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Greenfield Investment versus Acquisition: Alternative Modes of Foreign Expansion

by

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Abstract

Foreign direct investment is in reality a heterogeneous flow of funds, composed of both greenfield-FDI ("greenfield investment") and acquisition-FDI (cross-border mergers and acquisitions). We analyse the choice of FDI mode in an international oligopoly where process R&D decisions are made endogenously and potential entry into the industry is allowed for. Relative to greenfield-FDI, acquisition-FDI is a soft response to the entry threat: in intermediate-sized markets, entry deterrence via greenfield-FDI can make acquisition-FDI unprofitable. The effect of trade liberalisation on acquisition-FDI flows is shown to depend crucially on the R&D technology. Normative analysis shows that equilibria associated with acquisition-FDI generally exhibit higher industry profits but lower consumer surplus than those associated with greenfield-FDI. However, Pareto dominant acquisition-FDI arises in small markets when acquisition prompts R&D investment that would not otherwise occur.

JEL classification: F21, F23, L12, O31.

Keywords: greenfield-FDI, acquisition-FDI, process R&D, entry, social welfare.

Outline

Non-Technical Summary

By building a model where the form of FDI (greenfield-FDI vs. acquisition-FDI) is endogenously selected, a key aim of this paper is to explain the greenfield/ acquisition choice. Our motivation is twofold. First, the greenfield/ acquisition distinction is quantitatively important in empirical data (on both flow values and project numbers): neither type of FDI is ever reported as being trivial. Second, intuition suggests that the distinction is also qualitatively important: at least in the short run, it is reasonable to expect acquisition-FDI to result in a more "concentrated" market structure than greenfield-FDI, which implies that the welfare effects of the two forms of entry may differ markedly. Despite these observations, the existing formal literature on FDI tends to identify FDI in general with just one of its two constituent types.

Because our modelling structure allows two "wider" aspects of industrial structure also to be endogenously determined (i.e. firms' investment levels in process R&D and the number of firms), it can be used to investigate the interactions between the greenfield/ acquisition choice and those other industry characteristics. Two such interactions stand out in our positive analysis. First, we find that, relative to greenfield-FDI, acquisition-FDI is a "soft" response by the incumbents to the entry threat: in intermediate-sized markets, acquisition-FDI provokes, but greenfield-FDI deters, entry. The entry-deterrence potential of greenfield-FDI reduces the profitability of acquisition-FDI in intermediate-sized markets, and it implies that neither the industry volume of greenfield-FDI nor the occurrence of acquisition-FDI need necessarily be monotonically related to national market size. Second, we showed that if both incumbents invest in process R&D, the effect of changes in the trade cost on the incentive for acquisition-FDI depends crucially on the R&D technology: if the probability of R&D success is small (large), then trade liberalisation (i.e., falls in the trade cost) discourages (encourages) acquisition-FDI.

In our normative analysis, the inclusion of endogenous R&D decisions allows us to examine whether acquisition-FDI can sometimes be justified (despite the welfare costs associated with increased "concentration") because it leads to increased industry R&D spending. We find that equilibria involving acquisition-FDI are generally associated, relative to their "threat points," with a Williamson (1968)-type welfare trade-off between industry profits and consumer surplus. However, in small markets, when equilibrium acquisition-FDI is associated with R&D spending that would not otherwise occur, it can also raise consumer surplus despite monopolization. In this case, acquisition-FDI raises industry R&D spending because the MNE monopolist it forms has a much larger output base than a national firm and therefore a stronger incentive to invest in process R&D.

A general conclusion of this paper is that greenfield- and acquisition-FDI are conceptually quite distinct (in terms of both the positive and the normative aspects of the industrial structures that they are associated with), which casts doubt on the legitimacy of many analyses that treat FDI as a homogeneous flow of funds.

1 Introduction

In reality, foreign direct investment (FDI) is a heterogeneous flow of funds, composed of both *greenfield-FDI* ("greenfield investment"), which represents a net addition to the host country's capital stock, and *acquisition-FDI* (cross-border mergers and acquisitions, M&As), which represents a change in the ownership of pre-existing production facilities in the host country. Estimates of the relative importance of either type of FDI in aggregate global flows vary considerably, but neither type is ever reported as being trivial: for example, UNCTAD (2000) reports that 50-80% of total global flows are acquisition-FDI.[1] Furthermore, as Caves (1996, p. 69) argues, it is intuitively reasonable to expect FDI to have different welfare effects depending on its form (at least in the short run): insofar as foreign market entry via acquisition-FDI, rather than greenfield-FDI, results in a more concentrated market structure, acquisition-FDI will be associated with higher prices and lower consumer welfare than greenfield-FDI. Indeed, in a survey of empirical research on how the host-country impacts of FDI differ by mode of entry, UNCTAD (2000) found that the most significant distinction is that acquisition-FDI is associated, relative to greenfield-FDI, with a *persistent* "concentration effect."

These observations suggest that the greenfield/ acquisition distinction is both quantitatively and qualitatively important, and they provoke a number of questions, of which we shall focus on two. *First*, what determines the form of FDI that arises in equilibrium? *Second*, what are the comparative welfare properties of equilibria associated with the alternative forms of FDI?

To answer our first (positive) question, we clearly need a model where the choice between greenfield- and acquisition-FDI is made endogenously. However, the existing formal literature on FDI tends to identify FDI in general with *one* of its two constituent types.[2] For example, a set of papers examines firms' choices between exporting and greenfield-FDI, where a "tariff-jumping" motive drives greenfield-FDI.[3] On the other hand, a separate set of papers examines firms' choices between exporting and acquisition-FDI, where the industry is an "international oligopoly" spread across two countries.[4] This tendency to focus exclusively on one type of FDI means that existing models of equilibrium FDI cannot explain the greenfield/ acquisition choice: such an explanation requires a model where the form of FDI is endogenously selected. Providing such a model is the principal contribution of this paper.

In addition to incorporating the choice between greenfield- and acquisition-FDI, our model also includes firms' decisions on two "wider" aspects of corporate strategy: *process R&D* investment levels are determined endogenously, and *potential entry* into the industry (at a global level) is allowed for. There is empirical evidence that the *total* FDI activity of incumbent firms in international oligopolies is closely associated with their R&D decisions

[1] This figure would fall in data on the *number* of projects of each type because greenfield-FDI projects are, on average, worth less than cross-border M&A deals.

[2] Moreover, Dunning's informal (1977) OLI framework treats the two types of FDI as equivalent.

[3] Motta (1992) analyses a single firm's entry decision into a foreign market along these lines. Firms' reciprocal greenfield-FDI decisions in a two-firm, two-country world (à la Brander and Krugman, 1983) are examined by Dei (1990), Horstmann and Markusen (1992) and Rowthorn (1992).

[4] Barros and Cabral (1994), Head and Ries (1997), Falvey (1998), and Qiu and Zhou (2004) all analyse the profitability and (national vs. global) welfare effects of cross-border mergers between exogenously-specified firms. Models of *endogenous* cross-border mergers are presented by Horn and Persson (2001) and by Neary (2004), where the merging firms' identities are determined in, respectively, cooperative and non-cooperative games.

and with the entry decisions of "outside" firms.[5] In order to interpret these empirical correlations, a theoretical understanding of how the variables involved are related at the micro level – i.e., when individual firms' strategy spaces are clearly specified and, therefore, FDI flows are *dis*aggregated – is required.

In our model, there are initially two incumbent firms with "home" plants in different countries. If the incumbents merge (acquisition-FDI), then the resulting multinational enterprise (MNE) next chooses whether to undertake risky process R&D. Finally, before market competition, an "outside" firm chooses whether to enter the industry.[6] The "threat point" in the absence of acquisition-FDI is determined as follows: first, the incumbents simultaneously choose whether to undertake greenfield-FDI and/or process R&D; second, potential entry and market competition occur sequentially. Both the greenfield-FDI and process R&D decisions are discrete and incur a sunk cost. We solve the game backwards to isolate its subgame perfect Nash equilibria, and acquisition-FDI occurs at the outset if the equilibrium profits of the integrated firm it creates exceed the combined profits of the two incumbents behaving non-cooperatively (i.e., the standard bilateral merger decision rule of Salant *et al.*, 1983).

Our positive results on equilibrium determination highlight the conceptual distinctness of greenfield- and acquisition-FDI, which are shown to arise in equilibrium on distinct parameter sets. In equilibrium, neither the industry volume of greenfield-FDI nor the occurrence of acquisition-FDI is necessarily monotonically related to national market size. With small national product markets, entry is blockaded, and acquisition-FDI to create an MNE monopolist is profitable. As in small markets, in large markets, the potential entrant's optimal decision is independent of whether acquisition-FDI has occurred: entry is always accommodated in equilibrium. However, in intermediate-sized markets, entry is "more likely" following acquisition-FDI: although acquisition-FDI provokes subsequent entry, greenfield-FDI is used at the threat point (if additional plants are sufficiently cheap) to deter entry.[7] This use of greenfield-FDI to deter entry *reduces* the profitability of acquisition-FDI in intermediate-sized markets but *increases* that of greenfield-FDI. Therefore, acquisition-FDI frequently arises in equilibrium for extreme ("small" and "large") but not intermediate market sizes, whereas the industry volume of greenfield-FDI is nonmonotonically related to market size in the opposite way.

Our positive results demonstrate the importance of analysing both forms of FDI "simultaneously." In intermediate-sized markets, the option of undertaking greenfield-FDI, which is exercised in equilibrium, makes otherwise-profitable acquisition-FDI *un*profitable in equilibrium by deterring entry and bolstering the incumbents' "disagreement profits." This point would be missed in a model that omitted greenfield-FDI strategies and identified FDI in general with acquisition-FDI in particular. Finally, we examine how changes in the trade cost affect FDI flows in equilibrium. The relationship between the trade cost and the volume of (two-way) greenfield-FDI is positive, which reflects the conventional "tariff-jumping" motive. The effect of changes in the trade cost on equilibrium acquisition-FDI is more complex.

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[5] FDI intensity is generally found to be positively correlated with (a) R&D intensity at both firm and industry levels (e.g. Markusen, 1995, micro fact 2; Barrell and Pain, 1999); and with (b) measures of source- and host-country product market concentration (e.g. Davies and Lyons, 1996, chapter 7; Caves, 1996, section 4.1; UNCTAD, 1997, chapter 4).

[6] The "outside" firm cannot itself enter by acquisition. The inclusion of potential entry means that acquisition-FDI does not imply monopolization and therefore invariably arise in equilibrium. All our modelling assumptions are fully justified in the next section.

[7] Relative to greenfield-FDI, acquisition-FDI is a "soft" response to the entry threat (because entry is more profitable against a monopoly than a duopoly). Therefore, greenfield-FDI is more effective at maintaining "concentration" than acquisition-FDI.

With *very small national markets*, entry is blockaded and the equilibrium choice is between two national firms at the "threat point" and an MNE monopolist via acquisition-FDI, none of whom invests in process R&D. If the trade cost is sufficiently large, then the national firms can monopoly-price at home in the absence of acquisition-FDI, and industry profits are unaffected by acquisition-FDI. Therefore, in this case, rises in the trade cost *weaken* the incentive for acquisition-FDI.[8]

However, when in *intermediate-sized and large markets* the incumbents remain national firms at the "threat point" (because additional plants are too costly for greenfield-FDI to occur) but invest in process R&D, the effect of changes in the trade cost on the incentive for acquisition-FDI depends crucially on the R&D technology. If the probability of R&D success is small, rises in the trade cost *encourage* acquisition-FDI: it is likely that just one incumbent succeeds in obtaining the process innovation and serves both national markets alone in Bertrand equilibrium. In this outcome, rises in the trade cost reduce the successful innovator's export profits. However, if R&D success is quite likely, then rises in the trade cost *discourage* acquisition-FDI: it is likely that both incumbents obtain the process innovation and supply only their home markets in Bertrand equilibrium. In this case, rises in the trade cost offer the incumbents heightened protection from import competition at home and thereby raise their "disagreement profits."

Our positive results contrast with and extend those of Bjorvatn (2004), who also examines the greenfield/ acquisition choice under oligopoly.[9] However, Bjorvatn's model differs in crucial respects from ours. Only firm entry-strategies into a *single* host country are considered. Moreover, neither endogenous R&D investment nor potential entry into the industry at a global level, both of which are associated with incumbent firms' FDI decisions in empirical data, is allowed for. Bjorvatn finds that (a) the industry volume of greenfield-FDI is monotonically increasing in market size,[10] and (b) falls in the trade cost increase the profitability of acquisition-FDI by intensifying competition and cutting profits at the "threat point." We show that result (a) is not robust to the inclusion of potential entry and that if firms invest in R&D, (b) holds only when the probability of R&D success is large. Finally, when determining the "threat point," Bjorvatn rules out reciprocal greenfield-FDI by the host-country incumbent in the foreign firms' home markets. We show that firms' "disagreement profits" and, consequently, results on the equilibrium occurrence of acquisition-FDI are sensitive to this omission.[11]

To answer our second (normative) motivating question,[12] we compare the equilibrium levels of industry profits and consumer surplus following acquisition-FDI to those obtained when acquisition-FDI is ruled out (i.e., at the "threat point"). At first blush, it might appear that acquisition-FDI would invariably reduce global welfare by increasing "concentration." However, when potential entry is allowed for, we know that this is not the case (because,

[8] Horn and Persson (2001) find that increased trade costs weaken the incentive for cross-border mergers for essentially the same reason.

[9] Similar models to Bjorvatn's are built by Norbäck and Persson (2004), and Eicher and Kang (2005). (For two very different, and more "competitive," analyses of the greenfield/ acquisition choice, where equilibrium is established via zero-profit conditions rather than strategic interaction, see Gordon and Bovenberg (1996) and Nocke and Yeaple (2004).)

