the foreign threat effect and the strategic innovation effect dominate the market-rent effect, producing a lower entry fee under integration, $\tau^{Int} < \tau^{Aut}$.

and the probability that entry occurs altogether, $z^{entry}(\tau)$:

$$\begin{cases} z_{E,\tau}^{win'} = z_\tau^{Int\prime}(1-0.5z^*) - 0.5z^{Int}z_\tau^{*\prime} \\ z_\tau^{entry'} = z_\tau^{Int\prime}(1-z^*) + (1-z^{Int})z_\tau^{*\prime} \end{cases} \tag{3.10}$$

From (3.6) and (3.10), (3.9) can be rewritten as follows:

$$\underbrace{\left[z^{Int} + z_\tau^{Int'}\tau\right][1-0.5z^*] - 0.5z^{Int}z_\tau^{*\prime}\tau}_{\text{MR entry fee: } T^{Int\prime}(\tau)} \quad \underbrace{-\overbrace{[z_\tau^{Int'}(1-z^*) + (1-z^{Int})z_\tau^{*\prime}]}^{z_\tau^{Entry'}}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right]}_{\text{MR lobbying contrib: } L^{Int\prime}(\tau)} = 0 \tag{3.11}$$

The first two expressions contains the *marginal revenue from the entry fee.* Comparing with the marginal revenue of the entry fee under autarchy in (2.7), $z + z_\tau'\tau$, the corresponding term in (3.11), $z^{Int} + z_\tau^{Int'}\tau$, is depreciated by term $1 - 0.5z^*$. This depreciation reflects a "*foreign threat effect*": when the domestic entrepreneur is successful under integration, it is *only* when the foreign entrepreneur fails or looses the lottery (upon succeeding) that the government receives the entry fee (the sum of these probabilities is $1 - 0.5z^*$).

The marginal revenue from the entry fee under integration is further reduced by a "*strategic innovation effect".* As shown by the second expression in (3.11), a higher entry fee induces the foreign entrepreneur to increase her effort, which increases her probability to succeed, $z_\tau^{*\prime} > 0$. If both entrepreneurs succeed, with the foreign entrepreneur granted the patent for the innovation, the government is left without the fee. The term $-0.5z^{Int}z_\tau^{*\prime}\tau$ reflects the expected cost of this outcome.

The "*foreign threat effect*" and the "*strategic innovation effect*" can thus explain the downward shift of the locus of the marginal revenue from the entry fee under integration, $T^{Int'}(\tau)$, in Figure 3.2(ii). They can also explain the downward shift of the locus of the marginal revenue from lobbying contributions, $L^{Int'}(\tau)$. Compare the last expression in (3.11) under integration to the last expression in (2.7) under autarchy. From (2.7), we note that a higher entry fee reduces the probability of entry fee with $z_\tau' < 0$ under autarchy. From (3.10) the corresponding impact on the entry probability under integration is

$$z_\tau^{entry'} = \underset{(-)}{z_\tau^{Int'}}(1-z^*) + (1-z^{Int})\underset{(+)}{z_\tau^{*\prime}} > z_\tau^{Int'} < 0. \tag{3.12}$$

Equation (3.12) reveals that *a higher entry fee will reduce the probability of entry less than it reduces the probability of domestic entry*: The term $z_\tau^{Int'}(1-z^*) > z_\tau^{Int'} < 0$ shows that raising the entry fee to stop the domestic entrepreneur only works when the foreign entrepreneur fails (which occurs with probability $1-z^*$). Moreover, the term $(1-z)z_\tau^{*\prime} > 0$ shows that when domestic entrepreneur fails (which occurs with probability $1-z$), the increase in effort by the foreign entrepreneur (in response to the lower effort to by the domestic entrepreneur), will increase the probability of entry, since the probability of foreign entry increases, $z_\tau^{*\prime} > 0$. Thus, lobbying to prevent entry becomes less efficient under integration.

However, the impact of integration on the entry fee is also under the influence of a "*market rent effect*". If the rent that the incumbent lobby to protect under integration, $\Pi_I^{Int}(0)-\Pi_I^{Int}(k)$, is significantly larger than corresponding rent they lobby to protect under autarchy, $\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k)$, the marginal revenue from lobbying contributions may increase under integration. In addition, if the reward for the entrepreneur from succeeding is substantially higher under integration, $\Pi_E^{Int}(k) > \Pi_E^{Aut}(k)$, the domestic entrepreneur may increase her effort, which increases her success probability $z^{Int}(\tau)$, potentially even beyond the autarchy level, $z(\tau)$. This may limit the reduction of the marginal revenue from the entry fee under integration, or even increase it. Thus, it follows that is only when the foreign threat effect and the strategic innovation effect dominate the market-rent effect, that integration reduces the entry fee, $\tau^{Inte} < \tau^{Aut}$. Such a case is depicted in Figure 3.2(ii).

The optimal entry fee under integration To close the discussion, it is useful to also derive an explicit expression for the optimal entry fee under integration. It is then instructive to define λ^{Int} as the ratio of the change in the entry probability and the probability that the domestic entrepreneur enters successfully, resulting from an increase in the entry fee.

$$\lambda^{Int} = \frac{z_\tau^{entry\prime}}{z_{E,\tau}^{win\prime}} < 1. \tag{3.13}$$

This ratio is illustrated in Figure 3.2(i). Note that the slope of the locus showing the probability of entry $z^{entry}(\tau)$ is smaller (in absolute value) than slope of the locus depicting the probability that the domestic entrepreneur successfully enters, $z_E^{entry}(\tau)$. This again follows from (3.10), where the *strategic innovation effect*, $z_\tau^{*\prime} > 0$, dampens the reduction in the entry probability $z_\tau^{entry\prime}(\tau)$, while it increases the reduction in the probability of entry by the domestic entrepreneur, $z_{E,\tau}^{win\prime}(\tau)$. Moreover, the *foreign threat effect* discounts the reduction in the probability of entry more heavily, $z_\tau^{Int\prime}(1-0.5z^*) < z_\tau^{Int\prime}(1-z^*)$. Thus, from the strategic innovation effect and the foreign threat effect, the ratio λ^{Int} must be less than unity.

From (3.13) and (3.9), we now obtain

$$\tau^{Int} = \frac{\lambda^{Int}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right]}{1 - 1/\varepsilon_E^{win}(\tau^{Int})}, \tag{3.14}$$

where $\varepsilon_E^{win}(\tau^{Int}) = -\frac{z_{E,\tau}^{win\prime}}{z_E^{win}}\tau^{Int}$. If we compare (3.14) with the corresponding expression for the entry fee under autarchy τ^{Aut} in (2.8), we note that $\lambda^{Int} < 1 = \lambda^{Aut}$. Thus, even if incumbent losses would be greater under integration, this may not produce a higher entry fee since the incumbents' losses carry less weight in (3.14).[12] This lower impact of incumbent interests reflects that the strategic innovation effect and the foreign threat effect makes lobbying by incumbents less effective under integration.[13]

We can now summarize:

Proposition 1. *If the foreign threat effect and the strategic innovation effect dominate the market-rent effect, integration will induce the government to reduce the entry fee for the entrepreneur,* $\tau^{Inte} < \tau^{Aut}$.

Whether incumbent losses from entry are higher in the integrated market than in autarchy depends on the underlying assumptions in the oligopoly model. In the working paper version (Douhan, Norbäck and Persson, 2009), we use a linear Cournot model and show that the larger is the size of the foreign market and the fewer the firms by which it is served in autarchy, relative to the home country, the more likely it is that the market rent effect dominates. Moreover, it also can be shown that the market rent effect is dominated by the foreign innovation threat effect and the strategic innovation effort effect, as long as the integrated product market does not become too concentrated due to mergers and exits.

4. Consumer effects

Let us now relax the assumption of a purely rent maximizing government and allow the government to also take into account consumer effects. To highlight the effects, we once more take the foreign policy as given. Starting with autarchy, $CS^{Aut}(0)$ denotes the consumer surplus in the pre-innovation state, $CS(k)$ the consumer surplus with entrepreneurial firm entry and α is a preference parameter that shifts the importance attached to consumer welfare. Proceeding as

[12] We focus on the case where the strategic innovation effect is still limited so that $z_\tau^{entry\prime} < 0$, and $\lambda^{Int} \in (0, 1)$. If $\lambda^{Int} < 0$, the government would subsidize entry.

[13] Furthermore, from (2.8) and (3.14), the probability of successful domestic entry – and hence realized entry fees for the government – tends to be more elastic or sensitive to an increase in the entry fee under integration,. This can be seen noting that $\varepsilon_E^{win}(\tau^{Int}) = \varepsilon(\tau^{Int}) + \frac{0.5 z_\tau^{*\prime}\tau^{Int}}{(1-0.5z^*)}$.

in Section 3.4, the government's objective function now becomes:

$$G(\tau) = T(\tau) + L_I^{Aut}(\tau) \tag{4.1}$$
$$+CS^{Aut}(0) + \alpha z(\tau)[CS^{Aut}(k) - CS^{Aut}(0)].$$

where again $L_I(\tau) = V_I^{Aut}(\tau) - \bar{\Omega}_I^{Aut}$ and $T(\tau) = z(\tau)\tau$. It is reasonable to assume that $CS^{Aut}(k) > CS^{Aut}(0)$ if an innovation implies lower production costs, or higher quality products and if, at the same time, competition increases as a new firm enters product market competition.

The first-order condition becomes:

$$\underbrace{z + z'_\tau \tau^{Aut}}_{\text{MR from entry fee}} \quad \underbrace{-z'_\tau \left[\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k) + \alpha\left\{CS^{Aut}(k) - CS^{Aut}(0)\right\}\right]}_{\text{MR from lobbying contrib net of consumer loss}} = 0 \tag{4.2}$$

Proceeding as in Section 2.4, we can obtain an explicit expression for the entry fee:

$$\tau^{Aut} = \frac{\Pi_I^{Aut}(0) - \Pi_I^{Aut}(k) - \alpha\left\{CS^{Aut}(k) - CS^{Aut}(0)\right\}}{1 - 1/\varepsilon(\tau^{Aut})} \tag{4.3}$$

Turning to the integrated market, a symmetric argument means that the policy maker's objective function in integrated markets (3.8) becomes:

$$\max_\tau G(\tau) = T^{Int}(\tau) + L_I^{Int}(\tau) \tag{4.4}$$
$$+\alpha\left\{CS^{Int}(0) + z^{entry}(\tau)[CS^{Int}(k) - CS^{Int}(0)]\right\},$$

where $L_I^{Int}(\tau) = V_I^{Int}(\tau) - \bar{\Omega}_I^{Int}$ and $T^{Int}(\tau) = \tau z_E^{win}(\tau)$ and we once more assume that $CS^{Int}(k) > CS^{Int}(0) > 0$.

We can now examine how entry barriers are affected by integration. The first-order condition is:

$$\underbrace{z^{win} + z_\tau^{win'} \tau^{Int}}_{\text{MR from entry fee}} \quad \underbrace{-z_\tau^{Entry'} \left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k) + \alpha\left\{CS^{Int}(k) - CS^{Int}(0)\right\}\right]}_{\text{MR from lobbying contr net of consumer loss}} = 0 \tag{4.5}$$

Proceeding as in Section 3.4, we can again derive an explicit expression for the entry fee:

$$\tau^{Int} = \frac{\lambda^{Int}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right] - \alpha\left\{CS^{Int}(k) - CS^{Int}(0)\right\}\right]}{1 - 1/\varepsilon_E^{win}(\tau^{Int})} \tag{4.6}$$

Let us compare the entry fee under autarchy and integration in (4.3) and (4.6). As before, incumbent losses carry less weight under integration, $\lambda^{Int} < 1 = \lambda^{Aut}$ since lobbying is less effective when the domestic entrepreneur competes with the foreign entrepreneur. This effect reduces the entry fee under integration. However, a government that takes the consumer surplus effect into account will internalize that an increasing entry fee will also reduce the expected consumer surplus, since entry becomes less likely. How will this consumer surplus affect the impact of integration on the entry fee? This will depend on how entry affects the consumer surplus in autarchy and in the integrated market, respectively. It is plausible that the increase in consumer surplus from entry under autarchy $CS^{Aut}(k) - CS^{Aut}(0) > 0$ is larger than the increase in consumer surplus from entry under integration $CS^{Int}(k) - CS^{Int}(0)$, since the effect of the innovation and the presence of an additional firm increasing competition achieves the largest reduction in consumer prices in the autarchy market (i.e. the less competitive market).

We can state the following proposition:

Proposition 2. *Suppose that Proposition 1 holds for a purely rent maximizing government, $\alpha = 0$. A strictly positive weight $\alpha > 0$ on consumer surplus will then reduce the difference $\tau^{Aut} - \tau^{Int} > 0$, if $CS^{Aut}(k) - CS^{Aut}(0) > CS^{Int}(k) - CS^{Int}(0)$, thereby making the negative effect of integration on the entrepreneurial fee weaker.*

Intuitively, a government that puts little emphasis on the consumer surplus will have relatively high entry fees in autarchy. Such a government will then be more strongly affected by an international integration, and will therefore reduce the entry fee more forcefully than a government which already, pre-integration, uses low entry fees to promote competition to secure consumer interests.

In the working paper version (Douhan, Norbäck and Persson, 2009), we also show that in the Cournot model with linear demand and symmetric countries, it is verified that $CS^m(k) > CS^m(0)$ from the increase in output due to the cost-reducing innovation and the entry of an additional firm. Moreover, it is also shown that $CS^{Aut}(k) - CS^{Aut}(0) > CS^{Int}(k) - CS^{Int}(0)$ holds since the entry of an innovative entrepreneurial firm is more important in the autarchy economy where the initial output is lower.

5. Incumbent innovation

In this section we will examine how the possibility for incumbents to innovate affects their incentives to lobby, and how incumbent innovation affects our main results. To highlight the new mechanisms, we simplify and assume that only one of the domestic incumbents innovates. In the robustness section, we discuss innovation with multiple incumbents.

5.1. Autarchy

We first consider the case of autarchy and proceed as in Section 2 by backward induction.

5.1.1. Product market interaction (stage 4)

As before,we assume an unique stable Nash-equilbrium in product market actions from which we define firms' reduced-form profits. Let the reduced-form profit for firm j be $\pi_j^{Aut}(k_i, k_E)$. Reduced-form profits increase with the possession of an innovation, but profits decrease when an innovation is held by a rival. In the event that the entrepreneurial firm succeeds ($k_E = k$) and enters, while the incumbent fails ($k_i = 0$), the entrepreneur obtains the profit $\pi_E^{Aut}(0, k)$, while the incumbent receives the profit $\pi_i^{Aut}(0, k)$. When the incumbent succeeds and the entrepreneur fails, profits are $\pi_i^{Aut}(k, 0)$ and $\pi_E^{Aut}(k, 0)$, while in the event where both firms fail, profits are $\pi_i^{Aut}(0, 0)$ and $\pi_E^{Aut}(0, 0)$. Moreover, profits are $\pi_i^{Aut}(k, k)$ and $\pi_E^{Aut}(k, k)$ when both agents succeed. Finally, it is useful to denote $\pi_{-i}^{Aut}(k_i, k_E)$ as aggregate profits of incumbent i's *incumbent rivals.*

To *highlight* the incumbent's incentive to innovate to prevent entry, we assume the entrepreneur cannot enter the market when the incumbent succeeds, $\pi_E^{Aut}(0, k) > F > \pi_E^{Aut}(k, k)$.[14] We also discuss a setting without this assumption in the robustness section. From our assumptions on reduced-form profits, $\pi_i^{Aut}(k, 0) > \pi_i^{Aut}(0, 0) > \pi_i^{Aut}(0, k)$, where the latter inequality ensures incentives for incumbent i to lobby against entrepreneurial innovation.

5.1.2. Entry by entrepreneur (stage 3)

We thus assume k to be sufficiently large so that entry always occurs when the entrepreneur succeeds with its innovation while the incumbent fails, $\Pi_E(0, k) = \pi_E^{Aut}(0, k) - F > 0$.

5.1.3. Innovation (stage 2)

We assume that the incumbent's probability of success is determined by the same function as that of the entrepreneurs, $z(\cdot)$. Let ι denote the innovation effort of the incumbent i and let e denote the innovation effort of the entrepreneur, as before.

[14]This occurs because of the increased competition but can also be supported by litigation costs, where incumbency gives an advantage. If both succeed an incumbent obtains the profit $\pi_i(k, k) - L$, where L is a fixed litigation cost. If the entrepreneur succeeds she will get the profit $\pi_E(k, k) - L - F$, if entering in stage 3. Due to the fixed entry cost F, there must exist an L such that $\pi_i(k, k) - L > 0$ and $\pi_E(k, k) - L < F$.

We can then write the entrepreneurs' and incumbent's maximization problems as follows:

$$\max_e V_E^{Aut} = [1-z(\iota)]z(e)\left[\Pi_E^{Aut}(0,k)-\tau\right]-y(e), \quad (5.1)$$

$$\max_\iota V_i^{Aut} = z(\iota)\pi_i^{Aut}(k,0)+ [1-z(\iota)]\{\pi_i^{Aut}(0,0)-z(e)\underbrace{\left[\pi_i^{Aut}(0,0)-\pi_i^{Aut}(0,k)\right]}_{\text{Business stealing effect}}\}-y(\iota). \quad (5.2)$$

The entrepreneur will only enter when she succeeds and the incumbent fails, which occurs with probability $z(e)\,[1-z(\iota)]$. Note also that when the incumbent fails, she obtains the profit $\pi_i^{Aut}(0,0)$, net of the expected loss from when the entrepreneur succeeds, $z(e)\left[\pi_i^{Aut}(0,0)-\pi_i^{Aut}(0,k)\right] < 0$. We label the latter term the expected business-stealing effect.

The first-order condition for the entrepreneur's effort choice e and the first-order condition for the incumbent's effort choice ι are:

$$\frac{\partial V_E^{Aut}}{\partial e} = [1-z(\iota)]z'_e\left[\Pi_E(0,k)-\tau\right]-y'_e=0 \quad (5.3)$$

$$\frac{\partial V_I^{Aut}}{\partial \iota} = z'_\iota\pi_i(k,0)\underbrace{-z'_\iota\{\pi_i^{Aut}(0,0)-z(e)\underbrace{\left[\pi_i^{Aut}(0,0)-\pi_i^{Aut}(0,k)\right]}_{\text{Business stealing}}\}}_{\text{Replacement effect}}-y'_\iota=0. \quad (5.4)$$

In (5.3) the marginal expected profit for the entrepreneur is $[1-z(\iota)]z'_e\left[\Pi_E^D(k,0)-\tau\right]$. As illustrated in Figure 5.1(ii), this term is depreciated by $1-z(\iota)$ since it is only when the incumbent fails that the entrepreneur can enter. The marginal expected profit for the incumbent in (5.4) contains two terms: The term $z'_\iota\pi_i(k,0)$ represents the increase in expected profit when she succeeds and avoids entry. The second term represents a standard replacement cost: when she succeeds the incumbent will replace the expected profit she would obtain under a failure.[15]

From (5.3), we note that marginal expected profit is decreasing in the effort of the incumbent, $\frac{\partial^2 V_E^{Aut}}{\partial e\partial\iota} = -z'_\iota z'_e\left[\pi_E^D(k,0)-\tau\right] < 0$. Thus, innovation efforts are strategic substitutes for the entrepreneur: if the incumbent increases her research effort ι, she is more likely to succeed $z'_\iota > 0$, which reduces marginal expected profit. Thus, the reaction function of the entrepreneur is downward-sloping, $\mathcal{R}'_E(e) < 0$, as shown in Figure 5.1(iii), ending at the point Aut^0 which is the autarchy equilibrium without incumbent innovation. However, research efforts are strategic complements for the incumbent, so that the reaction function of the incumbent is upward-sloping, $\mathcal{R}'_i(e) > 0$. This follows from $\frac{\partial^2 V_I^{Aut}}{\partial\iota\partial e} = z'_\iota z'_e[\pi_i^{Aut}(0,0)-\pi_i^{Aut}(0,k)] > 0$. Intuitively, a higher effort by the entrepreneur makes entry more likely, $z'_e > 0$, which induces the incumbent to increase her innovation effort to prevent entry.

[15] The replaced expected profit can also be written $z(e)\pi_i^{Aut}(0,k)+[1-z(e)]\pi_i^{Aut}(0,k)$.

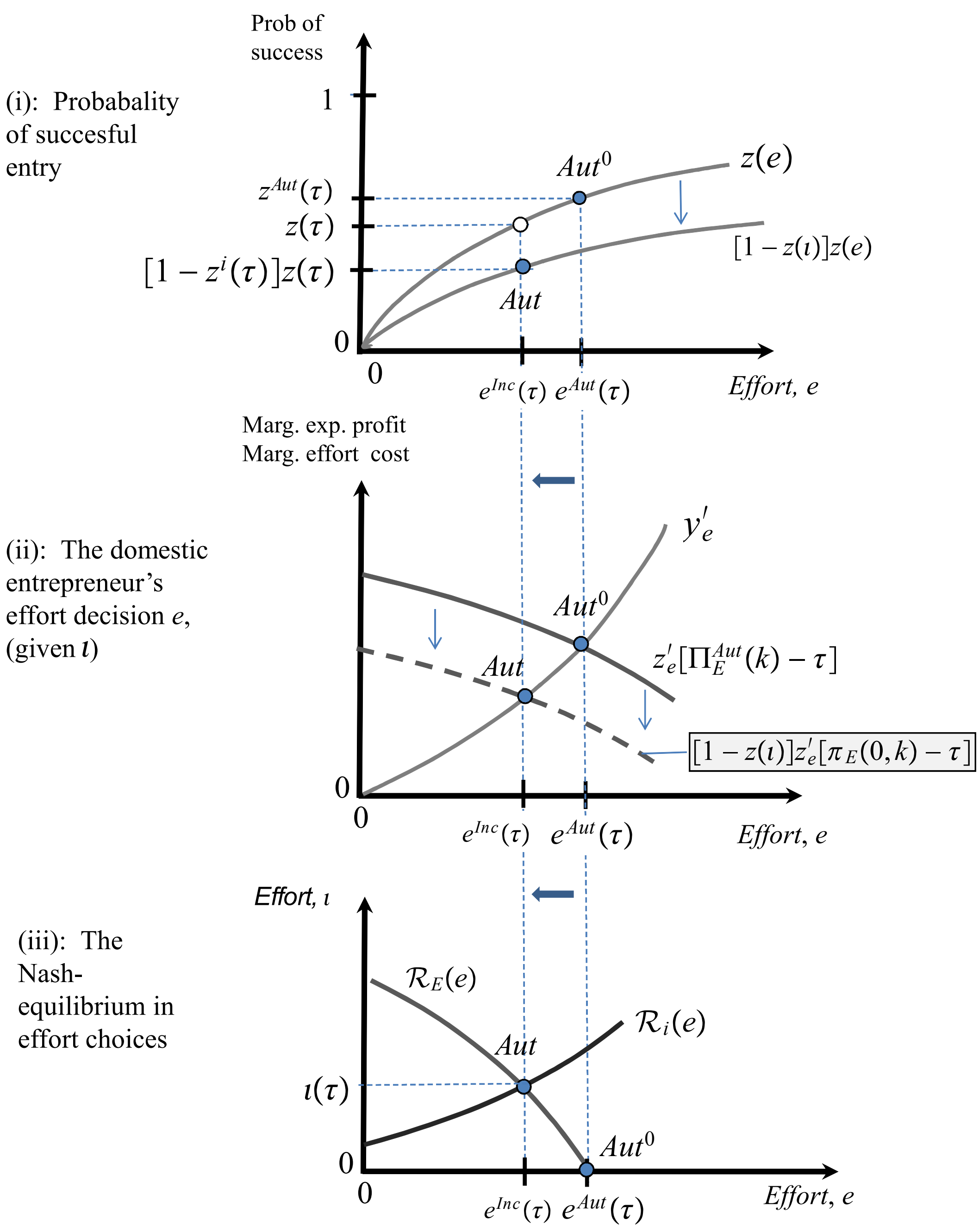


Figure 5.1: Illustrating the interaction between the domestic entrepreneur and a domestic incumbent in stage 2 under autarchy.