[10] This is equivalent to the volume of greenfield-FDI monotonically *decreasing* in the plant cost (Bjorvatn's result) because the important independent variable is plant cost *per head*.

[11] In intermediate-sized markets, two-way greenfield-FDI flows at the "threat point" make otherwise-profitable acquisition-FDI *un*profitable. This observation is important because, in reality, FDI "cross-hauling" is very significant (Markusen, 1995, macro fact 3).

[12] To my knowledge, this is the first normative analysis of the greenfield/ acquisition choice.

relative to greenfield-FDI, acquisition-FDI is a "soft" response to the entry threat). Moreover, our inclusion of endogenous R&D investment allows us to ask whether, even if it does increase "concentration," acquisition-FDI may improve welfare by raising R&D investment.[13] In the *national* context, governments have frequently promoted horizontal mergers to create "national champions," whose technological dynamism outweighs (it is argued) the harmful effects of merger on consumers.[14] We examine whether acquisition-FDI can increase welfare in an *open* economy.[15]

We find that the welfare comparison of equilibria under acquisition-FDI with their "threat points" generally involves a Williamson (1968) trade-off between industry profits and consumer surplus (with acquisition-FDI benefitting firms collectively relative to the "threat point," but harming consumers). Despite this general result, we do find limited circumstances where acquisition-FDI arises in a Pareto dominant equilibrium, in the sense that both firms and consumers are better off than at the "threat point." In small markets, equilibrium acquisition-FDI can substitute an MNE monopolist that undertakes process R&D for two national firms that do not. Because entry is blockaded, acquisition-FDI is profitable here. Moreover, if the R&D success probability is sufficently large, then consumers benefit despite monopolization. This equilibrium comparison arises when the trade cost is "large" because, in that case, an MNE monopolist has a much larger output base than a national firm and therefore a stronger incentive to invest in R&D.[16]

The remainder of the paper is organized as follows. The next section defines our modelling structure. Sections 3 and 4 present, respectively, positive analysis of the first motivating question and normative analysis of the second. Finally, section 5 concludes.

2 The Modelling Structure

2.1 Sequence of Moves and Equilibrium Concepts

We assume that the world comprises two identical countries and that international shipping of goods incurs a specific trade cost, t. There initially exist four plants to produce the homogeneous product, two in each country. There are three firms, two of which (firms 1 and 2, the "incumbents") own one plant each in different countries . The third firm (firm E, the "potential entrant") owns one plant in each country. The incumbents' plants initially have a constant marginal production cost of c, and the potential entrant's plants are initially (drastically) productively inefficient relative to the incumbents'.[17] By undertaking process R&D, the potential entrant can lower her marginal production cost and become active in product market equilibrium. Therefore, "entry" in our model occurs via R&D investment

[13] Such a justification of acquisition-FDI has much in common with the "failing firm" defence of mergers (see Persson, 2005), in the sense that both are concerned with how integration may improve firm performance.

[14] For example, Schenk (1999, pp. 187-8) describes how the Reagan Administration promoted horizontal mergers in the mid-1980s on the grounds that firms in a more concentrated market might "more easily" be able to bear the sunk costs of R&D. See also Horn and Persson (2001, p. 308) and the references cited therein.

[15] Note that Geroski (1989, p. 29) argues that the 1992 Single Market Programme in Europe was partly motivated by the restructuring through cross-border mergers of European industry that it would prompt, which would create large, technologically-dynamic pan-European firms "able to compete on a par with their US or Japanese rivals."

[16] Note that the size of the merger-induced reduction in marginal cost is *endogenously determined* in our model. This contrasts with the exogenously-given cost savings from cross-border mergers in Horn and Persson (2001).

[17] i.e., their marginal production cost exceeds the monopoly price of an incumbent.

rather than via sunk investments in new plants. This characterisation of the entry decision is consistent with entry by diversification: the potential entrant is an incumbent in a "related" industry.[18]

Figure 1 illustrates the extensive form of our four-stage game.[19] The stage-one choice between the two subgames is determined by the co-operative *greenfield/ acquisition decision rule* (GADR), which is formally equivalent to the Salant, Switzer and Reynolds (1983) decision rule: one of the incumbents acquires the other if and only if the integrated firm's equilibrium profits in the A subgame are strictly greater than the sum of the incumbents' equilibrium profits in the G subgame. In stages two and three, the incumbents and the potential entrant, respectively, make their sunk investments. In stage four market equilibrium is established in both countries via Bertrand competition. Firms maximize their expected profits, and equilibrium industrial structures are derived as follows. The A and G subgames are solved backwards to isolate their subgame perfect Nash equilibria in pure strategies. The GADR then determines which subgame is played. Therefore, the G-equilibrium represents a threat point if take-over negotiations break down.

[INSERT FIGURE 1 HERE]

Firms can establish additional plants (each with a constant marginal production cost) in either country at a sunk cost of G. Therefore, there are plant-level economies of scale, and neither the potential entrant nor the acquirer will optimally establish additional plants.[20] Moreover, each incumbent will optimally establish at most one additional plant abroad in the G subgame.

Technology is a public good within the firm. Technological progress occurs via process R&D investments in steps, and each step incurs a sunk cost of I. The technological laggard (the potential entrant) can purchase the industry's best-practice technology (i.e. a marginal production cost of c) in one step. For firms on the technological frontier (i.e. the incumbents initially, and the potential entrant after sinking an investment of I to catch up), I purchases a process R&D investment with a risky outcome. With probability p, R&D investment "succeeds" and the firm's marginal production cost falls to 0; however, with probability $1-p$, R&D investment "fails" and the firm's marginal production cost remains at c. The probability of success p is identical and independent across firms.

Several aspects of the order of moves in Figure 1 require justification. First, Bertrand competition is modelled as the final stage after firms have taken production location and R&D investment decisions because decisions involving sunk investments entail more commitment than pricing decisions, which can be altered rapidly and at relatively little cost. It is thus natural (and conventional) to treat pricing policies as contingent on prior sunk investment decisions. Second, we assume that the incumbents (whether or not an acquisition occurs) make sunk investments before the potential entrant to capture the frequently-cited first-mover advantage of incumbency (e.g. Dixit, 1980): historical presence in the industry

[18] Gilbert and Newbery (1982) also assume that entry occurs via R&D investment. The assumption of entry by a diversifying MNE can be justified on two empirical grounds. First, Geroski (1995, p. 424) shows that de novo entry is "less successful than entry by diversification." Second, Davies et al. (2001) in their study of 277 leading European manufacturers reported that 104 (i.e. 37.5%) were both multinational and diversified, indicating that the two strategies are often complements. We do not allow the potential entrant to enter via acquisition. We implicity assume that the sunk costs of administering such a merger are prohibitive (e.g. due to the problems of fusing together different corporate cultures when the firms involved historically operated in different industries).

[19] Figure 1 incorporates the simplification of firms' strategic choices given in Lemma 1.

[20] Note that, via acquisition-FDI, the acquirer gains the rival incumbent's "home" plant.

affords the incumbents earlier knowledge of, and ability to exploit, profitable investment opportunities created by the opening up of national markets to cross-border trade and investment flows. Third, the incumbents' merger decision (leading potentially to a flow of acquisition-FDI) occurs before their process R&D and greenfield-FDI decisions. We make this assumption to add significant interest to our investigation of the second motivating question given in the Introduction ("What are the comparative welfare properties of equilibria associated with the alternative forms of FDI?"). By making R&D investments conditional on whether a merger has occurred, we are able to explore additional welfare consequences of merger to the "pricing effects" that have traditionally dominated the literature.[21]

Given the characteristics of the firms' strategic choices described above, the strategy spaces of the acquirer (in the A subgame) and the potential entrant are $\{N, R\}$ and $\{\varnothing, E, R\}$ respectively. N and $\varnothing$ both represent decisions to invest nothing in process R&D. A choice of E by the potential entrant costs I and reduces its marginal production cost to c. A choice of R produces a marginal production cost of either 0 ("success") or c ("failure"), and it costs the acquirer I but the potential entrant $2I$. An incumbent's stage-two strategy space (in the G subgame) is $\{1N, 1R, 2N, 2R\}$. The first component of each pair indicates how many plants the incumbent will maintain (a choice of 2 costs G); the second component indicates whether (R) or not (N) the incumbent invests in process R&D at a sunk cost of I.

Lemma 1 allows us to drop the strategies of E and $2N$ from the strategy spaces.

Lemma 1: (i) The potential entrant will never optimally choose a corporate structure of E because it is strictly dominated by one of $\varnothing$. (ii) In the G subgame, an incumbent will never optimally choose a corporate structure of $2N$ because it is strictly dominated by one of $1N$.

Proof: Both results follow directly from the assumption of Bertrand competition in homogeneous goods. Choosing E over $\varnothing$ and $2N$ over $1N$ leaves expected variable profits unchanged (because the firm does not gain a marginal cost *advantage*) but increases sunk costs.[22]

Throughout we maintain the following assumption, which seems intuitively reasonable, on t and c:

$$1 > c > t > 0 \tag{A}$$

2.2 Market Size and Variable Profits

Market demand in either country is

$$Q_k = \mu (1 - x_k).$$

Q_k and x_k are demand and price in country k respectively, $k \in \{1, 2\}$. μ measures the "size" of either national product market and can be interpreted as an index of the number of homogeneous consumers in each country, all of whom have a reservation price of 1.

[21] Moreover, Petit and Sanna-Randaccio (2000, p. 341) cite several recent empirical studies which find that "to an ever greater degree, firms are concerned with how their international strategy will influence their innovative activity." This implies that firms' FDI decisions frequently precede (i.e. entail longer term commitment than) their R&D decisions.

[22] Ferrett (2004) discusses the sensitivity of equilibria in the G subgame to the assumption of Bertrand competition in homogeneous goods. Many of the qualitative results generalize to "less competitive" market structures (e.g. Cournot competition, or Bertrand competition in differentiated goods), although the analysis is more complex.

Variable profits equal revenue minus variable costs. If either national product market is monopolized by firm i with a constant marginal cost of c_i, the monopoly price will be

$$x^M(c_i) = \frac{1}{2}(1 + c_i).$$

The monopolist's variable profits are $\mu R^M(c_i)$, where

$$R^M(c_i) = \frac{1}{4}(1 - c_i)^2$$

measures variable profit per consumer.

If firms i and j serve either national product market in a Bertrand duopoly, then firm i's variable profit function is $\mu R(c_i, c_j)$, where

$$R(c_i, c_j) = \begin{cases} 0 \text{ for all } c_j \in [0, c_i] \\ (1 - c_j)(c_j - c_i) \text{ for all } c_j \in \left[c_i, x^M(c_i)\right] \\ R^M(c_i) \text{ for all } c_j \in \left[x^M(c_i), 1\right] \end{cases}$$

again measures variable profit per consumer. These results are standard. Variable profits at a Bertand equilibrium with more than two firms can be straightforwardly derived if c_j is defined as the minimum of firm i's rivals' marginal costs (i.e. $c_j \equiv \min\{c_1, c_2, ..., c_{i-1}, c_{i+1}, ..., c_N\}$).

3 Positive Analysis

3.1 Equilibria in the A subgame

Table 1 gives the payoff matrix in the A subgame. Because both the acquirer and the potential entrant own 2 plants, the trade cost t is irrelevant in the A subgame: international trade flows never occur in equilibrium. If the potential entrant chooses $\varnothing$, then the acquirer monopolises both product markets. If the potential entrant chooses R, then either firm must possess a marginal *production* cost advantage over its rival to earn $R(0, c)$ in both countries, which occurs with probability $p(1 - p)$ when both firms undertake R&D.

[INSERT TABLE 1 HERE]

The equilibria of the A subgame are plotted in (p, μ)-space in Figure 2. We consider the potential entrant's optimal decision first, which may be conditional on the acquirer's prior choice. If the acquirer chooses N, then the potential entrant has $R \succ \varnothing$ iff

$$\mu > \underline{\mu} \equiv \frac{I}{R(0, c)\, p}.$$

If the acquirer chooses R, then the potential entrant has $R \succ \varnothing$ iff

$$\mu > \overline{\mu} \equiv \frac{I}{R(0, c)\, p(1 - p)}. \tag{2A}$$

[INSERT FIGURE 2 HERE]

For $p \in (0, 1]$ $\overline{\mu} > \underline{\mu}$, so there are three distinct situations to be faced by the acquirer when making her stage-two R&D decision (see Figure 1). For $\mu < \underline{\mu}$ entry is blockaded (i.e. E's dominant strategy is $\varnothing$), and the acquirer has $R \succ N$ iff

$$\mu > \frac{I}{2\left[R^M(0) - R^M(c)\right] p}. \tag{1A}$$

For $\mu \in \left(\underline{\mu}, \overline{\mu}\right)$ the potential entrant's optimal decision is conditional on the acquirer's choice (i.e. E optimally chooses R in response to N, but the acquirer can deter entry by choosing R), and the acquirer has $R \succ N$ iff

$$\mu > \frac{I}{2R^M(c) + 2\left[R^M(0) - R^M(c)\right]p}.$$

Finally, for $\mu > \overline{\mu}$ the acquirer must accommodate entry (i.e. E's dominant strategy is R), and the acquirer has $R \succ N$ iff

$$\mu > \frac{I}{2R(0,c)\,p(1-p)}.$$

The acquirer's incentive to undertake R&D is stronger when it actively deters entry than when entry is anyway blockaded (since entry reduces the acquirer's expected profits); and because $\underline{\mu} > \mu(1A)$ (i.e. A optimally chooses R in the upper part of the blockaded-entry region[23]), this means that the acquirer *always* chooses R when it actively deters entry. When entry must be accommodated (i.e. $\mu > \overline{\mu} \equiv \mu(2A)$), the acquirer always undertakes R&D. Figure 2 shows that the acquirer is "more likely" to undertake R&D, the larger is p or μ. Note that although the entry threat in the A subgame alters the acquirer's "incentives" to invest in R&D, it does not alter the acquirer's equilibrium behaviour relative to the benchmark of blockaded entry, where (1A) would also determine the acquirer's R&D decision. The potential entrant is "more likely" to choose R, the larger is μ; but the likelihood of entry is maximized at the intermediate p-value $p = 0.5$. This is because entry only pays off (ex post) for firm E if it wins an *R&D advantage* over A (due to the assumption of Bertrand competition), the probability of which is $p(1-p)$.

3.2 Equilibria in the G subgame

The G subgame originates in Ferrett (2004) where it was called the "potential-entry game." The formal properties of the G subgame are summarised in section 6.1 of the Appendix; here, we give an intuitive account of the subgame's comparative statics. Under the following two assumptions on the marginal and sunk cost parameters, Figure 3 plots the G-equilibria in (p,μ)-space:

$$R(0,c+t) + R(t,c) - R(c,c+t) - R(0,c) > 0 \qquad \text{(B)}$$

$$\frac{R(0,t)}{R(0,c) - R(t,c)} > \frac{I}{G} \qquad \text{(C)}$$

[INSERT FIGURE 3 HERE]

Assumption (B) on t and c is only slightly more restrictive than our maintained assumption (A). (See Figure 6 in the Appendix where (B) holds in regions III and IV: in general, (B) holds if the gap $c - t$ is sufficiently large.) It is straightforward but tedious to show that the LHS of (C) is strictly greater than 1 for all (c,t) under assumption (A). (Therefore, setting $G \geq I$ *certainly* satisfies (C); however, it is unnecessary.[24])

The G-equilibria in Figure 3 are reported in the form $(S_1, S_2; S_E)$, where S_1 and S_2 are the incumbents' corporate structure choices and S_E is the potential entrant's. In regions I, II and III the G-equilibria depend on whether the incumbents deter or accommodate entry

[23] For $p > 0$, $\underline{\mu} > \mu(1\text{A})$ requires $2\left[R^M(0) - R^M(c)\right] > R(0,c)$, which holds for all $c \in [0,1]$.

[24] For example, if $c \gg t > 0.5$, then $R(0,t) = R(0,c) = R^M(0)$ and $R(t,c)$ is "large." Therefore, the LHS of (C) is much greater than 1, and some $I > G$ will be compatible with (C).

in equilibrium. Entry deterrence occurs via greenfield-FDI, and it is therefore "more likely," the smaller is G. To gain a feel for the comparative statics of the G subgame, consider the effect of changes in market size on the incumbents' greenfield-FDI spending. In small markets (i.e. $\mu < \mu(6G)$) greenfield-FDI does not (in general) arise because the sunk cost G cannot be supported.[25] In large markets (i.e. $\mu > \mu(9G)$) the incumbents must accommodate entry, and (two-way) greenfield-FDI occurs only if national product markets are "very large" (i.e. $\mu > \mu(10G)$). In intermediate-sized markets (i.e. $\mu(9G) > \mu > \mu(6G)$), greenfield-FDI behaviour is more complex because entry can be deterred via greenfield-FDI, which occurs when G is "small." Therefore, if G is "large," the incumbents accommodate entry in intermediate-sized markets (by remaining "national" firms), and the volume of greenfield-FDI increases monotonically over the whole domain of μ. However, if G is "small," one or both of the incumbents undertakes greenfield-FDI to deter entry in intermediate-sized markets, and the volume of greenfield-FDI *decreases* as markets move from "intermediate-sized" to "large" (i.e. as μ crosses $\mu(9G)$). This occurs because an incumbent's greenfield-FDI incentive is stronger just below $\mu(9G)$, where greenfield-FDI can be used to deter entry that would otherwise occur, than just above, where entry must be accommodated.

3.3 Equilibrium industrial structures: A-equilibrium vs. G-equilibrium

In this section we compare the A- and G-equilibria for given parameter values to derive overall equilibrium industrial structures and the equilibrium mode of FDI. This task comprises two steps. (The mechanics are presented in section 6.2 of the Appendix.) First, we locate the inter-regional boundaries in the A subgame (Figure 2) relative to those in the G subgame (Figure 3), so that both the A- and G-equilibria are fixed for given parameter values. Second, we determine the equilibrium industrial structure by comparing the acquirer's profits at the A-equilibrium to the incumbents' at the G-equilibrium.[26] Figures 4A and 4B plot the resulting equilibrium industrial structures for "small" and "large" t respectively.[27] For easy reference and comparison of the "small" and "large" t cases, Table 2 gives a stylised depiction of our model's equilibrium industrial structures.[28]

[INSERT FIGURES 4A AND 4B HERE]
[INSERT TABLE 2 HERE]

We need to define the distinction between "small" and "large" t, which underpins Figures 4A and 4B, formally. We say that t is "large" if and only if

$$2\left[R^M(0) - R^M(c)\right] > R(0, c+t) + R(t, c) - R(c, c+t) \qquad \text{(D)}$$

In Figure 6 in the Appendix, (D) holds in region III ("large" t) but fails in region IV ("small" t). If (D) holds ("large" t, Figure 4B), then $\mu(1A)$ lies always below $\mu(1G)$, whereas the opposite is true if (D) fails ("small" t, Figure 4A). Condition (D) has a straightforward *economic* meaning (in terms of firms' "incentives" to undertake R&D), which is explained in the next section where it naturally arises in the context of normative analysis.

We summarize our positive results on equilibrium determination in Proposition 1.

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[25] For the sake of clarity, this abstracts from the $(1N, 2R; \varnothing)$ equilibrium.

[26] Where multiple G-equilibria exist, acquisition-FDI arises in equilibrium if the unique A-equilibrium dominates either all its "threat points" (as inside $\mu(3G)$, $\mu(4G)$ and $\mu(5G)$ in Fig. 3) or the incumbents' Pareto dominant "threat point" (as in region III of Fig. 3 with "small" G).

[27] The dashed lines in Figures 4A and 4B depict inter-regional boundaries from Figure 3.

[28] As in the London Underground map, only relative positions are correct.

Proposition 1:

1. **Acquisition-FDI:** (a) Acquisition-FDI is generally strictly profitable in *small* markets ($\mu < \mu(2A)$) where entry into the industry is blockaded. (b) In *small* and *large* ($\mu > \mu(9G)$) markets, the potential entrant's optimal decision is independent of whether acquisition-FDI occurs. However, in *intermediate-sized* markets ($\mu(2A) < \mu < \mu(9G)$), the profitability of acquisition-FDI is reduced when it provokes sebsequent entry that is deterred at the G-equilibrium (especially via greenfield-FDI).

2. **Greenfield-FDI:** (a) Two conditions are necessary for greenfield-FDI to arise in equilibrium: sufficiently large markets (μ), and a sufficiently small plant cost (G). (b) If additional plants are cheap, then the industry volume of greenfield-FDI is not monotonically increasing in market size: entry deterrence motivates greenfield-FDI in intermediate-sized markets but not in large markets. (c) If the G-equilibrium involves greenfield-FDI, then the incumbents generally substitute between greenfield- and acquisition-FDI when the plant cost (G) changes.

3. **Simultaneity:** If greenfield-FDI strategies are ruled out, then acquisition-FDI becomes "more likely" in equilibrium in *intermediate-sized* markets ($\mu(2A) < \mu < \mu(9G)$): if permitted, greenfield-FDI is used by the incumbents to deter entry, which bolsters their "disagreement profits" and renders acquisition-FDI unprofitable.

4. **Trade Costs:** (a) In the $(N;\varnothing)$ vs. $(1N,1N;\varnothing)$ comparison in *small* markets, increases in the trade cost reduce the profitability of acquisition-FDI. (b) In the $(R;R)$ vs. $(1R,1R;R)$ comparison in *intermediate-sized* and *large* markets, increases in the trade cost increase (decrease) the profitability of acquisition-FDI if the probability of R&D success is small (large). (c) Increases in the trade cost make two-way ("tariff-jumping") greenfield-FDI flows "more likely" in equilibrium.

Consider first equilibrium selection in *small* markets ($\mu < \mu(2A)$) where entry into the industry is blockaded. Here, acquisition-FDI results in monopolization and is therefore *strictly* profitable in general (part 1a). The exception to this result concerns the $(N;\varnothing)$ vs. $(1N,1N;\varnothing)$ comparison in very small markets (part 4a): large t affords the incumbents sufficient protection to monopoly-price in the G-equilibrium, implying no strict profitability gains from acquisition-FDI; but if t is small, acquisition-FDI increases industry profits by eliminating the import competition faced by the incumbents in the G-equilibrium.

In *intermediate-sized* markets ($\mu(9\mathrm{G}) > \mu > \mu(2\mathrm{A})$), the potential entrant's optimal decision depends on whether acquisition-FDI occurs: the A-equilibrium is $(R;R)$, but entry can be deterred in the G subgame – generally, but not always, by greenfield-FDI (part 1b).[29] Our definition of "intermediate-sized" markets captures the fact that entry is "more likely" to occur in the A subgame than in the G subgame, which makes intuitive sense because the potential entrant faces a monopoly in the A subgame but a duopoly in the G subgame.[30]

If the plant sunk cost is small, then one- or two-way greenfield-FDI flows frequently arise in equilibrium in intermediate-sized markets (part 2a) for two reasons: first, a small plant cost implies that entry-deterring G-equilibria involving greenfield-FDI *exist* (see section 3.2);

[29] The exception occurs for small t where $\pi_E(R;R) > \pi_E(1R,1R;R)$, so on $\mu \in (\mu(2A), \mu(6G))$ in Fig. 4A R provokes, but $(1R,1R)$ deters, entry. With large t, $\pi_E(R;R) = \pi_E(1R,1R;R)$, so this possibility disappears.

[30] Therefore, acquisition-FDI is a "soft" response to the entry threat. (The exception – $(R;\varnothing)$ vs. $(1N,1N;R)$ in region I of Fig. 3 – is minor because, for the incumbents, $(1R,1R;\varnothing)$ Pareto dominates $(1N,1N;R)$.)

and second, this deterrence of entry bolsters the incumbents' "disagreement profits" and renders acquisition-FDI, which would provoke entry, unprofitable (part 3). When the plant sunk cost is large, entry is accommodated in G-equilibrium in intermediate-sized markets and, consequently, the profitability of acquisition-FDI improves: therefore, the incumbents frequently substitute acquisition- for greenfield-FDI when plants become more costly (part 2c).[31]

Large markets ($\mu > \mu(9G)$) are such that entry always occurs in both subgames. If markets are very large ($\mu > \mu(10G)$), then a choice between greenfield- and acquisition-FDI arises. Acquisition-FDI allows the incumbents to economise on sunk costs; therefore, large plant and R&D costs both favour acquisition-FDI.[32] The profitability of acquisition-FDI also increases with p.[33]

Viewing our positive results as a whole prompts three observations. First, neither the industry volume of greenfield-FDI nor the occurrence of acquisition-FDI is necessarily monotonically related to market size in equilibrium. The possibility of entry deterrence in the G subgame means that an incumbent's greenfield-FDI incentive is stronger just below $\mu(9\mathrm{G})$, where greenfield-FDI can be used to deter entry that would otherwise occur, than just above, where entry must be accommodated. Therefore, for a small plant sunk cost, the industry volume of greenfield-FDI *falls* as markets move from "intermediate-sized" to "large," before (possibly) rising again when markets become very large ($\mu > \mu(10G)$). The same basic reasoning means that the occurrence of acquisition-FDI can be nonmonotonic in market size in precisely the opposite fashion. Acquisition-FDI invariably arises in "small" markets and often in "large" markets. However, entry deterrence via greenfield-FDI in "intermediate-sized" markets, where the acquirer must accommodate entry, makes acquisition-FDI unprofitable.

Secondly, and related to the previous point, our positive findings illustrate the importance of analysing both forms of FDI "simultaneously" (part 3 of Proposition 1): for example, in "intermediate-sized" markets, the option of undertaking greenfield-FDI, when exercised in equilibrium, makes otherwise-profitable acquisition-FDI *un*profitable. This point would be missed in a model that identified FDI in general with acquisition-FDI in particular (and excluded greenfield-FDI strategies).

Third, our results highlight the complex effects of changes in the trade cost on equilibrium FDI flows. Two-way greenfield-FDI becomes "more likely" in equilibrium if the trade cost rises (part 4c of Proposition 1): a higher t makes two-way greenfield-FDI "more likely" in G-equilibrium,[34] and the profitability comparison between $(R;R)$ and either $(2R,2R;\varnothing)$ or $(2R,2R;R)$ is independent of t (because international trade occurs in none of the equilibria considered). The effect of changing t on equilibrium acquisition-FDI depends, of course, on which "threat point" is considered. The $(R;R)$ vs. $(1R,1R;R)$ comparison depends on t and p in an economically interesting way (part 4b of Proposition 1).[35] The acquirer's profits in $(R;R)$ are independent of t, and the derivative of the incumbents' expected profits in $(1R,1R;R)$ with respect to t is $2p(1-p)\mu\left[p\frac{dR(0,t)}{dt}+(1-p)\frac{dR(t,c)}{dt}\right]$. For small p,

[31] However, acquisition-FDI is not *always* substituted for greenfield-FDI when the plant cost rises because the "threat point" itself depends on the plant cost: e.g., for small p and $\mu \in (\mu(6G), \mu(8G))$ in Fig. 4A, $(1R,1R;R)$ is the unique "threat point" and overall equilibrium for large G.