The Nash-equilibrium is given from the intersection of the reaction functions at the point *Aut* in Figure 5.1(iii). Write the Nash-equilibrium as a function of the entry fee, $\{e(\tau), \iota(\tau)\}$ and assume stability. Then, since $\frac{\partial^2 V_E^{Aut}}{\partial e \partial t} = -[1 - z(\iota)]z_e' < 0$, $e'(\tau) < 0$ and $\iota'(\tau) < 0$ must hold. That is, when the entry fee increases, the reaction function of the entrepreneurs $\mathcal{R}_E(e)$ will shift to the left in Figure 5.1(iii), reducing the research effort by the entrepreneur *as well as* the research effort of the incumbent. With a lower research effort by the entrepreneur, the incumbent faces a lower expected cost from business stealing, which induces the incumbent to reduce her research effort.

Let $z(\tau) = z(e(\tau))$ be the reduced-form probability that the domestic entrepreneur succeeds and let $z^i(\tau) = z(\iota(\tau))$ be the reduced-form probability that the incumbent succeeds. We then have the following Lemma:

Lemma 2. *Increasing the entry fee τ for the domestic entrepreneur reduces the effort by the entrepreneur and the incumbent, reducing both the probability that the entrepreneur and the incumbent succeeds with the innovation, $z_\tau' = z_e' e_\tau' < 0$ and $z^{i'}(\tau) = z_\iota' \iota_\tau' > 0$*

Proof. See, the Appendix ■

To proceed, let $y(\tau) = y(e(\tau))$ and $y^i(\tau) = y(\iota(\tau))$ be the reduced-form effort costs. Define the aggregate incumbent profits as $\Pi_I^{Aut}(k, 0) = \pi_i^{Aut}(k, 0) + \pi_{-i}^{Aut}(k, 0)$, $\Pi_I^{Aut}(0, k) = \pi_i^{Aut}(0, k) + \pi_{-i}^{Aut}(0, k)$ and finally, $\Pi_I^{Aut}(0, 0) = \pi_i^{Aut}(0, 0) + \pi_{-i}^{Aut}(0, 0)$. This gives the following reduced-form expected profits:

$$\begin{cases} V_E^{Aut}(\tau) = \left(1 - z^i(\tau)\right) z(\tau) \left[\Pi_E^{Aut}(k, 0) - \tau\right] - y(\tau), \\ V_I^{Aut}(\tau) = z^i(\tau)\Pi_I^{Aut}(k, 0) + \left(1 - z^i(\tau)\right) [\Pi_I^{Aut}(0, 0) - z(\tau)\{\Pi_I^{Aut}(0, 0) - \Pi_I^{Aut}(0, k)\}] - y^i(\tau). \end{cases} \tag{5.5}$$

On a final note, let us show that incumbents have an incentive to lobby for higher entry fees also in this setting. To see this, write the reduced-form expected profit for incumbents as $V_I^{Aut}(\tau) = V_I(\iota(\tau), e(\tau))$. Differentiating in τ, we obtain

$$\frac{dV_I^{Aut}}{d\tau} = \underbrace{\frac{\partial V_I^{Aut}}{\partial \iota}}_{=0} \underbrace{\iota_\tau'}_{(-)} + \underbrace{\frac{\partial V_I^{Aut}}{\partial e}}_{(-)} \underbrace{e_\tau'}_{(-)} > 0 \tag{5.6}$$

where $e_\tau' < 0$ holds from Lemma 2 and where $\frac{\partial V_I^{Aut}}{\partial e} = -[1 - z^i]z_e'\{\Pi_I(0, 0) - \Pi_I^{Aut}(0, k)\} < 0$ from (5.2) since a higher entry fee reduces the expected loss from entry.

5.1.4. Entrepreneurial policy (stage 1)

The objective function of the policy maker is $G = T(t)+L(\tau)$, where $T(t) = [1-z^i(\tau)]z(\tau)\tau$ since the government only obtains the entry fee when the entrepreneur succeeds and the incumbent fails, and $L(\tau) = V_I^{Aut}(\tau) - \bar{\Omega}_I^{Aut}$ with $V_I^{Aut}(\tau)$ given from (5.5).

Using the incumbent's optimality condition (5.3), the policy maker's first-order condition is

$$\frac{\partial G}{\partial \tau} = \underbrace{\left(1 - z^i\right)\left[z + z'_\tau \tau\right] - z_\tau^{i\prime} z\tau}_{\text{MR entry fee}} \;\; \underbrace{-\left(1 - z^i\right) z'_\tau \left[\Pi_I^{Aut}(0,0) - \Pi_I^{Aut}(0,k)\right]}_{\text{MR lobbying contrib}} = 0 \qquad (5.7)$$

The presence of the incumbent depreciates the marginal revenue from the entry fee, since the government only collects the entry fee when the incumbent fails which occurs with probability $1-z^i$. The incumbent's gain from lobbying is depreciated in the same way, since lobbying only generates a gain when the incumbent fails. An additional incentive to raise the entry fee is however present. This is the term $-z_\tau^{i\prime} z\tau > 0$ which reflects the fact a raise in the entry fee will reduce the research effort of the incumbent, $z_\tau^{i\prime} < 0$ from Lemma 2, which will increase the marginal expected revenue from the entry fee.

To proceed, define the variable

$$\theta = \frac{z_\tau^{i\prime}}{z'_\tau} \frac{z}{(1 - z^i)} > 0. \qquad (5.8)$$

Using (5.8), we can then rewrite (5.7) to obtain an explicit expression for the optimal fee under autarchy:

$$\tau^{Aut} = \frac{\Pi_I^{Aut}(0,0) - \Pi_I^{Aut}(0,k)}{1 - \frac{1}{\varepsilon(\tau^{Aut})} - \theta}, \qquad (5.9)$$

where $\varepsilon(\tau^{Aut}) = -\frac{z'_\tau}{z}\tau^{Aut}$. Note that (2.8) and (5.9) are very similar: the only difference is the term θ which reflects the increase in the marginal revenue from a higher entry fee, as the incumbent reduces her innovation effort.

5.2. Integration

We maintain the assumption that only one of the domestic incumbents innovates. Otherwise, we use the same setting as in Section 3, with innovation and potential entry by a foreign entrepreneur and competition in the product market from foreign incumbents. We also maintain the assumption that successful innovation by the incumbent prevents entry. If the incumbent fails and both entrepreneurs succeed, only the domestic or the foreign entrepreneur enters with a lottery selecting the winner. In the product market competition we now denote profits as $\pi_j^{Int}(k_i, k_E)$ or $\pi_j^{Int}(k_i, k_{E^*})$ depending on the nationality of the entrant. Note also that the source of entry makes no difference for the incumbent, irrespective of it being the domestic or foreign entrepreneur that enters, the incumbent receives the profit $\pi_i^{Int}(0, k)$. In stage 3, the domestic or the foreign entrepreneur can, upon winning the innovation competition, enter the market given that the incumbent has failed. We can then move straight to the innovation stage 2.

5.2.1. Innovation (stage 2)

Let ι denote the innovation effort of the incumbent and let e and e^* denote the innovation effort of the domestic and foreign entrepreneur, respectively. Then, proceeding as in Section 3.3, we obtain the following expected profits

$$\begin{aligned}
\max_e V_E^{Aut} &= [1 - z(\iota)] z_E^{win}(e, e^*) \left[\Pi_E^{Int}(0, k) - \tau\right] - y(e) && (5.10)\\
\max_{e^*} V_{E^*}^{Aut} &= [1 - z(\iota)] z_{E^*}^{win}(e, e^*) \left[\Pi_{E^*}^{Int}(0, k) - \tau\right] - y(e^*) && (5.11)\\
\max_\iota V_i^{Aut} &= z(\iota)\pi_i^{Int}(k, 0) + \\
&\quad [1 - z(\iota)]\{\pi_i^{Int}(0, 0) - z^{entry}(e, e^*)\underbrace{[\pi_i^{Int}(0, 0) - \pi_i^{Int}(0, k)]}_{\text{Business stealing}}\} - y(\iota) && (5.12)
\end{aligned}$$

where $\Pi_E^{Int}(0, k) = \pi_E^{Int}(0, k) - F$ and $\Pi_{E^*}^{Int}(0, k) = \pi_{E^*}^{Int}(0, k) - F$. Maximization leads to the following first-order conditions:

$$\begin{aligned}
\frac{\partial V_E}{\partial e} &= [1 - z(\iota)] z_{E,e}^{win'} \left[\Pi_E^{Int}(k) - \tau\right] - y_e' = 0, && (5.13)\\
\frac{\partial V_{E^*}}{\partial e^*} &= [1 - z(\iota)] z_{E^*,e^*}^{win'} \left[\Pi_{E^*}^{Int}(k) - \bar{\tau}^*\right] - y_{e^*}' = 0. && (5.14)\\
\frac{\partial V_I^{Aut}}{\partial \iota} &= z_\iota' \pi_i^{Int}(k, 0) - z_\iota' \{\pi_i^{Int}(0, 0) - z^{entry}(e, e^*)[\pi_i^{Int}(0, 0) - \pi_i^{Int}(0, k)]\} - y_\iota' = 0 && (5.15)
\end{aligned}$$

The Nash-equilbrium defined by (5.13)-(5.15) can be written as an implicit function of the entry fee, $\{e(\tau), e^*(\tau), \iota(\tau)\}$. Assuming stability, we then have the following Lemma:

Lemma 3. *Increasing the entry fee τ for the domestic entrepreneur, increases the effort by the foreign entrepreneur (and the probability of successful foreign innovation), while decreasing the effort level (and the probability of successful domestic innovation), $z_\tau'^* = z_{e^*}' e_\tau^{*\prime} > 0$ and $z_\tau^{Int'} = z_e' e_\tau' < 0$. The impact on the effort level of the incumbent (and the effect on the success probability of the incumbent) is ambiguous, $z^{i'}(\tau) = z_\iota' \iota_\tau' \lesseqgtr 0$.*

Proof. See, Appendix. ■

Lemma 3 shows that Lemma 1 still applies in a setting with incumbent innovation: a higher entry fee reduces the effort of the domestic entrepreneur and increases the effort of the foreign entrepreneur, decreasing the success probability of the former, while increasing the probability that the latter succeeds. Intuitively, since the impact on the effort of the domestic and foreign entrepreneur differs, this has an ambiguous effect on the expected business stealing effect from entry, and hence an ambiguous effect on the incumbents effort choice.

Proceeding as in Section 5.1.3, we finally define reduced-form expected profits for the entrepreneur and the domestic incumbents (the innovating incumbent and non-innovating incumbents). These are as follows:

$$\begin{cases} V_E^{Int}(\tau) = \left(1 - z^i(\tau)\right) z_E^{win}(\tau) \left[\Pi_E^{Int}(0,k) - \tau\right] - y(\tau), \\ V_I^{Int} = z^i(\tau)\Pi_I^{Int}(k,0) + \left(1 - z^i(\tau)\right) \{\Pi_I^{Int}(0,0) - z^{Entry}(\tau)[\Pi_I^{Int}(0,0) - \Pi_I^{Int}(0,k)]\} - y^i(\tau). \end{cases} \quad (5.16)$$

5.2.2. Entrepreneurial policy (stage 1)

The government's objective function is again $G(\tau) = T^{Int}(\tau) + L^{Int}(\tau)$, where $T^{Int}(z) = [1 - z^i(\tau)]z_E^{win}(\tau)\tau$ and $L^{Int}(\tau) = V_I^{Int}(\tau) - \bar{\Omega}_I^{Int}$, with $V_I^{Int}(\tau)$ given from (5.16). The first-order conditions then becomes

$$\frac{dG}{d\tau} = \left(1 - z^i\right)\left[z_E^{win} + z_{E,\tau}^{win\prime}\tau\right] - z_\tau^{i\prime} z_E^{win}\tau - \left(1 - z^i\right) z_\tau^{Entry\prime}\left[\Pi_I^{Int}(0,0) - \Pi_I^{Int}(0,k)\right] = 0 \quad (5.17)$$

The first-order condition (5.17) is similar to the first-order condition (3.9), where incumbent innovation is absent. There are two noteworthy differences. First, the term $\left(1 - z^i\right)$, which reflects the fact that domestic entry can only occur when the incumbent fails. The other is the term $-z_\tau^{i\prime} z_E^{win}\tau$, which reflects the impact on the marginal revenue of the entry fee from the change in innovation effort by the incumbent. To proceed we define the variable

$$\theta_E^{win} = \frac{z_\tau^{i\prime}}{z_\tau^{\prime}} \frac{z_E^{win}}{(1 - z^i)}. \quad (5.18)$$

From (5.18), we can use (5.17) to obtain:

$$\tau^{Int} = \frac{\lambda^{Int}\left[\Pi_I^{Int}(0,0) - \Pi_I^{Int}(0,k)\right]}{1 - \frac{1}{\varepsilon_E^{win}} - \theta_E^{win}} \quad (5.19)$$

where $\varepsilon_E^{win} = -\frac{z_{E,\tau}^{win\prime}}{z_E^{win}}\tau > 0$ and $\lambda^{Int} < 1$ is defined by (3.13). We are now set to compare the impact of integration on the entry fee with incumbent innovation in (5.9) and (5.19), to the impact of integration on the entry fee without incumbent innovation in (2.8) and (3.14). Regardless of incumbent innovation, we note that the term $\lambda^{Int} < 1$ reduces the impact of lost incumbent rents under integration, reflecting the lower potency of lobbying under integration due to the foreign threat effect and the strategic innovation effect. Thus, while additional effects arise when allowing for incumbent innovation, our main result that integration can reduce entry barriers for entrepreneurs in Proposition 1 holds also when allowing for incumbent innovations.