[32] By assumption, the integrated firm formed by acquisition-FDI runs only one research lab.

[33] This is a mathematical artefact. The incumbents earn strictly positive variable profits with probability $p(1-p)$ in $(R;R)$ but $2p(1-p)^2$ in $(2R,2R;R)$, where $p(1-p) > 2p(1-p)^2$ on $p \in (0.5, 1)$.

[34] In Fig. 3, $\mu(7G)$ and $\mu(10G)$ are both decreasing in t, and $\mu(9G)$ is independent of t.

[35] If greenfield-FDI were ruled out, $(1R,1R;R)$ would be the "threat point" for all $\mu > \mu(6G)$.

the derivative approximately equals $2p(1-p)^2 \mu \frac{dR(t,c)}{dt} < 0$, so increases in t *increase* the profitability of acquisition-FDI:[36] with small p, it is more likely that just one of the incumbent's R&D efforts in $(1R, 1R; R)$ succeeds than that they both succeed (i.e. $2p(1-p) > p^2$). In this "more likely" outcome, the sole successful innovator serves both countries' markets, earning $R(0,c)$ per head at home and $R(t,c)$ abroad, and increases in t cut its export profits. By contrast, for large p, the derivative approximately equals $2p^2(1-p) \mu \frac{dR(0,t)}{dt} \geq 0$, so increases in t reduce the profitability of acquisition-FDI:[37] the "more likely" configuration of incumbents' R&D outcomes in $(1R, 1R; R)$ is that *both* incumbents' R&D efforts succeed, which implies that both incumbents earn $R(0,t)$ per head at home and that increases in the trade cost increase profits by offering heightened protection against import competition.

4 Normative Analysis

In this section we perform some illustrative welfare comparisons between the A- and G-equilibria. Our welfare concept is *global social welfare*, which is composed of total expected consumer surplus across both countries and total expected profits across the three firms.[38]

To keep the analysis tractable and brief, we concentrate on four distinct pairs of A- and G-equilibria that arise in Figures 4A and 4B (each is coded with a "C" for "comparison"):

C1. $(1N, 1N; \varnothing)$ vs. $(N; \varnothing)$, which arises on $\mu < \min\{\mu(1A), \mu(1G)\}$.

C2. $(1R, 1R; \varnothing)$ vs. $(R; \varnothing)$, which arises on $\mu(2A) > \mu > \max\{\mu(1A), \mu(2G)\}$.

C3. $(2R, 2R; R)$ vs. $(R; R)$, which arises on $\mu > \mu(10G)$.

C4. $(1N, 1N; \varnothing)$ vs. $(R; \varnothing)$, which arises on $\mu(1G) > \mu > \mu(1A)$ (a non-empty interval iff (D) holds).

We summarize the results of our welfare comparisons in C1-C4 in Proposition 2.

Proposition 2:

1. **Williamson Trade-off:** When industry R&D spending is no larger at the A-equilibrium, the welfare comparison of A- and G-equilibria generally involves a Williamson (1968)-type trade-off between industry profits and consumer surplus.

2. **Pareto Dominance:** When industry R&D spending is strictly larger at the A-equilibrium, equilibrium acquisition-FDI is Pareto dominant in small markets for sufficiently large p if and only if $c + t > 0.5$.

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[36] This effect is observed in equilibrium outcomes in Figs 4A and 4B on $\mu \in (\mu(8G), \mu(9G))$. This result differs from those of Horn and Persson (2001) and Tekin-Koru (2004), which both find that increases in trade costs cut the profitability of cross-border mergers (by offering firms heightened protection at home at the threat point, as in part 4a of Proposition 1). Hijzen *et al.* (2005) provide some evidence that "tariff-jumping" motivates horizontal cross-border mergers.

[37] This effect is observed in equilibrium outcomes in Figs 4A and 4B on $\mu \in (\mu(9G), \mu(10G))$ when I is small. This result is consistent with trade liberalisation contributing towards the boom in high-tech cross-border M&As in the late 1990s.

[38] All of our cost variables are assumed to represent *opportunity* costs. In particular, there are no tariffs in t. Given national demand $Q_k = \mu(1 - x_k)$, aggregate consumer surplus in country k at market price x_k is $S[x_k] = \frac{\mu}{2}(1 - x_k)^2$, a slight abuse of notation because S is used elsewhere for firms' "corporate structure" choices. We are implicitly assuming that the income effects of price changes are negligible, e.g. that the good represents a small share of the "representative" consumer's spending.

Part 1 refers to pairs C1-C3. The "Williamson trade-off" means that expected industry profits are higher, but consumer surplus lower, at the A-equilibrium than at the G-equilibrium. In all of C1-C4, the occurrence of acquisition-FDI in equilibrium is *sufficient* for industry profits to be higher at the A-equilibrium than at the G-equilibrium.[39] Moreover, acquisition-FDI arises in equilibrium for all permissible parameter values in C1, C2 and C4,[40] and it arises in equilibrium in C3 if p is "large" (≥ 0.5). Therefore, acquisition-FDI generally increases expected industry profits in C1-C3.

On the other hand, consumer surplus is certainly lower under acquisition-FDI in C1-C3.[41] In these three cases, acquisition-FDI is associated with a more "concentrated" industrial structure and unchanged or reduced industry R&D spending. Where, as in C1-C3, a Williamson trade-off exists, the normative conclusion depends crucially on the weights assigned to consumer surplus and profits in the global social welfare function: the greater is the relative weight on consumer surplus, the "more likely" it becomes that acquisition-FDI is considered undesirable (relative to its "threat point").[42]

However, there are circumstances in our model when the A-equilibrium Pareto dominates the G-equilibrium so no Williamson trade-off exists (part 2 of Proposition 2): both industry profits and consumer surplus are higher following acquisition-FDI. In C4, equilibrium acquisition-FDI raises industry profits, and for sufficiently large p expected consumer surplus is higher under $(R;\varnothing)$ than $(1N,1N;\varnothing)$ if and only if $c+t>0.5$.[43] Therefore, subject to some parameter restrictions, the A-equilibrium can Pareto dominate the G-equilibrium if industry R&D spending is larger following acquisition-FDI than it would be otherwise. This gives some (qualified) support to the hypothesis that acquisition-FDI can foster "technological progress," the benefits of which outweigh the costs of monopolization.

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[39] In C1, C2 and C4, where entry occurs in neither equilibrium considered, equilibrium acquisition-FDI is also *necessary* for higher industry profits. In C3, note that $\pi_E(R;R) > \pi_E(2R,2R;R)$, so a sufficient (but unnecessary) condition for expected industry profits to be higher in $(R;R)$ is that the incumbents prefer $(R;R)$. This certainly occurs for "large" (≥ 0.5) p.

[40] In C1, acquisition-FDI is *strictly* profitable iff $x^M(c) > c+t$.

[41]

$$ES[x_k] = \begin{cases} S\left[x^M(c)\right] \text{ in } (N;\varnothing) \\ pS[0.5] + (1-p)S\left[x^M(c)\right] \text{ in } (R;\varnothing) \\ p^2S[0] + 2p(1-p)S[\min\{c,0.5\}] + (1-p)^2S[c] \text{ in } (R;R) \\ S\left[\min\left\{c+t, x^M(c)\right\}\right] \text{ in } (1N,1N;\varnothing) \\ p^2S[\min\{t,0.5\}] + p(1-p)\left[S[\min\{c+t,0.5\}] + S\left[\min\left\{c, x^M(t)\right\}\right]\right] \\ \qquad + (1-p)^2S\left[\min\left\{c+t, x^M(c)\right\}\right] \text{ in } (1R,1R;\varnothing) \\ p^2(3-2p)S[0] + 3p(1-p)^2S[\min\{c,0.5\}] + (1-p)^3S[c] \text{ in } (2R,2R;R) \end{cases}$$

Expected consumer surplus is *strictly* larger in $(1N,1N;\varnothing)$ than in $(N;\varnothing)$ iff $x^M(c) > c+t$. Note that $x^M(0) = 0.5$, so $S[0.5]$ is the consumer surplus associated with monopoly-pricing on the basis of a marginal cost of 0. Of course, $S[0.5] > S\left[x^M(c)\right]$ for all $c>0$. (See Petit and Sanna-Randaccio (2000) for an analysis of the consumer surplus effects of the greenfield-FDI/ exporting choice when R&D is endogenous.)

[42] Economic theorists typically weight consumer surplus and profits equally. However, Lyons (2002) argues that, in reality, competition authorities place a substantial premium on consumer surplus in evaluating proposed mergers. Note also that our model can display a "reverse" Williamson trade-off: just above $\mu(2A)$ in Figures 4A and 4B, where E's expected profits in $(R;R)$ are very small, firms collectively prefer the G-equilibrium but consumers prefer the A-equilibrium.

[43] If $p=0$, then consumers never prefer $(R;\varnothing)$ to $(1N,1N;\varnothing)$. At $p=1$, $(R;\varnothing)$ is preferred iff $S[0.5] > S\left[\min\left\{c+t, x^M(c)\right\}\right] \Leftrightarrow \min\left\{c+t, x^M(c)\right\} > 0.5$ (i.e., iff the monopoly price with R&D success in $(R;\varnothing)$ is below the equilibrium price in $(1N,1N;\varnothing)$), which simplifies to $c+t>0.5$ because $x^M(c) > 0.5$ for all $c>0$.

The finding that, for certain parameter values, R&D can occur in A- but not in G-equilibrium is perhaps counter-intuitive because the G subgame is more "competitive."[44] The key to the puzzle lies in comparing the "incentives" to undertake R&D of the acquirer and an (independent) incumbent in the G subgame. Given that entry is blockaded, the acquirer's expected variable profits rise by $2p\mu\left[R^M(0)-R^M(c)\right]$ if it chooses R over N; with R&D success, it earns $R^M(0)$ per head rather than $R^M(c)$ in both countries. Also with blockaded entry, an incument's expected variable profits in the G subgame rise by $p\mu\left[R(0,c+t)+R(t,c)-R(c,c+t)\right]$ if it chooses $1R$ over $1N$ in response to $1N$ by its rival; with R&D success, it earns $R(0,c+t)$ per head at home rather than $R(c,c+t)$, and it makes export profits of $R(t,c)$. Therefore, the *economic* interpretation of condition (D) holding, which is required for comparison C4 to arise, is that (for $p,\mu>0$) the acquirer has a stronger incentive to invest in R&D than an incumbent at the "threat point."

Condition (D) holds (see Figure 6 in the Appendix) for sufficiently large t.[45] To see the intuition for this, consider the case where t is very large ("prohibitive"): if the incumbents remain national firms in the G subgame, then the return to either from R&D investment is an increase in expected monopoly profits *on one ("home") market.* Therefore, an independent incumbent's expected return to R&D investment is exactly *half* that enjoyed by the acquirer.[46] This limiting example highlights clearly the source of the acquirer's stronger R&D "incentive" in C4: its larger output base, over which a process innovation can be spread, due to the elimination ("jumping") of trade costs following acquisition-FDI. The cause of Pareto dominant acquisition-FDI in our model (an "output base" effect) differs from that in Horn and Persson (2001), where mergers are associated with savings in fixed and variable production costs ("synergies") whose size is exogenously fixed. If, as in C4, acquisition-FDI is Pareto dominant, then the normative conclusion is *independent* of the relative weights assigned to consumer surplus and profits, which generates added interest in the analysis of cases of Pareto dominance.[47]

5 Conclusion

By building a model where the *form* of FDI (greenfield-FDI vs. acquisition-FDI) is endogenously selected, a key aim of this paper was to explain the greenfield/ acquisition choice. Our motivation was twofold. First, the greenfield/ acquisition distinction is quantitatively important in empirical data (on both flow *values* and project *numbers*): neither type of FDI is ever reported as being trivial. Second, intuition suggests that the distinction is also qualitatively important: at least in the short run, it is reasonable to expect acquisition-FDI to result in a more "concentrated" market structure than greenfield-FDI, which implies that the welfare effects of the two forms of entry may differ markedly. Despite these observations, the existing formal literature on FDI tends to identify FDI in general with just one of its two constituent types.

[44] For example, Aghion et al. (2001, p. 468) argue that "an increase in [product market competition] can stimulate R&D by increasing the incremental profit from innovating, that is, by strengthening the motive to innovate in order to escape competition with 'neck-and-neck' rivals."

[45] Note that $c+t>0.5$, the condition for consumers to prefer $(R;\varnothing)$ to $(1N,1N;\varnothing)$ for sufficiently large p, holds in "most" of region III in Figure 6.

[46] Therefore, the formal conditions for "prohibitive" t are $t>c$ and $c+t>x^M(c)$, so that the R.H.S. of (D) becomes $R^M(0)-R^M(c)$: trade never occurs in equilibrium, *and* the possibility of trade does not constrain equilibrium prices.

[47] Greenfield-FDI can also be Pareto dominant in our model: e.g., with $\mu\gg\mu(10G)$ and p sufficiently small.

Because our modelling structure allowed two "wider" aspects of industrial structure also to be endogenously determined (i.e. firms' investment levels in process R&D and the number of firms), it can be used to investigate the interactions between the greenfield/ acquisition choice and those other industry characteristics. Two such interactions stand out in our positive analysis. First, we found that, relative to greenfield-FDI, acquisition-FDI is a "soft" response by the incumbents to the *entry threat*: in intermediate-sized markets, acquisition-FDI provokes, but greenfield-FDI deters, entry. The entry-deterrence potential of greenfield-FDI reduces the profitability of acquisition-FDI in intermediate-sized markets, and it implies that neither the industry volume of greenfield-FDI nor the occurrence of acquisition-FDI need necessarily be monotonically related to national market size. Second, we showed that if both incumbents invest in *process R&D*, the effect of changes in the trade cost on the incentive for acquisition-FDI depends crucially on the R&D technology: if the probability of R&D success is small (large), then trade liberalisation (i.e., falls in the trade cost) discourages (encourages) acquisition-FDI.

In our normative analysis, the inclusion of endogenous R&D decisions allowed us to examine whether acquisition-FDI can sometimes be justified (despite the welfare costs associated with increased "concentration") because it leads to increased industry R&D spending. We found that equilibria involving acquisition-FDI are generally associated, relative to their "threat points," with a Williamson (1968)-type welfare trade-off between industry profits and consumer surplus. However, in small markets, when equilibrium acquisition-FDI is associated with R&D spending that would not otherwise occur, it can also raise consumer surplus despite monopolization. In this case, acquisition-FDI raises industry R&D spending because the MNE monopolist it forms has a much larger output base than a national firm and therefore a stronger incentive to invest in process R&D.

A general conclusion of this paper is that greenfield- and acquisition-FDI are conceptually quite distinct (in terms of both the positive and the normative aspects of the industrial structures that they are associated with), which casts doubt on the legitimacy of many analyses that treat FDI as a homogeneous flow of funds. However, further work is needed to test the robustness both of this general conclusion and of our more specific results. Our modelling structure is relatively stylised, and future work will attempt to relax some of our assumptions.

6 Appendix [Not for Publication]

6.1 The G Subgame[48]

Under assumption (A) on the marginal cost parameters, Tables 3, 4 and 5 show the firms' expected variable profits per consumer at Bertrand equilibrium when one incumbent (firm 1) chooses $1N$, $1R$ and $2R$ respectively. Expected profits can be derived by multiplying by μ and subtracting the relevant sunk costs: 0 for $1N$ and $\varnothing$, I for $1R$, $2I$ for R, and $G+I$ for $2R$. All the expected variable profit functions have the same general form: each is a weighted sum of the firm's global variable profits across all possible "states of the world," where each state is associated with a distinct configuration of R&D outcomes across firms and the weight applied is the probability of that state's occurrence.[49]

[48] **The material presented in this section is taken from Ferrett (2004), where the G subgame is formally presented and solved (under the title of the "potential-entry game").**

[49] If a firm earns strictly positive variable profits in both countries in a given "state of the world," we apply the convention of writing domestic variable profits as the first term in square brackets and foreign variable profits as the second.

[INSERT TABLES 3, 4 AND 5 HERE]

Denoting firm 1's expected variable profits per consumer by $\pi_1(S_1, S_2; S_E)$ (where S_f is firm f's "corporate structure"), the inter-regional boundaries in Figure 3 are such that[50]

$$\begin{aligned}
\mu(1G)\left[\pi_1(1R,1N;\varnothing)-\pi_1(1N,1N;\varnothing)\right] &= I\\
\mu(2G)\left[\pi_1(1R,1R;\varnothing)-\pi_1(1N,1R;\varnothing)\right] &= I\\
\mu(3G)\,\pi_E(1N,1R;R) &= 2I\\
\mu(4G)\left[\pi_1(2R,1N;\varnothing)-\pi_1(1R,1N;\varnothing)\right] &= G\\
\mu(5G)\left[\pi_1(1R,2R;\varnothing)-\pi_1(1N,2R;\varnothing)\right] &= G\\
\mu(6G)\,\pi_E(1R,1R;R) &= 2I\\
\mu(7G)\left[\pi_1(2R,1R;\varnothing)-\pi_1(1R,1R;\varnothing)\right] &= G\\
\mu(8G)\,\pi_E(1R,2R;R) &= 2I\\
\mu(9G)\,\pi_E(2R,2R;R) &= 2I\\
\mu(10G)\left[\pi_1(2R,1R;R)-\pi_1(1R,1R;R)\right] &= G
\end{aligned}$$

Assumption (C) on G and I, presented in the main text, is necessary for Figure 3 but not sufficient.[51] However, *all* G, I in (C) generate a plot of G-equilibria that, for our purposes, is only trivially different from Figure 3. Region I has two G-equilibria (as in the key to Figure 3), rather than a unique equilibrium of $(1R, 1R; \varnothing)$, iff

$$\frac{R(0,t)\left[R(0,c)+R(t,c)\right]}{\left[R(0,t)+2R(t,c)\right]\left[R(0,c)-R(t,c)\right]} > \frac{I}{G} \qquad \text{(C)*}$$

which is tighter than (C) (i.e. LHS(C) > LHS(C)*). However, the distinction is trivial because, as we show below (section 6.2), the counterpart A-equilibrium of $(R; \varnothing)$ is always selected in region I. By extension, we do not judge it important that $\mu(3G) > \mu(4G)$ at $p = 1$ iff

$$\frac{I}{G} > \frac{R(0,t)}{2\left[R(0,c)-R(t,c)\right]} \qquad \text{(C)**}$$

whose RHS is strictly less than the LHS of (C)*. (If I/G is very small, so that (C)* holds but (C)** fails, then region I will extend to $p = 1$ but will continue to lie entirely above $\mu(2G)$.) Finally, it should be noted that (C)** is also necessary and sufficient for $\mu(8G) > \mu(7G) > \mu(6G)$ at "large" p; otherwise, under (C), $\mu(9G) > \mu(7G) > \mu(8G)$ at "large" p.

The G-equilibria in regions II and III of Figure 3 depend on whether G is "small" or "large" (within (C)). Furthermore (see section 6.2), within both regions II and III, the stage-one choice between the G subgame and the counterpart A-equilibrium of $(R; R)$ is sensitive to whether the G-equilibrium deters ("small" G) or accommodates ("large" G) entry. Therefore, we need to make explicit the notion of "small" vs. "large" G: "small" G will mean $G \leq I$, and "large" G refers to the limiting case as $G \longrightarrow \infty$. The following results from Proposition 4 of Ferrett (2004) then apply:

[50] The following equality conditions are "indifference conditions" for the firm whose variable profit function is featured. The symmetry of our model across incumbents implies that "1" could be replaced by "2" (with incumbent 2's expected variable profits written as $\pi_2(S_2, S_1; S_E)$) and that the incumbents' choices in $\pi_E(\cdot)$ could be swapped. In the definitions of $\mu(7G)$ and $\mu(10G)$, $S_2 = 1R$ could be replaced by $S_2 = 2R$ without change of meaning because product markets are "national," so an incumbent's greenfield-FDI decision depends on "competitive conditions" abroad, which are independent of the rival incumbent's greenfield-FDI decision.

[51] In addition to (C), Figure 3 invokes assumption (B) on t and c.

(i) If $G = I$ and t is sufficiently large (i.e. above locus V in Figure 6), then $(1R, 2R; \varnothing)$ is the unique G-equilibrium in region II of Figure 3. (Note that, for $G = I$ and $p \geq 0.5$, $(1R, 2R; \varnothing)$ is the unique G-equilibrium in region II of Figure 3 *independently of* t.)

(ii) If $G = I$ and p is sufficiently large ($\mu > \mu(7G)$ is sufficient but unnecessary), then a second G-equilibrium of $(2R, 2R; \varnothing)$ exists in region III of Figure 3.

(iii) In both regions II and III of Figure 3: Falls in G make the existence of entry-deterring G-equilibria "more likely" (so (i) and (ii) generalize to all "small" G – with looser restrictions on on t and p respectively), and in the limit as $G \longrightarrow \infty$ (i.e. "large" G) entry-deterring G-equilibria never exist.[52]

6.2 Equilibrium Industrial Structures: A-equilibrium vs. G-equilibrium

6.2.1 Comparing inter-regional boundaries from Figures 2 and 3

We need to locate the inter-regional boundaries from Figures 2 and 3 relative to each other in order to fix, for given parameter values, the counterpart A- and G-equilibria. The result is given in Figure 5.

[INSERT FIGURE 5 HERE]

We have $\mu(6G) \geq \mu(2A)$ as $R(0, c) \geq R(0, t)$, so $\mu(6G) = \mu(2A)$ for $t \geq 0.5$. For $p \neq 0, 1$ $\mu(2A) > \mu(5G)$; and for $p > 0$ $\mu(2A) > \mu(2G)$ iff $pR(0, t) + (1 - p)[\text{LHS (B)}] > 0$, which holds for all $p \in (0, 1]$ by assumption (B).

Turning to $\mu(1A)$, $\mu(1G) > \mu(1A)$ for $p > 0$ iff

$$2\left[R^M(0) - R^M(c)\right] > R(0, c + t) + R(t, c) - R(c, c + t) \tag{D}$$

which holds for sufficiently large t (in Figure 6 (D) holds in region III but fails in region IV). If (D) fails (so $\mu(1A) > \mu(1G)$ for all p), then we know that $\mu(6G) > \mu(1A)$ because $\mu(6G) \geq \mu(2A)$ and $\mu(2A) > \mu(1A)$. $\mu(3G) > \mu(1A)$ for $p > 0$ iff

$$2\left\{2\left[R^M(0) - R^M(c)\right] - R(0, c)\right\} + \left[2R(0, c) - R(0, t)\right]p > 0,$$

which holds for all $p \in (0, 1]$ because $\{\cdot\} > 0$ for all $c \in [0, 1]$. $\mu(4G) > \mu(1A)$ for $p > 0$ iff

$$\frac{2\left[R^M(0) - R^M(c)\right]}{R(0, c) - R(t, c)} > \frac{I}{G}$$

which is looser than (C) and therefore holds ($2\left[R^M(0) - R^M(c)\right] > R(0, c)$, which holds for all c, is sufficient for this because $R(0, c) \geq R(0, t)$). Finally, $\mu(1A) > \mu(2G)$ for $p > 0$ iff

$$\begin{aligned} & R(0, c + t) + R(t, c) - R(c, c + t) - 2\left[R^M(0) - R^M(c)\right] \\ > \; & \left[R(0, c + t) + R(t, c) - R(c, c + t) - R(0, t)\right]p \end{aligned}$$

where LHS > 0 because (D) fails and $[\cdot]$ on RHS > 0 by (B). For "small" p the inequality holds, but for "large" p it fails (because $2\left[R^M(0) - R^M(c)\right] > R(0, c) \geq R(0, t)$ holds for all c).

[52] In region II and in region III where $\mu < \mu(7G)$, entry-deterring G-equilibria exist iff μ exceeds a critical value that itself is strictly increasing in G. However, $\mu(6G)$, $\mu(8G)$ and $\mu(9G)$ are all independent of G. In region III where $\mu > \mu(7G)$, an entry-deterring G-equilibrium of $(2R, 2R; \varnothing)$ *always* exists; however, rises in G shift $\mu(7G)$ upwards relative to $\mu(6G)$, $\mu(8G)$ and $\mu(9G)$.

6.2.2 Equilibrium Selection for $\mu < \mu(2A)$

The first three comparisons are relevant independently of whether (D) holds. (i) relates to the G-equilibrium that lies below $\mu(1A)$ when (D) holds, and (ii), (iii) relate to G-equilibria that lie above $\mu(1A)$ when (D) fails. The second three comparisons relate to the area in Figure 5 between the two possible positions of $\mu(1A)$.

Notation: In the G subgame, we denote firm f's *expected variable profits per head* by $\pi_f(S_1, S_2; S_E)$, where $f \in \{1, 2, E\}$ and S_f is f's "corporate structure." In the A subgame, the acquirer's *expected variable profits per head* are written as $\pi_A(S_A; S_E)$. Expected profits can be obtained by multiplying by μ and subtracting the relevant sunk costs, which depend on the firm's S.

(i) The incumbents have $(N; \varnothing) \succ (1N, 1N; \varnothing)$ iff $R^M(c) > R(c, c+t) \Leftrightarrow x^M(c) > c + t$, i.e. t sufficiently small; otherwise, they could monopoly price at the G-equilibrium.

(ii) For strictly positive values of the four cost parameters, the incumbents have (a) $(R; \varnothing) \succ (1N, 1R; \varnothing)$, and (b) $(R; \varnothing) \succ (1N, 2R; \varnothing)$ for all $p \in [0, 1]$ and $\mu > 0$; and (c) $(R; \varnothing) \succ (1N, 1N; R)$ wherever $(R; \varnothing)$ is the A-equilibrium because the incumbents make zero profits in $(1N, 1N; R)$. Because it implies monopolization, acquisition-FDI strictly increases the incumbents' expected variable profits in all three cases; furthermore, it reduces their combined sunk costs in (b) (as acquisition-FDI is substituted for greenfield-FDI).

(iii) The incumbents have $(R; \varnothing) \succ (1R, 1R; \varnothing)$ iff

$$\frac{I}{\mu} > 2\pi_1(1R, 1R; \varnothing) - \pi_A(R; \varnothing). \tag{1}$$

The comparison between $(R; \varnothing)$ and $(1R, 1R; \varnothing)$ arises on $\mu \in (\max\{\mu(2G), \mu(1A)\}, \mu(2A))$ or, equivalently,

$$\frac{I}{\mu} \in \left(\frac{I}{\mu(2A)}, \min\left\{\frac{I}{\mu(2G)}, \frac{I}{\mu(1A)}\right\}\right) \tag{2}$$

where all three arguments on the RHS are independent of I (i.e. I enters $\mu(2A)$, $\mu(2G)$ and $\mu(1A)$ multiplicatively). Using the following two results, we conclude that (1) holds for "almost all" I/μ in (2). Result (a): All I/μ in (2) satisfy (1) unless (c, t) lies below W and right of X in Figure 6, *and* p is "small."[53] If (a) cannot be invoked (i.e. p "small" and (c, t) within W and X in Figure 6), then (b) applies when (D) holds. Result (b): If $I/\mu(2G) < I/\mu(1A)$, then *some* I/μ in (2) satisfy (1) for all $p \in [0, 1]$.[54] Therefore, if p is "large," result (a) applies; if p is "small," the only area in Figure 6 not discussed is (c, t) below W, right of X and within region IV. The comparison between $(R; \varnothing)$ and $(1R, 1R; \varnothing)$ is complicated, despite being monopoly vs. duopoly, because R&D investment is twice as large under $(1R, 1R; \varnothing)$ so for the industry as a whole the probability of R&D success exceeds p.