6. Robustness

In this section, we show that our main theoretical results also hold when relaxing several of the assumptions in the model. We consider several extensions. First, we examine the case where entrepreneurs can lobby. Second, we examine multi-entrepreneur entry and non-innovation entry. Third, we allow for a global incumbent lobbying group that can simultaneously give contributions to the domestic and the foreign policy maker. Fourth, we study the case of entrepreneurial innovation for sale.

6.1. Lobbying by the entrepreneur

In practise, it is likely difficult for entrepreneurs to undertake lobbying activities due to financial constraints and coordination problems. However, groups of potential entrepreneurs might have wealth from other sources and it can therefore be interesting to examine what would happen to the results if we assumed that the entrepreneur can lobby?

Allowing lobbying by the entrepreneur only changes stage 1 in the game. In Stage 1, lobbying contributions under autarchy become:

$$L(\tau) = V_I^{Aut}(\tau) + V_E^{Aut}(\tau) - \bar{\Omega}_I^{Aut} - \bar{\Omega}_E^{Aut}. \tag{6.1}$$

Substituting (2.5) into (6.1) and using the entrepreneur' optimality condition (2.4), one can show that the autarchy fee $\tau^{Aut} = \arg\max_\tau \{G(\tau) = T(\tau) + L(\tau)\}$ is simply:

$$\tau^{Aut} = \Pi_I^{Aut}(0) - \Pi_I^{Aut}(k). \tag{6.2}$$

With lobbying by the entrepreneur under integration, lobbying contributions become:

$$L^{Int}(\tau) = V_I^{Int}(\tau) + V_E^{Int}(\tau) - \bar{\Omega}_I^{Int} - \bar{\Omega}_E^{Int}. \tag{6.3}$$

Proceeding as above and substituting (3.7 into (6.3) and using the domestic and foreign entrepreneur's optimality condition (3.4) and (3.5), one can show that the entry fee under integration $\tau^{Int} = \arg\max_{\tau}\{G(\tau) = T^{Int}(\tau) + L^{Int}(\tau)\}$, is

$$\tau^{Int} = \frac{\lambda^{Int}\left[\Pi_I^{Int}(0,0) - \Pi_I^{Int}(0,k)\right] - \varphi^{Int}\Pi_E(k)}{1-\varphi^{Int}}, \tag{6.4}$$

where $\varphi^{Int} = z_{E.e^*}^{win'} e_{\tau}^{*'} > 0$ and where $\lambda^{Int} < 1$ is defined by (3.13). Also in this setting, $\lambda^{Int} < 1$ indicates the lower potency of lobbying under integration due to the presence of foreign threat effect and the strategic innovation effect. With lobbying by the entrepreneur there is also an extra effect which occurs as a higher entry fee reduces the probability that the entrepreneur wins the R&D game (since a higher entry fee increases the foreign entrepreneur's innovation effort). Since this reduces lobbying income from the entrepreneur,$-\varphi^{Int}\Pi_E(k) < 0$, this tends to reduce the fee.

6.2. Multiple entry and non-innovation entrepreneurial entry

In the main analysis, we have assumed that if both entrepreneurs are successful only one entrepreneur can enter. Let us relax this assumption in a setting where incumbents do not innovate. Of course, the full game then remains the same under autarchy. Under integration, however, the innovation game in stage 2 and the policy choice in stage 1 is different. To take multiple entry into account, we us use a slightly different notation for profits. Thus, let $\pi_E^{Int}(k_E, k_{E^*})$ be the reduced-form product market profit of the domestic entrepreneur and let $\pi_{E^*}^{Int}(k_{E^*}, k_E)$ be the profit of the foreign entrepreneur. The expected profits of the domestic entrepreneur and foreign entrepreneur can then be written as follows

$$\begin{aligned}
\max_e V_E &= z(e)\{\Pi_E^{Int}(k,0) - \tau - z(e^*)[\Pi_E^{Int}(k,0) - \Pi_E^{Int}(k,k)]\} \\
&\quad + (1-z(e))\{\Pi_E^{Int}(0,0) - \tau - z(e^*)[\Pi_E^{Int}(0,0) - \Pi_E^{Int}(0,k)]\}, \qquad (6.5) \\
\max_{e^*} V_{E^*} &= z(e^*)\{\Pi_{E^*}^{Int}(k,0) - \tau - z(e)[\Pi_{E^*}^{Int}(k,0) - \Pi_E^{Int}(k,k)]\} \\
&\quad + (1-z(e^*))\{\Pi_{E^*}^{Int}(0,0) - \tau - z(e)[\Pi_{E^*}^{Int}(0,0) - \Pi_{E^*}^{Int}(0,k)]\}. \qquad (6.6)
\end{aligned}$$

The Nash-equilibrium is given from the first-order conditions $\frac{\partial V_E}{\partial e} = 0$ and $\frac{\partial V_E^*}{\partial e^*} = 0$. As before, these conditions define Nash-efforts as functions of the entry fee, $\{e(\tau), e^*(\tau)\}$. By calculation:

$$\frac{\partial^2 V_E}{\partial e \partial e^*} = -z'(e)z'(e^*)\{\Pi_E^{Int}(k,0) - \Pi_E^{Int}(k,k) - [\Pi_E^{Int}(0,0) - \Pi_E^{Int}(0,k)]\}. \tag{6.7}$$

Thus, it follows if the condition $\Pi_E^{Int}(k,0) - \Pi_E^{Int}(k,k) > \Pi_E^{Int}(0,0) - \Pi_E^{Int}(0,k)$ holds then $\frac{\partial^2 V_E}{\partial e \partial e^*} < 0$. Since the same condition holds for $\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} < 0$, it follows that if the loss from a successful rival innovation is larger when the firm succeeds with its own innovation than when she fails to with her own innovation, efforts are strategic substitutes. Then, Lemma 1 holds, so that $e'(\tau) < 0$ and $e^{*'}(\tau) > 0$. In most oligopoly models, it is also the case that a firm is more hurt by stronger competition when it has large sales. This is the case in the Linear Cournot model, where succeding with the innovation brings a low marginal cost which boosts sales. The price reduction from stronger competition when the rival succeeds, then affects more units when the firm succeeds than when it fails.

Define $z^{Int}(\tau) = z(e(\tau))$and $z^*(\tau) = z^*(e(\tau))$ as reduced-form success probabilities. The expected reduced-form profit for incumbents now becomes:

$$V_I(\tau) = \Pi_I^{Int}(0,0) - z^{entry}(\tau)[\Pi_I^{Int}(0,0) - \Pi_I^{Int}(k,0)] - z^{Int}(\tau) z^*(\tau)[\Pi_I^{Int}(k,0) - \Pi_I^{Int}(k,k)] \quad (6.8)$$

where $z^{entry}(\tau)$is given from (3.6). Turning to stage 1 the government then maximizes the objective function $G(\tau) = z^{Int}(\tau)\tau + V_I^{Int}(\tau) - \bar{\Omega}_I^{Int}$. The optimal entry fee, $\tau^{Int} = \arg\max_\tau G(\tau)$, is:

$$\tau^{Int} = \frac{\tilde{\lambda}^{Int}\left[\Pi_I^{Int}(0) - \Pi_I^{Int}(k)\right] + \Psi[\Pi_I^{Int}(k,0) - \Pi_I^{Int}(k,k)}{1 - 1/\varepsilon_E^{win}(\tau^{Int})} \quad (6.9)$$

where $\tilde{\lambda}^{Int} = \frac{z_\tau^{entry'}}{z_\tau^{Int'}} < 1$ from (3.6) and where $\Psi = z^* + \frac{z + z_\tau^{*'}}{z_\tau^{Int'}} \lesseqgtr 0$ is ambiguous from the strategic innovation effect, $z_\tau^{*'} > 0$. Nevertheless, also in this setting the term $\lambda^{Int} < 1$ illustrates how lobbying for lower entry fees is less effective due to the presence of foreign threat effect and the strategic innovation effect under integration.

In the main analysis, we have considered entry built upon innovation. We could also consider small scale entry where an innovation is not necessary for entrepreneurial entry. The entrepreneur will then enter if the entry profit covers the entry cost. Moreover, it is easily seen that the model also applies to the case of multiple entry. Entry takes place until the last entrepreneur cannot cover its investment costs. Then, it follows that the rest of the model stands as above and that our results carry over to the case of non-innovation entrepreneurial entry and multiple entry. The difference will be that the size of the effects identified might be smaller due to the non-innovation-entry and multiple entry which both reduce the rents to be captured in the market.

6.3. Multiple incumbents innovating

It is tedious but straightforward to show that allowing for innovation by multiple incumbents does not qualitatively change our main result that foreign competition in R&D tends to reduce entry barriers. Multiple incumbents innovating brings additional strategic effects. If we where to assume multiple domestic incumbents and these where symmetric, Lemma 3 and our discussion in Section 5.2.2 would apply so that lobbying to prevent domestic entry would again be less effective due to foreign competition. Things would be more complicated if foreign incumbents were also to innovate. However, in this setting as well, the foreign threat effect and strategic innovation effect would limit the potential to lobby to prevent entry.

6.4. Global incumbent lobbying

Now, relax the assumption that incumbents can only lobby their domestic policy maker. Instead, assume that incumbent firms come together as one global lobbying group, giving contributions to both the domestic and the foreign policy maker. As previously, entrepreneurs are restricted to only lobby against their own policy maker and the policy maker once more takes the other policy maker's fee as exogenous. In the case of symmetric countries, it is easily realized that the problem, and the optimal fee, are the same in both cases: If policy makers take the other country's fee as given, and countries are symmetric, under the assumption of no communication between delegates, the optimal fee in integrated markets does not change when incumbent firms are allowed to lobby against both policy makers.[16]

6.5. Entrepreneurial innovations for sale

In the analysis, we have assumed that entrepreneurs enter the market. In practice, we observe that entrepreneurs often sell their innovation. Indeed, we observe a significant amount of inter-firm technology transfers, ranging from joint ventures and licensing to outright acquisitions of innovations.[17] However, it can be shown that our identified mechanism is still valid as long as there is bidding competition over the innovation. The reason is that the entrepreneur then exerts similar negative externalities as in the case of entry, and globalization affects these externalities in a similar fashion.[18]

[16] For a proof, see working paper version Douhan, Norbäck and Persson (2009).

[17] Granstrand and Sjölander (1990) present evidence from Sweden and Hall, Berndt and Levin (1990) present evidence from the US of firms acquiring innovative targets to gain access to their technologies.

[18] For a proof, see the working paper version Douhan, Norbäck and Persson (2009).

7. Econometric Analysis

The prediction emerging from Proposition 1 suggests that globalization in terms of the integration of markets can reduce the domestic entry barriers for entrepreneurs. As shown by Proposition 2, this effect may also be stronger in countries where governments have stronger preferences for rent extraction. To examine these predictions, we now turn to an empirical analysis of how barriers to entry are affected by a country's international openness. Descriptive statistics for all variables involved are found in Appendix Table A.1.

7.1. Econometric Model

To examine Proposition 1, we will estimate a reduced-form model of how the international openness of a country affects the cost of entry for domestic entrepreneurs. For country i, at time t, we have:

$$Entry\_barrier_{i,t} = \alpha_0 + \alpha_1 Globalization_{i,t} + \mathbf{X}'_{i,t}\boldsymbol{\beta} + \gamma_i + \gamma_t + \varepsilon_{i,t}, \tag{7.1}$$

where $Entry\_\text{barrier}_{i,t}$ is the entry cost, $Globalization_{i,t}$ is proxied by measures of globalization, $X_{i,t}$ is a vector of controls, γ_i is a country-specific effect, γ_t is a time-specific effect and u_{ij} is the usual error term. From Proposition 1, the entry barriers should be negatively correlated with measures of globalization, $\alpha_1 < 0$, when the market rent effect is dominated by the foreign threat effect and the strategic innovation effort effect. However, if the market rent effect dominates the foreign threat effect and the strategic innovation effort effect, the sign is reversed, $\alpha_1 > 0$. We discuss all variables affecting entry barriers, the choice of proxies and the data in the sections below. Descriptive statistics are presented in the Appendix, Table A1.

To examine Proposition 2, we will augment (7.1) and compare the impact of globalization in countries with high and low corruption where rent-seeking governments should be associated with a higher level of corruption:

$$\begin{aligned} Entry\_barrier_{i,t} &= \alpha_0 + \alpha_1 Globalization_{i,t} + \underset{(+)}{\alpha_2} Corruption_{i,t} + \\ &\quad \underset{(-)}{\alpha_3} Corruption_{i,t} \times Globalization_{i,t} + \mathbf{X}'_{i,t}\boldsymbol{\beta} + \gamma_i + \gamma_t + \varepsilon_{i,t}. \end{aligned} \tag{7.2}$$

As shown by Proposition 2, we would expect countries associated with a higher level of corruption to have higher entry barriers, but also to be more strongly affected by globalization, $\alpha_2 > 0$ and $\alpha_3 < 0$. The argument is that governments in countries with a high level of corruption are less likely to care about consumer welfare.

Our approach of proposing a correlation running *from globalization to entry barriers* differs from the previous literature which has used entrepreneurial polices acting as an explanatory variable. Table A.2 provides an overview. For instance, the level of entry barriers has been found to be a very good predictor of the level of corruption (Svensson 2005). Entry barriers have been discussed as a factor determining how adept a country is to use trade liberalization to generate growth (Freund and Bolaky, 2008; Fisman and Sarria-Allende, 2010). In addition, entry barriers have been found to have a strong negative effect on sector-level productivity and dynamics (Klapper *et al.*, 2006; Barseghyan, 2008). As compared to (7.1) and (7.2), previous studies have used entry costs as an explanatory variable.[19]

While our idea of a negative correlation between entry barriers and globalization is novel, such a correlation may be driven by factors unrelated to the theory we propose. We try to deal with this in a number of ways. First, we include country-specific effects and time-specific effects and use the country-specific time variation in entry barriers, whereas previous studies have used data for one year, frequently the data for 1999 used in Djankov *et al.* (2002). Second, we will try to control for an omitted variable in the form of a general country-specific trend in institutional quality.

7.1.1. Dependent variable: Entry barriers

To proxy the cost τ levied on entrepreneurial entry, we will use data from the World Bank's *Doing Business* project. The World Bank's *Doing Business* project was initiated by Djankov *et al.* (2002), and collects country-level data on regulations affecting the start-up of a limited liability company. Djankov *et al.* (2002) collected data for a sample of 85 countries in 1999. The extension of this project has collected data for 183 countries since 2003 and up to 2010.[20]

We use of three measures of entry regulation from the World Bank: (i) the number of different procedures that a start-up firm needs to go through to get legal status to operate as a firm (ii) the time it takes to obtain legal status to operate as firm (measured in business days) and (iii) the cost of obtaining legal status where these costs cover all identifiable expenses to obtain legal status. Importantly, unofficial costs due to corruption and costs pertaining to bureaucratic inefficiencies are not considered. To control for differences in the level of development, the official cost for setting up a new business is scaled by country per capita income. To adjust for

[19] Measures of openness may be endogenous if a reduction in entry barriers leads to the entry of export-oriented firms affecting measures of openness as suggested by the recent trade literature of heterogenous firms (see, for instance, Helpman, Melitz and Rubinstein, 2008). In the literature on corruption, there is also an established link between entry barriers and the level of corruption (see Svensson, 2005).

[20] Data lso exists up to 2012. However, our main measure of openness in terms of the KOF Index is only available up to 2010.

the skewness in the distribution, we take the log of the cost to start a firm, and the number of business days to start a firm. We treat the number of procedures as a discrete variable, as the latter variable varies much less than the number of business days.

7.1.2. Explanatory variable: International market integration

We use the KOF Index provided by the Swiss Federal Institute of Technology in Zurich to measure the international integration of product and innovation markets. The KOF Index was recently updated and is available for over 200 countries for the period 1999-2010. [21]

The KOF index captures economic, social and political aspects of globalization. The main components of the economic parts are trade flows and in- and outflows of direct and portfolio investments. The social parts build on information on international personal contacts and information flows. Political globalization is measured by membership in international organizations and participation in UN missions. The KOF index is described in detail in Appendix Table A.3.

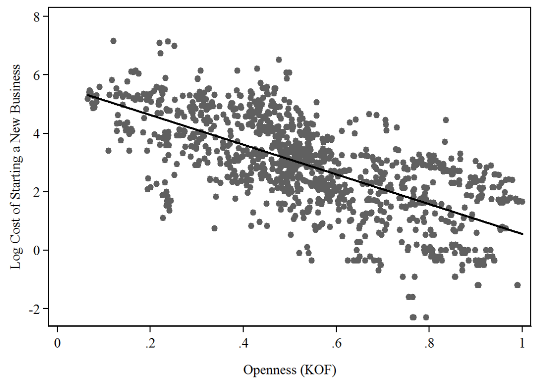
The globalization that we have theoretically depicted contains the integration of both product and innovation markets. To the best of our knowledge, there exists no established methodology in the literature on how to separate product and innovation market integration. Thus, our explanatory variable will be the aggregate index. Figure II shows a strong negative correlation between the KOF Globalization Index and our three measures of entry barriers, giving some initial support for Proposition 1.

7.1.3. Other covariates

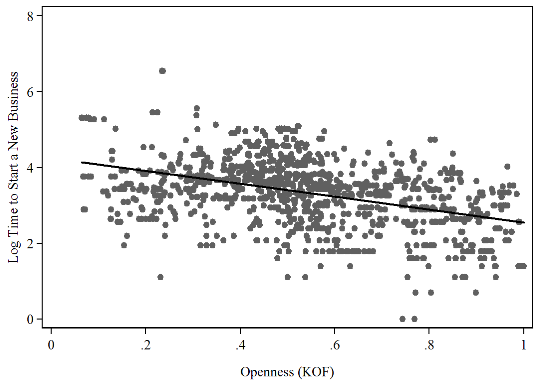
The cross-country effect of openness $Open_{i,t}$ on entry barriers $Entry\_cost_{i,t}$ in (7.1) is likely to be confounded with a range of variables. Among these, the features of the overall institutional setup (formal-legislative as well as their implementation) stand out as the most serious ones. In our main specification, we therefore control for country-specific effects, γ_i.

However, institutions may change over time affecting both the level of globalization or openness and the barriers to entry. Observed reductions in entry fees might then simply reflect a general change in institutions towards market orientation and not be driven by international integration. Increased openness may occur simultaneously as a change in government preferences towards reducing taxes, reducing government intervention, or conducting financial deregulation. Entry costs may be reduced due the government's change in stance towards market intervention, but may also be directly reduced due to such reforms. To control for this omitted variable

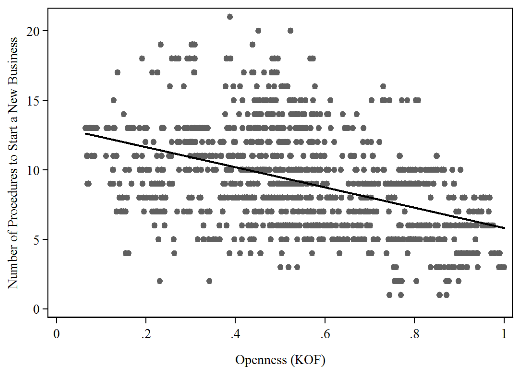
[21] In our working paper, we also use the CSGR Index provided by University of Warwick. Data for the CSGR Index is only available from 1999 to 2004 and covers about 120 countries. Results are qualitatively similar for the KOF- and the CSGR indices, albeit standard errors are larger with the CSGR Index due to a much smaller sample. Examples of previous studies using these indices include Dreher (2006) and Joyce (2006).



PANEL A:
Correlation between openness and Barriers to Entry, as measured by *cost*.



PANEL B
Correlation between openness and Barriers to Entry, as measured as by *time*.



PANEL C
Correlation between openness and Barriers to Entry, as measured by *Procedures*.

Figure 7.1: Illustrating the negative correlation between entry barriers and globalization.

problem, we use broad measures intended to capture the extent to which a country's institutions are aligned to free-market solutions. In our preferred specification, we also add time-specific effects, γ_t, to control for broad macroeconomic changes that may affect both entry regulation and globalization.

We first apply an average of selected components of the Heritage Foundation index of economic freedom. These include fiscal freedom (a measure of the tax burden imposed by the government), government size (defined as government expenditures as a percentage of GDP), financial freedom (a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector) and protection of property rights (assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state). We use a simple average of these components as our measure of institution. We also examine the impact of the individual components.

To further control for changing institutions, we also apply several indices of governance available from the World Bank. These include rule of law, regulatory quality and political stability. When examining Proposition 2 by estimating (7.2), we also include a measure of corruption which is taken from the World Bank as an interaction variable with openness. Kaufmann, Kraay and Mastruzzi, (2007) describe these World Bank indexes in more detail.

7.2. Results

We first run different specifications of the model in eq 7.1. Table I contains three different panels, one for each measure of entry regulation/barriers. Panel A displays the results for entry barriers as measured by log of the official direct cost to start a firm (*cost*). As shown in the first column of panel A, openness is highly correlated with entry barriers across countries. The significantly negative coefficient shows that high globalization level is correlated with low costs of starting a firm. Adding a control for other institutions in column (ii), the effect of openness is somewhat decreased but still highly significant, where better institutions also have a significantly negative effect on the entry cost. Adding year dummies in (iii) or country dummies as in (iv) does not change these results. However, when controlling for country-specific as well as time-specific effects the estimated coefficient for openness is not statistically significant.

In panel B we measure entry regulation by the log number of days to start a firm (*time*). Again, openness is highly correlated with entry barriers across countries. Across all specifications there is a consistent negative correlation, and the estimated coefficient for openness is significant at the one percent level across all specification, including our preferred specification with country- and year-specific effects. That is, when controlling for common macroeconomic trends and institutional quality, when globalization increases over time in a specific country, it is associated with a decrease in the time required to start a firm.

In Panel C in Table I entry regulation is measured in terms of the number of procedures required to start a business (*Procedures*). Since the number of procedure is a discrete count variable, we use a Poisson regression in Panel C.[22] The pattern is the same as when entry regulation is measured in terms of the number of days it takes to start a firm - there is a consistent, highly statistically significant, negative correlation between openness and entry regulation.

—— [TABLE I] ———

In Table II we further explore our preferred specification country fixed effects and year fixed effects. Specifications (i)-(v) in Panel A measure entry regulation as the log number of days to start a business (*time*). Specifications (vi)-(x) in Panel B measure entry barriers as the number of procedures required to start a firm (*Procedures*). We omit the official direct cost as measure for entry regulation as this did not produce a significant partial correlation with country fixed effects and year fixed effects in Table I. As can be seen, we consistently find a negative and significant effect of openness on entry regulation across almost all specifications. We first add the full list of indices from the Heritage foundation controlling for institutional changes in government policy. In specification (ii) we note that fiscal freedom has a negative significant effect on the number of days to start a firm. This is also the case for financial freedom and property rights. The remaining index for government size has no statistically significant effect. In specification (iii)-(v), we use the governance indicators from the World Bank. As these are highly correlated, we only use them separately. We find a statistically significant negative effect of regulatory quality on the time to entry, but no effect from the other institutional measures. Regulatory quality in specification (iv) also renders the coefficient of openness insignificant. Inspecting columns (i)-(v) in Panel B, where we measure entry regulation from the number of procedures to start a firm (*Procrdures)*, we find very similar effects. In particular, openness is negatively correlated with the number of procedures to start a business across all specifications, with estimated coefficients which are all significant at the one percent level.