[INSERT FIGURE 6 HERE]

(iv) If (D) holds, the incumbents have $(R; \varnothing) \succ (1N, 1N; \varnothing)$ for all $\mu > \mu(1A)$. ($(R; \varnothing) \succ (1N, 1N; \varnothing)$ iff $I/\mu < \pi_A(R; \varnothing) - 2\pi_1(1N, 1N; \varnothing)$; because $R^M(c) \geq R(c, c+t)$, $\mu > \mu(1A)$ is sufficient.)

---

[53] Proof: $I/\mu(2A) > 2\pi_1(1R, 1R; \varnothing) - \pi_A(R; \varnothing)$ is a quadratic in p of the form $\alpha + \beta p + \gamma p^2 > 0$ with $\alpha, \alpha + \beta + \gamma \geq 0$ for all (c, t). Locus W in Figure 6 is s.t. $\beta = 0$; below W, $\beta < 0$. $\alpha \equiv 2\left[R^M(c) - R(c, c+t)\right]$ and "most" of the area enclosed by W and X is s.t. $\alpha = 0$, i.e. $t > x^M(c) - c$. Note that $\alpha + \beta p + \gamma p^2 < 0$ within W and X only for "small" p from symmetry of LHS around its turning point: $\alpha + \beta + \gamma \equiv 2\left[R^M(0) - R(0, t)\right]$, which exceeds α for "small" t because $R^M(0) > R^M(c)$.

[54] Proof: This requires $\pi_A(R; \varnothing) > 2\pi_1(1R, 1R; \varnothing) - I/\mu(2G)$, where the LHS and the RHS are, respectively, linear and strictly concave in p. At $p = 0$, LHS $\geq$ RHS; and, at $p = 1$, LHS $>$ tangent to RHS from $p = 0$.

(v) If (D) fails, the incumbents have $(N;\varnothing) \succ (1N,1R;\varnothing)$ iff $I/\mu > \pi_1(1N,1R;\varnothing) + \pi_2(1N,1R;\varnothing) - \pi_A(N;\varnothing)$. The comparison between $(N;\varnothing)$ and $(1N,1R;\varnothing)$ arises on $\mu \in (\mu(1G), \min\{\mu(2G), \mu(1A)\})$ or, equivalently, $I/\mu \in (\max\{I/\mu(2G), I/\mu(1A)\}, I/\mu(1G))$. $I/\mu(1A) > \pi_1(1N,1R;\varnothing) + \pi_2(1N,1R;\varnothing) - \pi_A(N;\varnothing)$ is sufficient for $(N;\varnothing)$ always to be preferred, and it holds because both LHS, RHS are linear in p and LHS > RHS at $p = 0,1$.

(vi) If (D) fails, $(N;\varnothing)$ and $(1R,1R;\varnothing)$ are counterpart equilibria on $\mu \in (\mu(2G), \mu(1A))$ or, equivalently, $I/\mu \in (I/\mu(1A), I/\mu(2G))$. We showed in (iii) above that $(R;\varnothing) \succ (1R,1R;\varnothing)$ "almost always" on $I/\mu > I/\mu(2A)$. Therefore, under looser conditions, $(R;\varnothing) \succ (1R,1R;\varnothing)$ on $I/\mu > I/\mu(1A)$ because $I/\mu(1A) > I/\mu(2A)$. $(R;\varnothing) \succ (1R,1R;\varnothing)$ is sufficient for $(N;\varnothing) \succ (1R,1R;\varnothing)$ if $\pi_A(N;\varnothing) > \pi_A(R;\varnothing)$, i.e. $\mu < \mu(1A) \Leftrightarrow I/\mu > I/\mu(1A)$, so we conclude that the incumbents have $(N;\varnothing) \succ (1R,1R;\varnothing)$ "almost everywhere" that the comparison arises.

6.2.3 Equilibrium Selection for $\mu > \mu(2A)$

Notation: See start of section 6.2.2.

On $\mu > \mu(2A)$ the A-equilibrium is always $(R;R)$. There are five counterpart G-equilibria to consider:

(i) $\mu(6G) > \mu(2A)$ for all $p \in (0,1)$ iff $t < 0.5$; otherwise, they coincide. If it is non-empty, the comparison on $(\mu(2A), \mu(6G))$ is between $(R;R)$ and $(1R,1R;\varnothing)$; $(R;R) \succ (1R,1R;\varnothing)$ iff $I/\mu > 2\pi_1(1R,1R;\varnothing) - \pi_A(R;R)$, which is inconsistent with $\mu > \mu(2A) \Leftrightarrow I/\mu < I/\mu(2A)$ iff $2\pi_1(1R,1R;\varnothing) - \pi_A(R;R) > I/\mu(2A)$. This inequality gives a quadratic in p of the form $\alpha + \beta p + \gamma p^2 > 0$ with $\alpha, \alpha+\beta+\gamma > 0$ for all (c,t). LHS > 0 for all $p \in [0,1]$ unless (c,t) lies above locus Y and below $t = 0.5$ in Figure 6.[55] Therefore, we conclude that, on $\mu \in (\mu(2A), \mu(6G))$, the incumbents have $(1R,1R;\varnothing) \succ (R;R)$ for "almost all" c,t,p.

The next four comparisons use Figure 7, which plots the G-equilibria for $\mu > \mu(6G)$ in $(G/\mu, I/\mu)$-space. (The denominators of the inter-regional boundaries in Figure 7 are implicitly defined by the equalities listed at the start of section 6.1. Note that, because I enters $\mu(6G)$, $\mu(8G)$ and $\mu(9G)$ multiplicatively and G enters $\mu(7G)$ and $\mu(10G)$ multiplicatively, all the inter-regional boundaries are independent of G, I.)

[INSERT FIGURE 7 HERE]

(ii) For "almost all" $I/\mu < I/\mu(6G)$ a comparison between $(R;R)$ and $(1R,1R;R)$ arises.[56] The incumbents have $(R;R) \succ (1R,1R;R)$ iff $I/\mu > 2\pi_1(1R,1R;R) - \pi_A(R;R)$. It is straightforward to show that the vertical position of $I/\mu = 2\pi_1(1R,1R;R) - \pi_A(R;R)$ in Figure 7 is as follows:

For "small" t and "small" p: $2\pi_1(\cdot) - \pi_A(\cdot) > I/\mu(6G) \Rightarrow (1R,1R;R) \succ (R;R)$ on all $\mu \in (\mu(6G), \mu(10G))$.

For "small" t and "large" p: $2\pi_1(\cdot) - \pi_A(\cdot) < 0 \Rightarrow (R;R) \succ (1R,1R;R)$ on all $\mu \in (\mu(6G), \mu(10G))$.

For "large" t (and all p): $I/\mu(9G) > 2\pi_1(\cdot) - \pi_A(\cdot) > 0 \Rightarrow (R;R) \succ (1R,1R;R)$ on all $\mu \in (\mu(6G), \mu(9G))$, and on $\mu \in (\mu(9G), \mu(10G))$ $(R;R)$ is "more likely" to be preferred, the larger is I.

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[55] For "small" t, $\beta > 0$ so LHS > 0 for all p. However, for "large" t, $\beta + 2\gamma > 0 > \beta$, which implies $\gamma > 0$ and that LHS has an interior minimum; therefore, LHS > 0 for all p iff $4\alpha\gamma > \beta^2$, which holds below locus Y. Note that LHS < 0 within Y and $t = 0.5$ only for "small" p from symmetry of LHS around its turning point: $\alpha + \beta + \gamma \equiv 2R(0,t)$, which exceeds $\alpha \equiv 2R(c, c+t)$ for "large" (c,t).

[56] The two exceptional cases are $G/\mu < G/\mu(10G) \Leftrightarrow \mu > \mu(10G)$ and $G/\mu < G/\mu(7G), I/\mu > I/\mu(8G) \Leftrightarrow \mu(8G) > \mu > \mu(7G)$, which potentially occurs only if p is "large."

Therefore, for "small" p increases in t can cause the incumbents' preferred equilibrium to switch from $(1R, 1R; R)$ to $(R; R)$ (i.e. increases in t "encourage" acquisition-FDI). However, for "large" p increases in t can have the opposite effect, "discouraging" acquisition-FDI. Intuition for this result is provided in the main text.

(iii) For $I/\mu \in (I/\mu(8G), I/\mu(6G))$ a comparison between $(R; R)$ and $(1R, 2R; \varnothing)$ arises (if $G/\mu > G/\mu(7G) \Leftrightarrow \mu < \mu(7G)$). This is region II of Figure 3. The incumbents have $(R; R) \succ (1R, 2R; \varnothing)$ iff $I/\mu > \pi_1(1R, 2R; \varnothing) + \pi_2(1R, 2R; \varnothing) - \pi_A(R; R) - G/\mu$, whose RHS is strictly decreasing in G to reflect a straightforward "substitution effect" towards acquisition-FDI as greenfield-FDI becomes more costly. Therefore, for "large" G (defined in section 6.1 as the limiting case as $G \longrightarrow \infty$) the incumbents have $(R; R) \succ (1R, 2R; \varnothing)$ for all $\mu \in (\mu(6G), \min\{\mu(7G), \mu(8G)\})$.

Next we investigate the incumbents' preference ranking for "small" G, defined in section 6.1 as $G \leq I$. The incumbents have $(1R, 2R; \varnothing) \succ (R; R)$ for all "small" G on $\mu \in (\mu(6G), \min\{\mu(7G), \mu(8G)\})$ iff $\pi_1(1R, 2R; \varnothing) + \pi_2(1R, 2R; \varnothing) - \pi_A(R; R) - I/\mu(6G) > I/\mu(6G)$, which holds for "almost all" c, t, p.[57] Therefore, the equilibrium industrial structure (EIS) in region II of Figure 3 is determined as follows:

	G-equilibrium	A-equilibrium	EIS
"Small" G	$(1R, 2R; \varnothing)$[58]	$(R; R)$	$(1R; 2R; \varnothing)$[59]
"Large" G	$(1R, 1R; R)$	$(R; R)$	t, p "small": $(1R, 1R; R)$ otherwise: $(R; R)$

Whenever the incumbents have $(R; R) \succ (1R, 1R; R)$ in region II of Figure 3 (i.e. unless t and p are both "small"), the EIS would always be $(R; R)$ if greenfield-FDI were ruled out. Therefore, for "small" G, acquisition-FDI is made unprofitable by the option of greenfield-FDI, but it *would* arise if greenfield-FDI were ruled out.

(iv) A comparison between $(R; R)$ and $(2R, 2R; \varnothing)$ arises (a) on $I/\mu \in (I/\mu(9G), I/\mu(8G))$, i.e. region III of Figure 3; and (b) for $G/\mu < G/\mu(7G)$, on $I/\mu > I/\mu(8G)$, which are compatible under (C) iff p is "large." Comparison (b) refers to $\mu \in (\mu(7G), \mu(8G))$ in Figure 3. The incumbents have $(R; R) \succ (2R, 2R; \varnothing)$ iff $I/\mu > 2\pi_1(2R, 2R; \varnothing) - \pi_A(R; R) - 2G/\mu$, whose RHS is strictly decreasing in G due to substitution towards acquisition-FDI as greenfield-FDI becomes more costly. In case (a) the incumbents have $(2R, 2R; \varnothing) \succ (R; R)$ for all "small" G iff $2\pi_1(2R, 2R; \varnothing) - \pi_A(R; R) - 2I/\mu(8G) > I/\mu(8G)$; for $p \neq 0, 1$, this requires $2R(0, c)(3p - 1) > 3R(0, t)p$, which holds (resp. fails) for "large" (resp. "small") p.[60] Therefore, the EIS in region III of Figure 3 is determined as follows:

[57] The inequality condition yields a cubic in p of the form $\alpha + \beta p + \gamma p^2 + \delta p^3 > 0$ with $\alpha, \gamma > 0 > \beta$ and $\delta \equiv 2[R(0, t) - R(0, c)] \leq 0$. We have LHS > 0 for all $p \in [0.5, 1]$. (This follows from two conditions, together sufficient for $\pi_1(1R, 2R; \varnothing) + \pi_2(1R, 2R; \varnothing) - \pi_A(R; R) > 2I/\mu(6G)$: $p(1-p)[R(0, c+t) + R(t, c)] > 2p(1-p)^2 R(0, c)$ and $(1-p)^2 R(c, c+t) > p^2(1-2p) R(0, t)$.) Turning to $p \in [0, 0.5)$, there are two cases to consider. First, if $t \geq 0.5$ so $\delta = 0$, then the resulting quadratic has an interior minimum on $p \in [0, 1]$ (because $\beta + 2\gamma > 0$). Therefore, the quadratic is strictly positive for all p iff $4\alpha\gamma > \beta^2$, which never holds on $t \geq 0.5$. Second, if $t < 0.5$ so $\delta < 0$, then the cubic has an interior minimum on $p \in [0, 1]$ at the smaller root of $\beta + 2\gamma p + 3\delta p^2 = 0$ because the LHS is larger at $p = 1$ than 0. Setting LHS $= 0$ at that p-value generates locus Z in Figure 6; below (resp. above) Z, LHS $>$ (resp. $<$) 0 at its minimum on $p \in [0, 1]$.