——— [Table II] ———

[22]We also estimated Panel B with a poisson regression. This produced very similar results.

The broad negative correlation between the broad KOF Index of globalization and entry regulation in Tables I and II is consistent with the theory when the market rent effect is dominated by the foreign innovation and strategic innovation effort effects, as shown in Proposition 1. When entry regulation is measured as the log of the number of days to start a firm and, in particular, when entry regulation is measured by the number of official procedures needed to start a firm, we find a strong persistent negative correlation between entry regulation and globalization. When measuring entry regulation as the cost to start a firm, we do find a negative statistically significant correlation when controlling for institutions and country-specific effects. However, when adding a common time-specific effect the estimate of the correlation between openness and the official direct cost to start a firm is less precise.

A reason for this asymmetry might be that the official direct cost of entry does not include red tape costs of entry. The number of procedures and the number of days to start a firm may be closer to the latter costs, which may be politically easier to invoke since they could be argued to serve other purposes such as health and safety. The stronger results when entry regulation is measured in the number of procedures and in the number of days to start a firm then suggest that incumbents lobby for such "red-tape" entry barriers, and that competition from foreign entrepreneurs under integration makes this less worthwhile.

Rent seeking governments Proposition 2 shows that globalization in terms of increased openness should have a stronger effect on the entry barriers erected by governments with stronger preferences for rent-shifting. To investigate Proposition 2, we employ interaction effects between openness and corruption. To alleviate the concerns of endogeneity, we construct dummy variables for corruption levels above the mean. The regression results are reported in Table IV, are, however, mixed. The dummy for high corruption and the interaction between openness and high corruption come out as statistically significant when entry regulation is measured by the number of procedures required to start a firm in Panel C. Consistent with Proposition 2, countries that score higher on the corruption index are then those with the largest negative effect on the cost of entry from being more open. However, the estimated coefficients indicating the correlation between entry regulation and the interaction of high corruption and openness is not significant when entry regulation is measured by the official cost or the number of days required to start a firm in Panels A and B.

—— [TABLE III] ——

7.3. Robustness

Considering the heterogeneity in our country sample, it might be suspected that the observed effect of openness on entry barriers pertains to some sub-sample or is driven by outliers. The first two columns of Table IV show estimates for a sample where the income bottom or top 20-percentile of the sample have been dropped. This does not change the results: we still find a significant negative correlation between entry regulation in Panel B, where entry regulation is measured by the number of days required to start a firm, and in Panel C, where entry regulations is measured by the number of procedures needed to start a firm. In Panel A, where entry regulation is measured is captured by the cost to start a firm, there is no significant correlation.

Next, some countries that have been subjected to aid programs have been forced to comply with some institutional improvement program. One concern is that this creates a spurious relation between entry costs and openness for some countries. As a robustness check, we exclude sub-Saharan countries from our sample in column (iii). This experiment renders the coefficient of globalization on entry barriers measured by the official start-up cost in Panel A significant, with a negative sign. The impact of openness on the number days required to start a firm in Panel B and the number of procedures in Panel C remain negative and highly significant.

Finally, our data on entry costs is collected both from the 1999 Djankov *et al.* (2002) sample and from the more recent extensions of the survey beginning in 2003. There might be some concerns about changes in the measurement driving our result. In column (iv), we exclude observations from the older sample, which reduces statistical significance. However, in Panel C openness is negatively correlated with the number of procedures to start a firm, with an estimated coefficient which is significant at the one percent level.

—— [TABLE IV] ——

8. Conclusion

Industrial policy worldwide has shifted attention towards small and entrepreneurial firms. Our analysis explains this as an endogenous response to the ongoing international integration of product and innovation markets. In more open economies, it becomes more difficult to protect the profits of incumbent firms from independent innovators, and innovation efforts become more intertwined across countries, thus making foreign entrepreneurs more aggressive. This reduces the incumbents' incentive to pay for protection against the domestic entrepreneur, hence reducing the entry barriers. Data from the World Bank on entry regulation, support our theory by indicating a strong negative correlation between openness and the degree of barriers to entry into entrepreneurship.

We find some evidence for a second prediction of our theory in that the reduction of barriers to entry into entrepreneurship is larger in more corrupt countries. Consequently, the ongoing process of international agreements on trade and investment such as WTO agreements (e.g. TRIPS), and the enlargement of the EU single market program might be of particular benefit for entrepreneurs and consumers in the most corrupt countries.

International market integration can also make policies more anti-entrepreneurial. When integration is accompanied by merger and exit waves, and increased access to foreign markets for large domestic incumbent firms, incumbents' profits may increase to such an extent that their willingness to pay to protect their market increases. Globalization may then shift policy towards increased entrepreneurial barriers. Consequently, if entrepreneurial activity is considered to have positive externalities on societies in general, policies preventing internationally integrated markets from becoming too concentrated seem warranted. Moreover, studies identifying which type of market integration has a positive impact on entrepreneurial policies, and under which circumstances, seem to be a promising avenue for future research.

What other factors could explain the recent trend towards pro-entrepreneurial policies? One potential explanation is the increased importance of international policy benchmarking. The inception of new indices, such as the Doing Business index, is likely to make governments more prone to evaluate their policy relative to other countries. The existing entrepreneurship literature has typically explained the shift towards more pro-entrepreneurial policies as a consequence of the increased advantage of small scale activities and technological development favoring small scale production (Achs and Audretsch, 2005; Loveman and Sengenberger, 1991; Baumol, 2002). These explanations do not contradict our explanation, but rather compliment with our political economy explanation. Exploring this interaction in detail is left to future research.

Another interesting extension would be to assume that each incumbent lobbies independently. In the current version they can act together without coordination cost. In such an extension incumbents will face a free rider problem reducing their lobbying activities. We leave it to future research to examine how integration would affect entry barriers in a setting with such a free riding problem present.

References

[1] Acs, Zoltan J., and David B. Audretsch, "Entrepreneurship, Innovation and Technological Change," *Foundations and Trends in Entrepreneurship*, 1 (2005), 149–195.

[2] Barseghyan, Levon, "Entry Costs and Cross-country Differences in Productivity and Output," *Journal of Economic Development*, 13 (2008), 145–167.

[3] Baumol, William J., "Entrepreneurship, Innovation and Growth: The David-Goliath Symbiosis," *Journal of Entrepreneurial Finance and Business Venture*, 7 (2002), 1–10.

[4] Baumol, William J., "Entrepreneurial Enterprises, Large Established Firms and Other Components of the Free-Market Growth Machine," *Small Business Economics*, 23 (2004), 9–21.

[5] Bernheim, Douglas B., and Michael D. Whinston, "Menu Auctions, Resource Allocation and Economic Influence," *Quarterly Journal of Economics*, 101 (1986) , 1–32.

[6] Bombardini, Matilde, "Firm Heterogeneity and Lobby Participation," *Journal of International Economics*, 75 (2008), 329–348.

[7] Ciccone, Antonio, and Elias Papaioannou, "Red Tape and Delayed Entry," *Journal of the European Economic Association*, 5 (2007), 444–458.

[8] Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, "The Regulation of Entry," *Quarterly Journal of Economics*, 117 (2002), 1–37.

[9] Do, Quy-Toan and Levchenko, Andrei A., "Trade, inequality, and the political economy of institutions," *Journal of Economic Theory*, Elsevier, vol. 144(4), (2009), 1489-1520, July.

[10] Dreher, Axel, "Does Globalization Affect Growth? Evidence from a new Index of Globalization," *Applied Economics*, 38 (2006), 1091–1110.

[11] Douhan, Robin, Pehr-Johan Norbäck and Lars Persson, "Entrepreneurial Innovations, Entrepreneurship Policy and Globalization", Working Paper No. 807, Research Institute of Industrial Economics, Stockholm, 2009.

[12] Eaton, Jonathan, and Gene M. Grossman, "Optimal Trade and Industrial Policy under Oligopoly," *Quarterly Journal of Economics*, 101 (1986), 383–406.

[13] Fisman, Raymond, and Virginia Sarria-Allende, "Regulation of Entry and the Distortion of Industrial Organization," *Journal of Applied Economics*. Vol 13, No. 1, pp. 91-111, May 2010.

[14] Freund, Caroline, and Bineswaree Bolaky, "Trade, Regulations, and Income," *Journal of Development Economics*, 87 (2008), 309–321.

[15] Gilbert, Brett A, David B. Audretsch, and Patricia P. McDougall, "The Emergence of Entrepreneurship Policy," *Small Business Economics*, 22 (2004), 313–323.

[16] Goldberg, Pinelopi Koujinaou and Giovanni Maggi, "Protection for Sale: An Empirical Investigation," *American Economic Review* 89, 1135–1155.

[17] Granstrand, Ove, and Sören Sjölander, "The Acquisition of Technology and Small Firms by Large Firms," *Journal of Economic Behavior and Organization*, 13 (1990), 367–386.

[18] Grossman, Gene M., and Elhanan Helpman, 1991, *Innovation and growth in the global economy*, The MIT Press Cambridge, Massachusetts London, England

[19] Grossman, Gene M., and Elhanan Helpman, "Protection for Sale", *American Economic Review*, 84 (1994), 833–850.

[20] Haaland Jan I., and Hans Jarle Kind, "R&D Policies, Trade and Process Innovation," *Journal of International Economics*, 74 (2008), 170–187.

[21] Hall, Bronwyn H., Ernst Berndt, and Richard C. Levin, "The Impact of Corporate Restructuring on Industrial Research and Development," *Brookings Papers on Economic Activity: Microeconomics* (1990), 85–124.

[22] Helpman, Elhanan, Marc Melitz, and Yona Rubinstein, "Estimating Trade Flows: Trading Partners and Trading Volumes," *Quarterly Journal of Economics*, 123 (2008), 441–487.

[23] Hirukawa, Masayuki, and Masako Ueda, "Venture Capital and Industrial Innovation," CEPR Discussion Paper No. 7089, (2008).

[24] Imai, Susumu, Haijime Katayama, and Kala Krishna, "Is Protection Really for Sale? A Survey and Directions for Future Research," NBER Working Papers No. w13899, 2008.

[25] Impullitti, Giammario, "International Competition and U.S. R&D subsidies: a quantitative welfare analysis," *International Economic Review*, Vol. 51, issue 4, November 2010.

[26] Joyce, Joseph P., "Promises Made, Promises Broken: A Model of IMF Program Implementation," *Economics & Politics*, 18 (2006), 339–365.

[27] Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi, "Governance Matters IV: Aggregate and Individual Governance Indicators, 1996-2006," The World Bank Policy Research Working Paper No. 4280, 2007.

[28] Klapper, Leora, Luc Laeven, and Raghuram Rajan, "Entry Regulation as a Barrier to Entrepreneurship," *Journal of Financial Economics*, 82 (2006), 591–629.

[29] Kortum, Samuel, and Josh Lerner, "Assessing the Contribution of Venture Capital to Innovation," *RAND Journal of Economics*, 31 (2000), 674-692.

[30] Leahy, Dermot, and Peter J. Neary, "Multilateral Subsidy Game", *Economic Theory*, forthcoming, 2008.

[31] Loveman, Gary, and Werner Sengenberger, "The Reemergence of Small-scale Production: an International Comparison," *Small Business Economics*, 31 (2001), 1–37.

[32] Melitz, Marc J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71 (2003), 1695–1725.

[33] Perotti, Enrico C., and Paolo F. Volpin, "Politics, Investor Protection and Competition," ECGI Finance Working Paper No. 162, 2007.

[34] Rajan, Raghuram G., and Luigi Zingales, "The Great Reversals: the Politics of Financial Development in the Twentieth Century," *Journal of Financial Economics*, 69 (2003), 5–50.

[35] Spencer, Barbara J. and James A. Brander. "International R&D Rivalry and Industrial Strategy." *Review of Economic Studies*, Vol. 50, No. 163, (October 1983), pp. 707-722.

[36] Svensson, Jakob, "Eight Questions about Corruption," *Journal of Economic Perspectives*, 19 (2005), 19–42.

[37] Vives, Xavier. Oligopoly Pricing: Old Ideas and New Tools, MIT Press, 1999.