[58] If (c, t) lies below V in Figure 6, then the G-equilibrium will be $(1R, 1R; R)$ rather than $(1R, 2R; \varnothing)$ for some "small" G and some "small" p; see result (i) in section 6.1. To limit taxonomy, we ignore this minor case.

[59] If (c, t) lies above Z in Figure 6, then the incumbents have $(R; R) \succ (1R, 2R; \varnothing)$ for some "small" G and some "small" p; see footnote 57 above. To limit taxonomy, we ignore this minor case.

[60] The critical p-value (LHS = RHS) is $p = 2R(0, c)/[2R(0, c) - R(0, t)]$. $(2R, 2R; \varnothing) \succ (R; R)$ for some "small" G, which requires $2\pi_1 2R, 2R; \varnothing - \pi_A(R; R) - 2I[R(0, c) - R(t, c)]/[R(0, t)\mu(9G)] >$

	"Small" p		"Large" p	
	"Small" t	"Large" t	"Small" G	"Large" G
G-equilibrium	$(1R, 1R; R)$		$(1R, 1R; R)$ $(2R, 2R; \varnothing)$[61]	$(1R, 1R; R)$
A-equilibrium	$(R; R)$		$(R; R)$	
EIS	$(1R, 1R; R)$	$(R; R)$	$(2R, 2R; \varnothing)$[62]	$(R; R)$

Turning to case (b),[63] the region in Figure 7 enclosed by $G/\mu < G/\mu\,(7G)$ and $I/\mu > I/\mu\,(8G)$ is non-empty iff $p > 2\,[R(0,c) - R(0,t)]\,/\,[2R(0,c) - R(0,t)]$. Given this, the incumbents have $(2R, 2R; \varnothing) \succ (R; R)$ for all permissible $(G/\mu, I/\mu)$ iff $2R(t,c) > R(0,t)$, i.e. t "small." If t is "large" (i.e. $R(0,t) > 2R(t,c)$), then two cases emerge: for "small" permissible p, $(R; R) \succ (2R, 2R; \varnothing)$ for all permissible $(G/\mu, I/\mu)$; for "large" permissible p, $(2R, 2R; \varnothing) \succ$ (resp. $\prec$) $(R; R)$ for "small" (resp. "large") permissible $(G/\mu, I/\mu)$.[64]

(v) For $\mu > \mu\,(10G) \Leftrightarrow G/\mu < G/\mu\,(10G)$, a comparison arises between $(R; R)$ and $(2R; 2R; R)$. The incumbents have $(R; R) \succ (2R, 2R; R)$ iff $I/\mu > 2\pi_1\,(2R, 2R; R) - \pi_A\,(R; R) - 2G/\mu$. $\pi_A\,(R; R) \geq 2\pi_1\,(2R, 2R; R)$ for all $p \in [0.5, 1]$, so $(R; R) \succ (2R, 2R; R)$ for all permissible $(G/\mu, I/\mu)$ there. For $p < 0.5$, $2\pi_1\,(2R, 2R; R) > \pi_A\,(R; R)$, so $(2R, 2R; R) \succ (R; R)$ certainly for "small" permissible $(G/\mu, I/\mu)$. $(2R, 2R; R) \succ (R; R)$ for all permissible $(G/\mu, I/\mu)$ iff $2\pi_1\,(2R, 2R; R) - \pi_A\,(R; R) - 2G/\mu\,(10G) > \{R(0,t)/\,[R(0,c) - R(t,c)]\}\,[G/\mu\,(10G)]$, which holds for sufficiently "small" p iff $2R(t,c) > R(0,t)$, i.e. t "small." Therefore, for "small" p, we have: $(2R, 2R; R) \succ (R; R)$ for all permissible $(G/\mu, I/\mu)$ if t is "small"; and $(2R, 2R; R) \succ$ (resp. $\prec$) $(R; R)$ for "small" (resp. "large") permissible $(G/\mu, I/\mu)$ if t is "large." Intuition for these results is analogous to that given in footnote 64.

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$I/\mu\,(9G)$, iff $p > [2R(0,c) - 2R(t,c) - R(0,t)]\,/\,[R(0,t) + 2R(0,c) - 2R(t,c)]$, which is strictly less than $2R(0,c)/\,[2R(0,c) - R(0,t)]$.

[61] For "large" p, "small" G implies the existence of a G-equilibrium of $(2R, 2R; \varnothing)$ in region III of Figure 3 for two reasons: first, it makes $\mu\,(7G)$ "low" relative to $\mu\,(8G)$ and $\mu\,(9G)$, and $(2R, 2R; \varnothing)$ *always* exists on $\mu \in (\mu\,(7G)\,, \mu\,(9G))$; second, it means that $(2R, 2R; \varnothing)$ exists below $\mu\,(7G)$ in region III (see result (ii) in section 6.1).

[62] In this case, the incumbents have $(2R, 2R; \varnothing) \succ (R; R) \succ (1R, 1R; R)$, so whether acquisition-FDI occurs in equilibrium depends crucially on which G-equilibrium is played as an alternative. Because $(2R, 2R; \varnothing)$ Pareto dominates $(1R, 1R; R)$ for the incumbents above $\mu\,(7G)$, we assume that $(2R, 2R; \varnothing)$ will be selected in the G subgame. As in (iii) above, otherwise-profitable acquisition-FDI is made *un*profitable by the option of greenfield-FDI.

[63] To limit the taxonomy, we do not explicitly report results for this case in Figure 4. Note, however, that if t is "large," then cases (a) and (b) coincide for "large" p.

[64] "Small" permissible p is s.t. $2\,[R(0,c) - k]\,/l > p > 2\,[R(0,c) - R(0,t)]\,/l$, and "large" permissible p is s.t. $1 > p > 2\,[R(0,c) - k]\,/l$; where $k \equiv 2R(0,c)R(0,t)/\,[R(0,t) + 2R(0,c) - 2R(t,c)]$, $l \equiv 2R(0,c) - R(0,t)$.
Although the profit comparison of $(R; R)$ and $(2R, 2R; \varnothing)$ is itself independent of t (it implies that above a critical μ-value $(2R, 2R; \varnothing) \succ (R; R)$ because $\pi_1\,(2R, 2R; \varnothing) = \pi_A\,(R; R)$), the smallest μ-value where $(2R, 2R; \varnothing)$ is the G-equilibrium, given by the position of $\mu\,(7G)$, is *decreasing* in t (because rises in t make greenfield-FDI more profitable). This explains why it is "more likely" that $(2R, 2R; \varnothing) \succ (R; R)$ for all permissible $(G/\mu, I/\mu)$ if t is "small" than if t is "large."

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		Potential entrant's choice: $\varnothing$	Potential entrant's choice: R
Acquirer	N	$\pi_{\mathrm{A}} = 2\mu R^{M}(c)$ $\pi_{\mathrm{E}} = 0$	$\pi_{\mathrm{A}} = 0$ $\pi_{\mathrm{E}} = 2p\mu R(0,c) - 2I$
	R	$\pi_{\mathrm{A}} = 2p\mu R^{M}(0) + 2(1-p)\mu R^{M}(c) - I$ $\pi_{\mathrm{E}} = 0$	$\pi_{\mathrm{A}} = 2p(1-p)\mu R(0,c) - I$ $\pi_{\mathrm{E}} = 2p(1-p)\mu R(0,c) - 2I$

Table 1: Payoff Matrix in the A subgame

<table>
<tr><td rowspan="7">Market Size</td><td>(2R, 2R; R)</td><td rowspan="2">(R; R)</td><td>Small G, I: (2R, 2R; R)
Large G, I: (R; R)</td><td>(R; R)</td></tr>
<tr><td rowspan="2">(1R, 1R; R)</td><td colspan="2">Small I: (1R, 1R; R)
Large I: (R; R)</td></tr>
<tr><td>Small G: (2R, 2R; ∅)
Large G: (R; R)</td><td>(R; R)</td><td>Small G: (2R, 2R; ∅)
Large G: (R; R)</td></tr>
<tr><td>Small G: (1R, 2R; ∅)
Large G: (1R, 1R; R)</td><td colspan="3">Small G: (1R, 2R; ∅)
Large G: (R; R)</td></tr>
<tr><td colspan="2">(1R, 1R; ∅)</td><td colspan="2" rowspan="2">(R; ∅)</td></tr>
<tr><td colspan="2">(R; ∅)</td></tr>
<tr><td colspan="2">(N; ∅)</td><td colspan="2">(1N, 1N; ∅)</td></tr>
<tr><td></td><td>Small p</td><td>Large p</td><td>Small p</td><td>Large p</td></tr>
<tr><td></td><td colspan="2">Small t (Fig. 4A)</td><td colspan="2">Large t (Fig. 4B)</td></tr>
</table>

Table 2: Stylised Representation of Equilibrium Industrial Structures

Potential entrant's choice

Firm 2's choice	∅	R
1N	$\pi_1 = \pi_2 = R(c, c+t)$	$\pi_1 = \pi_2 = 0$ $\pi_E = 2pR(0,c)$
1R	$\pi_1 = (1-p)R(c, c+t)$ $\pi_2 = p[R(0, c+t) + R(t,c)]$ $+(1-p)R(c, c+t)$	$\pi_1 = 0$ $\pi_2 = p(1-p)[R(0,c) + R(t,c)]$ $\pi_E = 2p(1-p)R(0,c) + p^2 R(0,t)$
2R	$\pi_1 = 0$ $\pi_2 = p[R(0, c+t) + R(0,c)]$ $+(1-p)R(c, c+t)$	$\pi_1 = 0$ $\pi_2 = 2p(1-p)R(0,c)$ $\pi_E = 2p(1-p)R(0,c)$

Table 3: Expected variable profits per head in the G subgame if S_1 = 1*N*

Potential entrant's choice

Firm 2's choice	∅	R
1R	$\pi_1 = \pi_2 =$ $p(1-p)[R(0, c+t) + R(t,c)]$ $+p^2 R(0,t) + (1-p)^2 R(c, c+t)$	$\pi_1 = \pi_2 = p(1-p)^2[R(0,c) + R(t,c)]$ $+p^2(1-p)R(0,t)$ $\pi_E = 2p(1-p)^2 R(0,c) + 2p^2(1-p)R(0,t)$
2R	$\pi_1 = p(1-p)[R(0,c) + R(t,c)]$ $\pi_2 = p(1-p)[R(0, c+t) + R(0,c)]$ $+p^2 R(0,t) + (1-p)^2 R(c, c+t)$	$\pi_1 = p(1-p)^2[R(0,c) + R(t,c)]$ $\pi_2 = 2p(1-p)^2 R(0,c) + p^2(1-p)R(0,t)$ $\pi_E = 2p(1-p)^2 R(0,c) + p^2(1-p)R(0,t)$

Table 4: Expected variable profits per head in the G subgame if S_1 = 1*R*

Potential entrant's choice

Firm 2's choice	∅	R
2R	$\pi_1 = \pi_2 = 2p(1-p)R(0,c)$	$\pi_1 = \pi_2 = 2p(1-p)^2 R(0,c)$ $\pi_E = 2p(1-p)^2 R(0,c)$