9. Appendix

9.1. Proof of Lemma 1

Differentiate the first-order condition for the domestic and foreign entreprenur, (3.4) and (3.5), in e, e^* and τ and rewrite in matrix form. This gives

$$\begin{bmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \end{bmatrix} \begin{bmatrix} e'_\tau \\ e^{*\prime}_\tau \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ 0 \end{bmatrix}, \tag{9.1}$$

where $\frac{\partial^2 V_{E^*}}{\partial e^* \partial \tau} = 0$. Define the determinants:

$$D_1 = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \end{vmatrix}, D_e = \begin{vmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} & \frac{\partial^2 V_E}{\partial e \partial e^*} \\ 0 & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \end{vmatrix}, D_{e^*} = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & 0 \end{vmatrix} \tag{9.2}$$

Then applying Cramers rule, we obtain

$$e'_\tau = \frac{D_e}{D_1} = \frac{-\frac{\partial^2 V_E}{\partial e \partial \tau} \frac{\partial^2 V_E}{\partial e^{*2}}}{D_1} < 0 \tag{9.3}$$

$$e^{*\prime}_\tau = \frac{D_{e^*}}{D_1} = \frac{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} \frac{\partial^2 V_E}{\partial e \partial \tau}}{D_1} > 0 \tag{9.4}$$

since $\frac{\partial^2 V_E}{\partial e \partial \tau} < 0$ and $\frac{\partial^2 V_E}{\partial e^{*2}} < 0$, $\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} < 0$ and $D_1 > 0$. The latter must hold in order for the Nash-equilibrium in (3.4) and (3.5) to be stable. To see this, note that

$$D_1 = \frac{\partial^2 V_E}{\partial e^2} \frac{\partial^2 V_E}{\partial e^{*2}} - \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} \frac{\partial^2 V_E}{\partial e \partial e^*} = \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} \frac{\partial^2 V_E}{\partial e \partial e^*} \left[\frac{\frac{\partial^2 V_E}{\partial e^2} \frac{\partial^2 V_E}{\partial e^{*2}}}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} \frac{\partial^2 V_E}{\partial e \partial e^*}} - 1 \right] \tag{9.5}$$

Since $\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} < 0$ and $\frac{\partial^2 V_E}{\partial e \partial e^*} < 0$, $D_1 > 0$ implies

$$\frac{\frac{\partial^2 V_E}{\partial e^2} \frac{\partial^2 V_E}{\partial e^{*2}}}{\frac{\partial^2 V_E}{\partial e \partial e^*} \frac{\partial^2 V_{E^*}}{\partial e^* \partial e}} > 1 \tag{9.6}$$

Differenting (3.4) and (3.5) to derive the slopes of the reaction functions $\mathcal{R}'_{E^*}(e) = \frac{de^*}{de}\big|_{\mathcal{R}_{E^*}(e)} = -\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} / \frac{\partial^2 V_{E^*}}{\partial e^{*2}} < 0$ and $\mathcal{R}'_E(e) = \frac{de^*}{de}\big|_{\mathcal{R}_E(e)} = -\frac{\partial^2 V_E}{\partial e^2} / \frac{\partial^2 V_E}{\partial e \partial e^*}$ and re-arranging (9.6), we have

$$D_1 > 0 \Rightarrow \frac{\frac{\partial^2 V_E}{\partial e^2}}{\frac{\partial^2 V_E}{\partial e \partial e^*}} > \frac{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e}}{\frac{\partial^2 V_{E^*}}{\partial e^{*2}}} \iff -\frac{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e}}{\frac{\partial^2 V_{E^*}}{\partial e^{*2}}} > -\frac{\frac{\partial^2 V_E}{\partial e^2}}{\frac{\partial^2 V_E}{\partial e \partial e^*}} \iff \mathcal{R}'_{E^*}(e) > \mathcal{R}'_E(e). \tag{9.7}$$

With the reaction functions downward sloping in the $e - e^*$ space, $D_1 > 0$ implies that the reaction function of the domestic entrepeneur intersects the reaction function of the foreign entrepeneur from above. But this is what is required for the Nash-equilbrium to be stable (see, Vives, 1999). Thus, since $e'_\tau < 0$ and $e^{*\prime}_\tau > 0$ holds from (9.3) and 9.4, we have

$$z'_\tau = z'_e e'_\tau < 0 < z^{*\prime}_\tau = z'_{e^*} e^{*\prime}_\tau. \tag{9.8}$$

9.2. Proof of Lemma 2

Proceed as in the previous section. Differentiate the first-order condition for the domestic entreprenur and the domestic incumbent, (5.3) and (5.4), in e, ι and τ and rewrite in matrix form. This gives

$$\begin{bmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota^2} \end{bmatrix} \begin{bmatrix} e'_\tau \\ \iota'_\tau \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ 0 \end{bmatrix} \tag{9.9}$$

where $\frac{\partial^2 V_i}{\partial \iota \partial \tau} = 0$. Define the determinants

$$D_2 = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}, D_e = \begin{vmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ 0 & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}, D_\iota = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & 0 \end{vmatrix}. \tag{9.10}$$

Note that $\frac{\partial^2 V_E}{\partial e^2} < 0$ and $\frac{\partial^2 V_i}{\partial \iota^2} < 0$ by the second-order conditions. Moreover, we have $\frac{\partial^2 V_E}{\partial e \partial \iota} < 0 < \frac{\partial^2 V_i}{\partial \iota \partial e}$ as explained in the text. But then $D_2 = \frac{\partial^2 V_E}{\partial e^2}\frac{\partial^2 V_i}{\partial \iota^2} - \frac{\partial^2 V_i}{\partial \iota \partial e}\frac{\partial^2 V_E}{\partial e \partial \iota} > 0 > D_e = -\frac{\partial^2 V_E}{\partial e \partial \tau}\frac{\partial^2 V_i}{\partial \iota^2} < 0$ must hold. Finally, $D_\iota = \frac{\partial^2 V_E}{\partial e \partial \tau}\frac{\partial^2 V_i}{\partial \iota \partial e} < 0$. Again, applying Cramer's rule, we have

$$e'_\tau = \frac{D_e}{D_2} < 0 \tag{9.11}$$

$$\iota'_\tau = \frac{D_\tau}{D_2} < 0 \tag{9.12}$$

Note, finally, that differenting (5.3) and (5.4) to derive the slopes of the reaction functions, gives $\mathcal{R}'_i(e) = \frac{d\iota}{de}\big|_{\mathcal{R}_i(e)} = -\frac{\partial^2 V_i}{\partial e^* \partial e} / \frac{\partial^2 V_i}{\partial e^{*2}} < 0$ and $\mathcal{R}'_E(e) = \frac{d\iota}{de}\big|_{\mathcal{R}_E(e)} = -\frac{\partial^2 V_E}{\partial e^2} / \frac{\partial^2 V_E}{\partial e \partial \iota} < 0$, so that $\mathcal{R}'_E(e) < \mathcal{R}'_i(e)$ as shown in Figure 5.1(iii). Stability of the Nash-equilibrium then requires that the reaction functions in Figure 5.1(iii) are not too steep (see Vives, 1999).

9.3. Proof of Lemma 3

From Section 5.2.1, equations (5.13)-(5.15) define the Nash-equilibrium as a function of the entry fee, $\{e(\tau), e^*(\tau), \iota(\tau)\}$. Differenting the first-order conditions (5.13)-(5.15) in e, e^*, ι and τ, gives:

$$\begin{bmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} & \frac{\partial^2 V_i}{\partial \iota^2} \end{bmatrix} \begin{bmatrix} e'_\tau \\ e^{*\prime}_\tau \\ \iota'_\tau \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ 0 \\ 0 \end{bmatrix}. \tag{9.13}$$

The stability of the Nash-equilibrium requires that the Hessian H is i negative definit (see Vives, 1999):

$$H = \begin{bmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} & \frac{\partial^2 V_i}{\partial \iota^2} \end{bmatrix} \tag{9.14}$$

To explore the conditions for this to hold, define the determinants

$$D_3 = \left| \frac{\partial^2 V_E}{\partial e^2} \right|, D_4 = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \end{vmatrix}, \ D_5 = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}. \tag{9.15}$$

The Hessian H is in (9.14) negative definite if $D_3 < 0$, $D_4 > 0$ and $D_5 < 0$. Note that $\frac{\partial^2 V_E}{\partial e^2} < 0$ and $\frac{\partial^2 V_{E^*}}{\partial e^{*2}} < 0$ hold from the second order conditions. Thus, $D_3 < 0$. It can also be checked that $\frac{\partial^2 V_E}{\partial e \partial e^*} < 0$ and $\frac{\partial^2 V_{E^*}}{\partial e^* \partial e} < 0$. Then, note that $D_1 > 0$ must hold for the stability of the Nash-equilibrium without incumbent innovation in (9.1). But then it must be that $D_4 = (1 - z^i) D_1 > 0$. Define the determinants:

$$D_6 = \begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} \end{vmatrix}, \ D_7 = \begin{vmatrix} \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} \end{vmatrix} \tag{9.16}$$

We then have

$$\begin{aligned} D_5 &= (-1)^{3+3} \frac{\partial^2 V_i}{\partial \iota^2} D_4 + (-1)^{2+3} \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} D_6 + (-1)^{1+3} \frac{\partial^2 V_E}{\partial e \partial \iota} D_7 \\ &= \underset{(-)}{\frac{\partial^2 V_i}{\partial \iota^2}} \underset{(+)}{D_4} - \underset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota}} D_6 + \underset{(-)}{\frac{\partial^2 V_E}{\partial e \partial \iota}} D_7 \end{aligned} \tag{9.17}$$

A sufficient condition for $D_5 > 0$ to hold is then that $D_6 < 0$ and $D_7 > 0$. If this is not fulfilled, $D_5 < 0$ holds if the first term in (9.17) is sufficiently large (in absolute value).

Assuming $D_5 < 0$ and using Cramer's rule, we finally obtain

$$
\begin{aligned}
e'_\tau &= \frac{\begin{vmatrix} -\frac{\partial^2 V_E}{\partial e \partial \tau} & \frac{\partial^2 V_E}{\partial e \partial e^*} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ 0 & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ 0 & \frac{\partial^2 V_i}{\partial \iota \partial e^*} & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}}{D5} = \frac{(-1)^{1+1}\left(-\frac{\partial^2 V_E}{\partial e \partial \tau}\right)\begin{vmatrix} \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e^*} & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}}{D5} \\
&= \frac{-\overset{(-)}{\frac{\partial^2 V_E}{\partial e \partial \tau}} \overbrace{\left[\overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^{*2}}} \overset{(-)}{\frac{\partial^2 V_i}{\partial \iota^2}} - \overset{(+)}{\frac{\partial^2 V_i}{\partial \iota \partial e^*}} \overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota}} \right]}^{>0}}{\underset{(-)}{D5}} < 0,
\end{aligned} \tag{9.18}
$$

and

$$
\begin{aligned}
e^{*\prime}_\tau &= \frac{\begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & -\frac{\partial^2 V_E}{\partial e \partial \tau} & \frac{\partial^2 V_E}{\partial e \partial \iota} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & 0 & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & 0 & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}}{D5} = \frac{(-1)^{1+2}\left(-\frac{\partial^2 V_E}{\partial e \partial \tau}\right)\begin{vmatrix} \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota^2} \end{vmatrix}}{D5} \\
&= \frac{\overset{(-)}{\frac{\partial^2 V_E}{\partial e \partial \tau}} \overbrace{\left[\overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e}} \overset{(-)}{\frac{\partial^2 V_i}{\partial \iota^2}} - \overset{(+)}{\frac{\partial^2 V_i}{\partial \iota \partial e}} \overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial \iota}} \right]}^{>0}}{\underset{(-)}{D5}} > 0,
\end{aligned} \tag{9.19}
$$

and, finally,

$$
\begin{aligned}
\iota'_\tau &= \frac{\begin{vmatrix} \frac{\partial^2 V_E}{\partial e^2} & \frac{\partial^2 V_E}{\partial e \partial e^*} & -\frac{\partial^2 V_E}{\partial e \partial \tau} \\ \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} & 0 \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} & 0 \end{vmatrix}}{D5} = \frac{(-1)^{1+3}\left(-\frac{\partial^2 V_E}{\partial e \partial \tau}\right)\begin{vmatrix} \frac{\partial^2 V_{E^*}}{\partial e^* \partial e} & \frac{\partial^2 V_{E^*}}{\partial e^{*2}} \\ \frac{\partial^2 V_i}{\partial \iota \partial e} & \frac{\partial^2 V_i}{\partial \iota \partial e^*} \end{vmatrix}}{D5} \\
&= \frac{-\overset{(-)}{\frac{\partial^2 V_E}{\partial e \partial \tau}} \overbrace{\left[\overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^* \partial e}} \overset{(+)}{\frac{\partial^2 V_i}{\partial \iota \partial e^*}} - \overset{(+)}{\frac{\partial^2 V_i}{\partial \iota \partial e}} \overset{(-)}{\frac{\partial^2 V_{E^*}}{\partial e^{*2}}} \right]}^{\lesseqgtr 0}}{\underset{(-)}{D5}} \lesseqgtr 0.
\end{aligned} \tag{9.20}
$$

TABLE I

MAIN RESULTS, EFFECTS ON ENTRY REGULATION FROM OPENNESS

	(i)	(ii)	(iii)	(iv)	(v)
			Panel A: cost		
Openness	-5.08***	-4.74***	-4.74***	-5.60***	-1.04
	(0.17)	(0.18)	(0.18)	(0.86)	(1.00)
Institutions		-0.028***	-0.030***	-0.020*	-0.028***
		(0.0049)	(0.0048)	(0.010)	(0.010)
Observations	1,064	1,031	1,031	1,031	1,031
R-squared	0.454	0.476	0.493	0.177	0.334
			Panel B: time		
Openness	-1.70***	-1.56***	-1.55***	-5.18***	-2.14***
	(0.12)	(0.12)	(0.12)	(0.66)	(0.77)
Institutions		-0.015***	-0.016***	-0.011**	-0.015***
		(0.0027)	(0.0026)	(0.0050)	(0.0051)
Observations	1,075	1,042	1,042	1,042	1,042
R-squared	0.178	0.208	0.275	0.188	0.331
			Panel C: Procedures		
Openness	-0.80***	-0.81***	-0.80***	-2.10***	-1.03***
	(0.049)	(0.053)	(0.052)	(0.33)	(0.34)
Institutions		-0.0018	-0.0031***	-0.0031	-0.0065***
		(0.0012)	(0.0011)	(0.0025)	(0.0024)
Observations	1,075	1,042	1,042	1,042	1,042
Pseudo R-Squared	0.050	0.054	0.069		
Countr y fixed effects	No	No	No	Yes	Yes
Year fixed effects	No	No	Yes	No	Yes

Robust standard errors in parentheses. *** indicates p-value<0.01, ** p-value<0.05 and * p-value<0.1. Panel A and B are estimated using OLS and Panel C with Poisson regression. The variable cost is log of the official cost incurred in the process of starting up a new firm as a share of the country's GDP per capita. Costs include all identifiable official expenses. The variable time is the log of the total number of days required to register a firm. The variable Procedures is the total number of procedures required by law to register a firm.

TABLE II
MAIN RESULTS WITH ALTERNATIVE INSTITUTIONS CONTROLS

	Panel A: time					Panel B: Procedures				
	(i)	(ii)	(iii)	(iv)	(v)	(i)	(ii)	(iii)	(iv)	(v)
Openness	-2.14***	-2.05***	-1.99**	-1.47	-2.31**	-1.03***	-0.95***	-1.15***	-0.96***	-1.24***
	(0.77)	(0.77)	(0.89)	(0.91)	(0.91)	(0.34)	(0.33)	(0.35)	(0.36)	(0.35)
Institutions	-0.015***					-0.0065***				
	(0.0051)					(0.0024)				
Fiscal Freedom		-0.0068**					-0.0032**			
		(0.0030)					(0.0013)			
Government Size		0.0020					0.0019			
		(0.0030)					(0.0013)			
Financial Freedom		-0.0047**					-0.0019*			
		(0.0022)					(0.0011)			
Property Rights		-0.0071*					-0.0044**			
		(0.0041)					(0.0017)			
Rule of Law			0.24					0.026		
			(0.21)					(0.085)		
Regulatory Quality				-0.52***					-0.19***	
				(0.17)					(0.068)	
Politcal Stability					0.15					-0.0034
					(0.11)					(0.045)
Observations	1,042	1,042	992	992	825	1,042	1,042	992	992	773
R-squared	0.331	0.338	0.314	0.329	0.325					
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. *** indicates p-value<0.01, ** p-value<0.05 and * p-value<0.1. Panel A is estimated using OLS and Panel B with Poisson regression Note: Panel A is estimated using OLS and Panel B with Poisson regression. The variable time is the log of the total number of days required to register a firm. The variable Procedures is the total number of procedures required by law to register a firm..

TABLE III

INTERACTION BETWEEN OPENNESS AND LEVEL OF CORRUPTION

	Panel A:	Panel B:	Panel C:
VARIABLES	cost	time	Procedures
Openness	-0.35	-0.67	-0.50*
	(1.25)	(0.98)	(0.30)
Institutions	-0.015	-0.020***	-0.0047**
	(0.010)	(0.0049)	(0.0022)
High Corruption	0.28	0.28	0.23**
	(0.42)	(0.34)	(0.10)
Openness×High Corruption	-0.019	-0.15	-0.37*
	(0.69)	(0.52)	(0.21)
Observations	950	959	959
R-squared	0.295	0.323	
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Robust standard errors in parentheses. *** indicates p-value<0.01, ** p-value<0.05 and * p-value<0.1. Panel A and B are estimated using OLS and Panel C with Poisson regression. The variable cost is log of the official cost incurred in the process of starting up a new firm as a share of the country's GDP per capita. Costs include all identifiable official expenses. The variable time is the log of the total number of days required to register a firm. The variable Procedures is the total number of procedures required by law to register a firm.

TABLE IV

ROBUSTNESS CHECKS

	(i)	(ii)	(iii)	(iv)
		Panel A: cost		
Openness	-0.97	-1.56	-1.95*	-0.51
	(1.12)	(1.01)	(1.11)	(1.07)
Institutions	-0.033***	-0.018***	-0.015**	-0.016
	(0.012)	(0.0060)	(0.0059)	(0.010)
Observations	828	913	823	950
R-squared	0.348	0.359	0.394	0.289
		Panel B: time		
Openness	-1.74**	-2.46***	-2.74***	-0.90
	(0.71)	(0.82)	(0.91)	(0.80)
Institutions	-0.024***	-0.011**	-0.0095*	-0.021***
	(0.0050)	(0.0053)	(0.0057)	(0.0049)
Observations	830	923	833	959
R-squared	0.394	0.327	0.356	0.319
		Panel C: Procedures		
Openness	-1.06***	-1.21***	-1.29***	-0.82***
	(0.35)	(0.32)	(0.38)	(0.26)
Institutions	-0.0076***	-0.0043*	-0.0044	-0.0047**
	(0.0026)	(0.0025)	(0.0028)	(0.0022)
Observations	829	922	833	959
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Excluded	Top 20th percentile in GNI/capita	Bottom 20th percentile in GNI/capita	sub-Sahara countries	Obs. before 2002

Robust standard errors in parentheses. *** indicates p-value<0.01, ** p-value<0.05 and * p-value<0.1. Panel A and B are estimated using OLS and Panel C with Poisson regression. The variable cost is log of the official cost incurred in the process of starting up a new firm as a share of the country's GDP per capita. Costs include all identifiable official expenses. The variable time is the log of the total number of days required to register a firm. The variable Procedures is the total number of procedures required by law to register a firm.

TABLE A.I
SUMMARY STATISTICS

VARIABLES	Years	Obs.	Mean	SD	Min	Max
Log of the official cost incurred in the process of starting up a new firm as a share (%) of the country's GDP per capita (*cost*)	1999, 2003–2010	1,473	2.84	1.64	-2.30	7.16
Log of the total number of business days required to register a firm (*time)*	1999, 2003–2010	1,488	3.24	0.92	0.00	6.54
The Number of procedures needed to start a new business (*Procedures*)	1999, 2003–2010	1,488	8.76	3.61	1.00	21.00
Openness (KOF index)	1999, 2003–2010	1,557	0.50	0.21	0	1
Institutions	1999, 2003–2010	1,582	59.36	11.02	1.25	91.68
High Corruption	1999, 2003–2010	1,863	0.58	0.49	0	1
Fiscal Freedom	1999, 2003–2010	1,582	61.05	20.29	0.00	99.90
Government Size	1999, 2003–2010	1,582	64.56	23.83	0.00	98.90
Financial Freedom	1999, 2003–2010	1,582	63.90	20.59	0.00	99.90
Property Rights	1999, 2003–2010	1,582	47.94	24.33	0.00	95.00
Rule of Law	2003–2010	1,890	-0.00	1.00	-2.67	2.00
Regulatory Quality	2003–2010	1,857	-0.00	1.00	-2.68	2.00
Politcal Stability	2003–2010	1,581	-0.04	1.00	-3.28	1.95

TABLE A.2

STUDIES USING THE WORLD BANK'S DOING BUSINESS INDEX.

	Dependent	Entry Barrier	Method	Result
Djankov et. al., (2002)	Corruption	Cost, procedures and time	Cross-country regressions (N=78) controlling for gdp/capita.	Positive effect (more corruption) in countries with higher entry barriers.
Svensson (2005)	Corruption	Procedures	Cross-country regressions (N=60) controlling for gdp/capita and education.	Positive effect (more corruption) in countries with many procedures.
Fisman and Sarria-Allende (2004)	Number, average size and operating margin of firms per 3-digit sector.	Cost	Interaction of sector specific natural entry barrier and growth potential with country specific entry barrier due to regulation.	In industries with low natural entry barriers, the average size of firms depends positively, and number of firms negatively, on the entry cost imposed by regulation.
Chang, Kaltani and Loayza (2005)	Growth	Index of cost, procedures and time	Panel of 80 countries over 40 years (5-year avg). Study interaction of openness with (time-invariant) institutional variables.	Openness has a positive effect on growth only in countries with low entry barriers.
Barseghyan (2008)	Output per worker and TFP	Cost	Cross-country IV regressions (N=50-100), with instruments for entry costs. Also controlling for human capital, corruption and business regulation (other than entry costs).	Negative effect of entry costs on output per worker and TFP.
Freund and Bolaky (2008)	Income gdp/capita	Procedures	Cross-country regressions (N=100-126) studying interaction of openness with entry regulation.	Finds strong negative effect of entry regulation and its interaction with openness on gdp/capita.
Klapper, Laeven and Rajan (2006)	Firm creation, average size of entrants and growth of incumbents	Procedures and entry	Interaction of country specific (institutional) entry barriers with industry specific characteristics (natural entry barriers)	Higher institutional entry barriers lower entry rate in sectors with high natural entry barriers, leads to larger new entrants, and increase incumbents' value added per employee.

TABLE A.3

THE GLOBALIZATION INDEX AND ITS SUBCOMPONENTS

	KOF index	
	Variable	Weight
Economic	Trade (percent of GDP)	0.19
	Foreign Direct Investment, flows (percent of GDP)	0.20
	Foreign Direct Investment, stocks (percent of GDP)	0.23
	Portfolio Investment (percent of GDP)	0.17
	Income Payments to Foreign Nationals (percent of GDP)	0.09
	Hidden Import Barriers	0.01
	Mean Tariff Rate	0.09
	Taxes on International Trade (percent of current revenue)	0.07
	Capital Account Restrictions	0.09
Social	Telephone Traffic	0.09
	Transfers (percent of GDP)	0.01
	International Tourism	0.09
	Foreign Population (percent of total population)	0.07
	International letters (per capita)	0.09
	Internet Users (per 1000 people)	0.12
	Television (per 1000 people)	0.12
	Trade in Newspapers (percent of GDP)	0.10
	Number of McDonald's Restaurants (per capita)	0.12
	Number of Ikea (per capita)	0.12
	Trade in books (percent of GDP)	0.08
Political	Embassies in Country	0.25
	Membership in International Organizations	0.28
	Participation in U.N. Security Council Missions	0.22
	International Treaties	0.25

Note that the weight refers to weight in each sub-index. For further information about sources for the specific variables we refer to (kof) http://globalization.kof.ethz.ch/. Variables are normalized across time and countries and the weights are obtained as the principal component of the variables in each subindex. The kof index obtains the overall globalization index as the principal component of the three sub-indices. In our estimations we exclude the following parts of the kof index: hidden import barriers, mean tariff rate, taxes on international trade and capital account restrictions. The index we use is obtained as the principal component excluding this variables