Table 5: Expected variable profits per head in the G subgame if S_1 = 2*R*

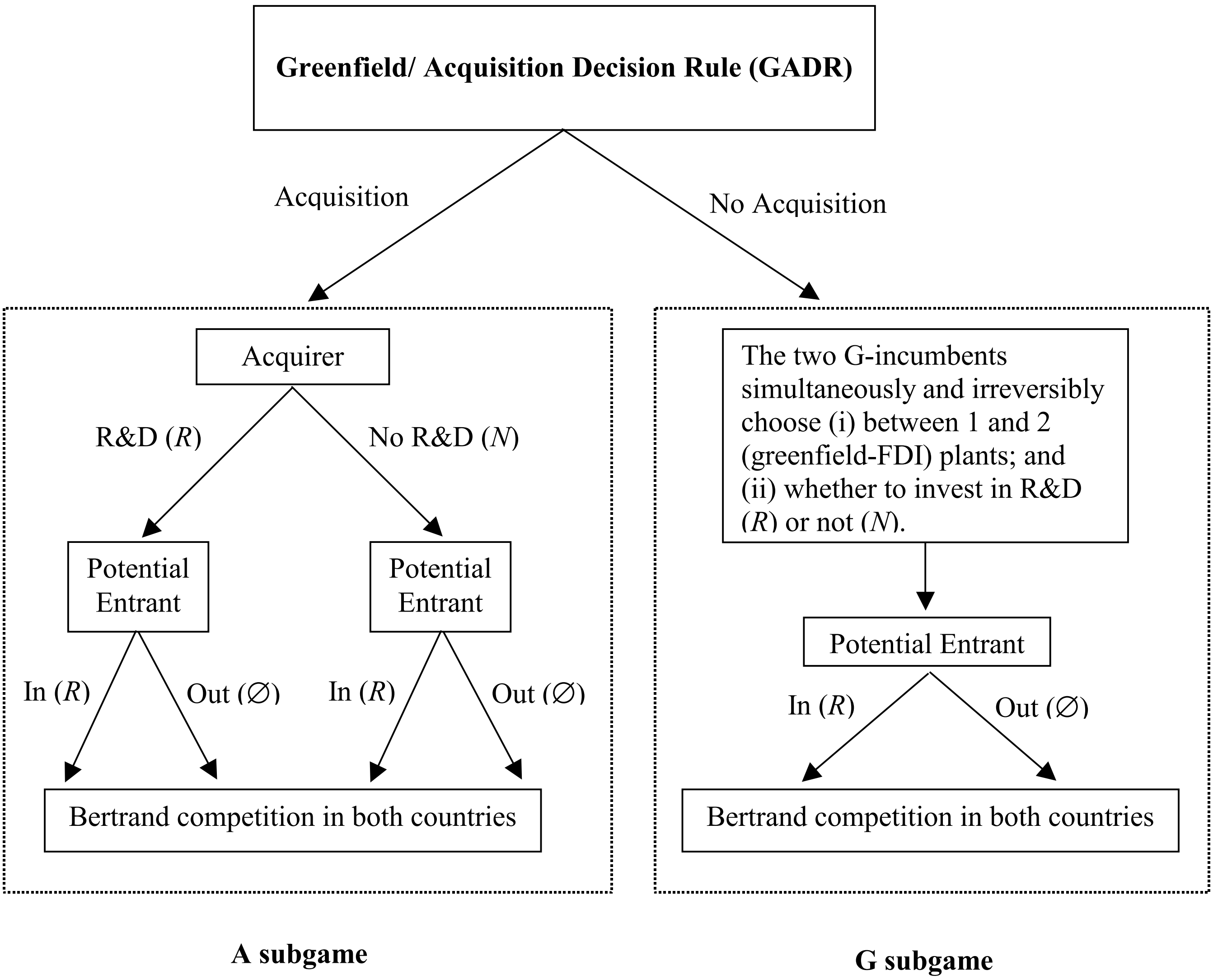

Figure 1: Game Tree

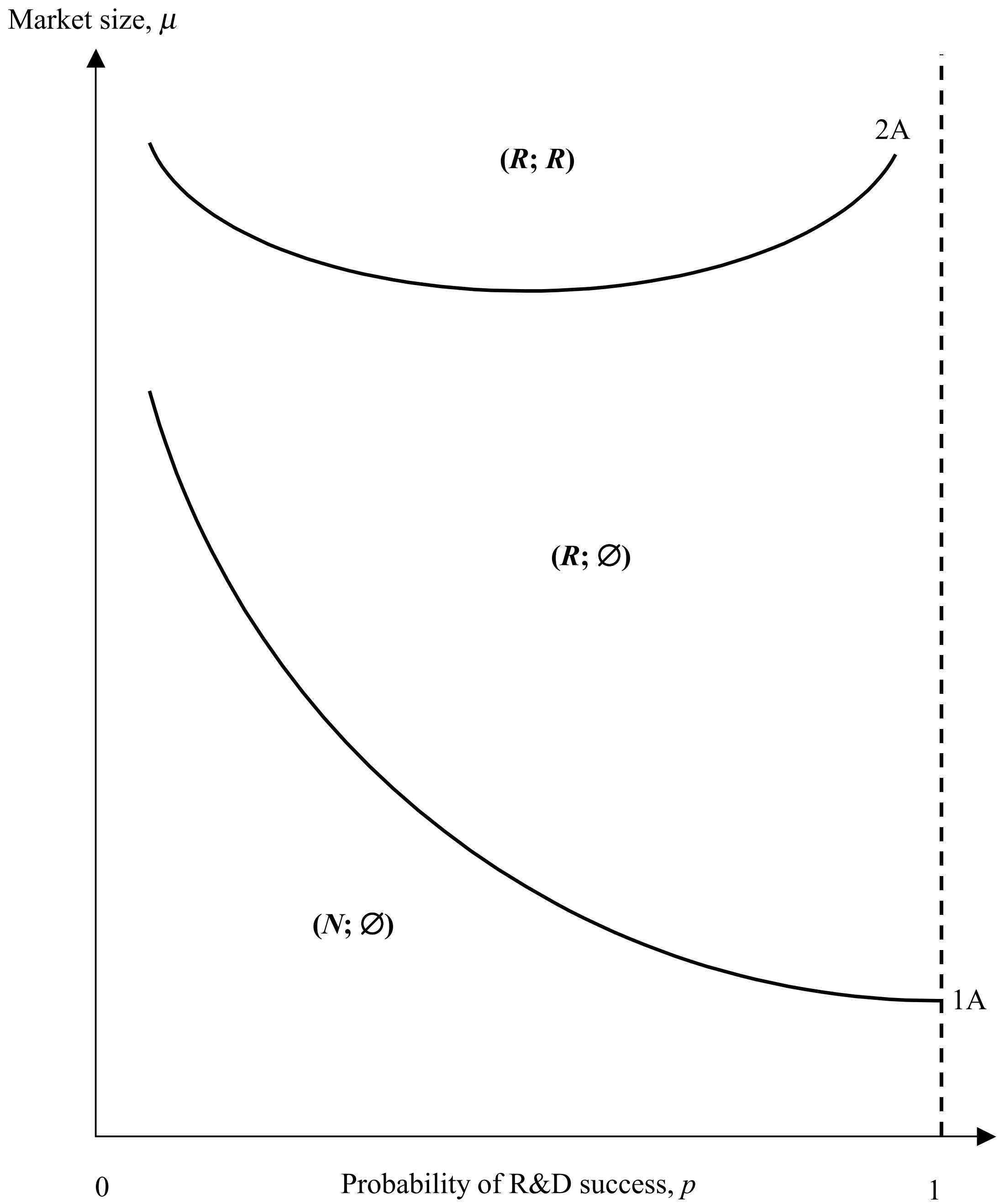

Figure 2: Equilibria in the A Subgame

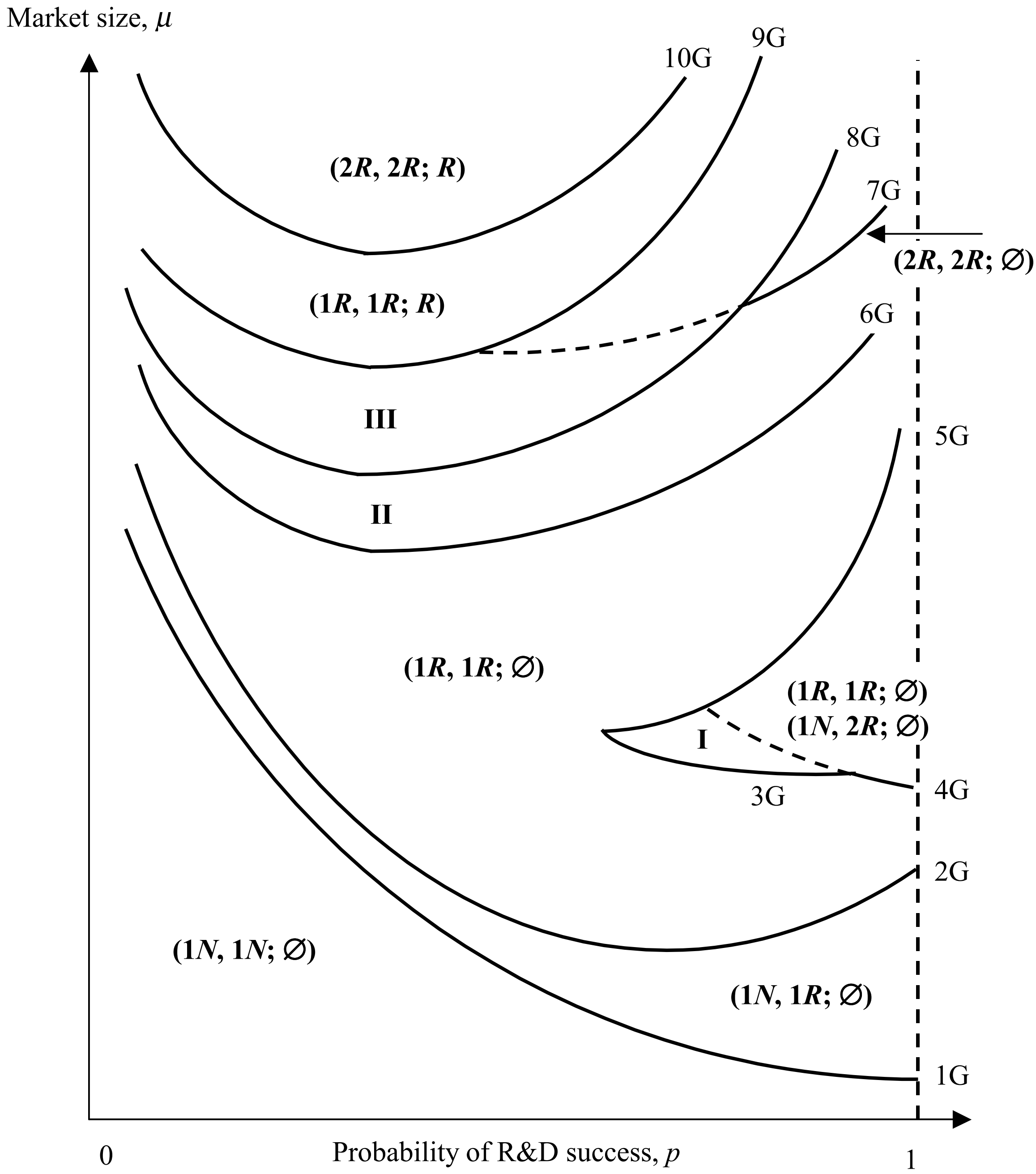

Figure 3: Equilibria in the G Subgame

Region		"small" G	"large" G
	I	(1R, 1R; ∅) (1N, 2R; ∅)	(1R, 1R; ∅) (1N, 1N; R)
	II	(1R, 2R; ∅)	(1R, 1R; R)
	III	(1R, 1R; R) (2R, 2R; ∅) (for p "large")	(1R, 1R; R)

Note: See section 6.1 for details of the derivation of Figure 3.

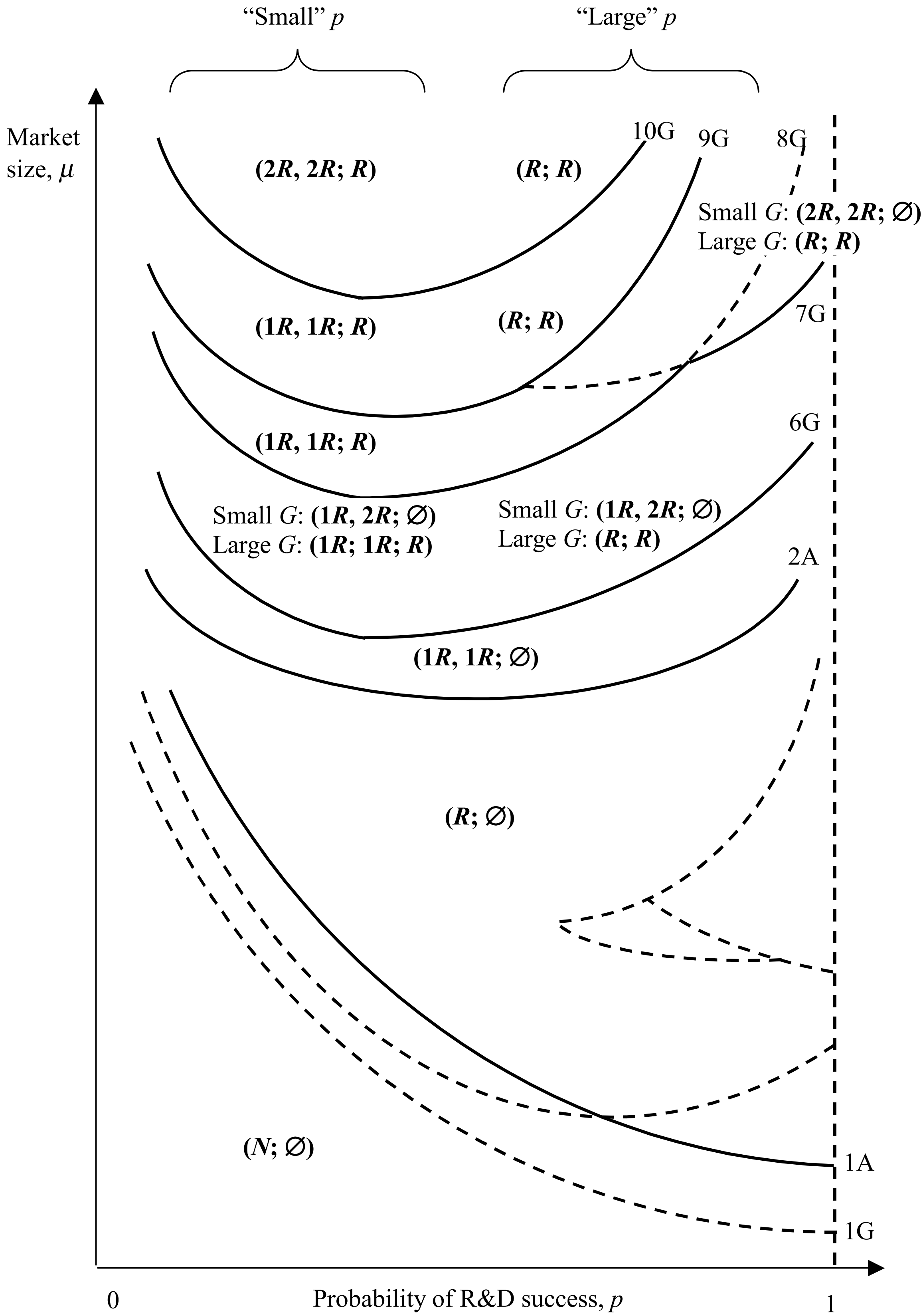

Figure 4A: Equilibrium Industrial Structures if Trade is Cheap (i.e. “small” t)

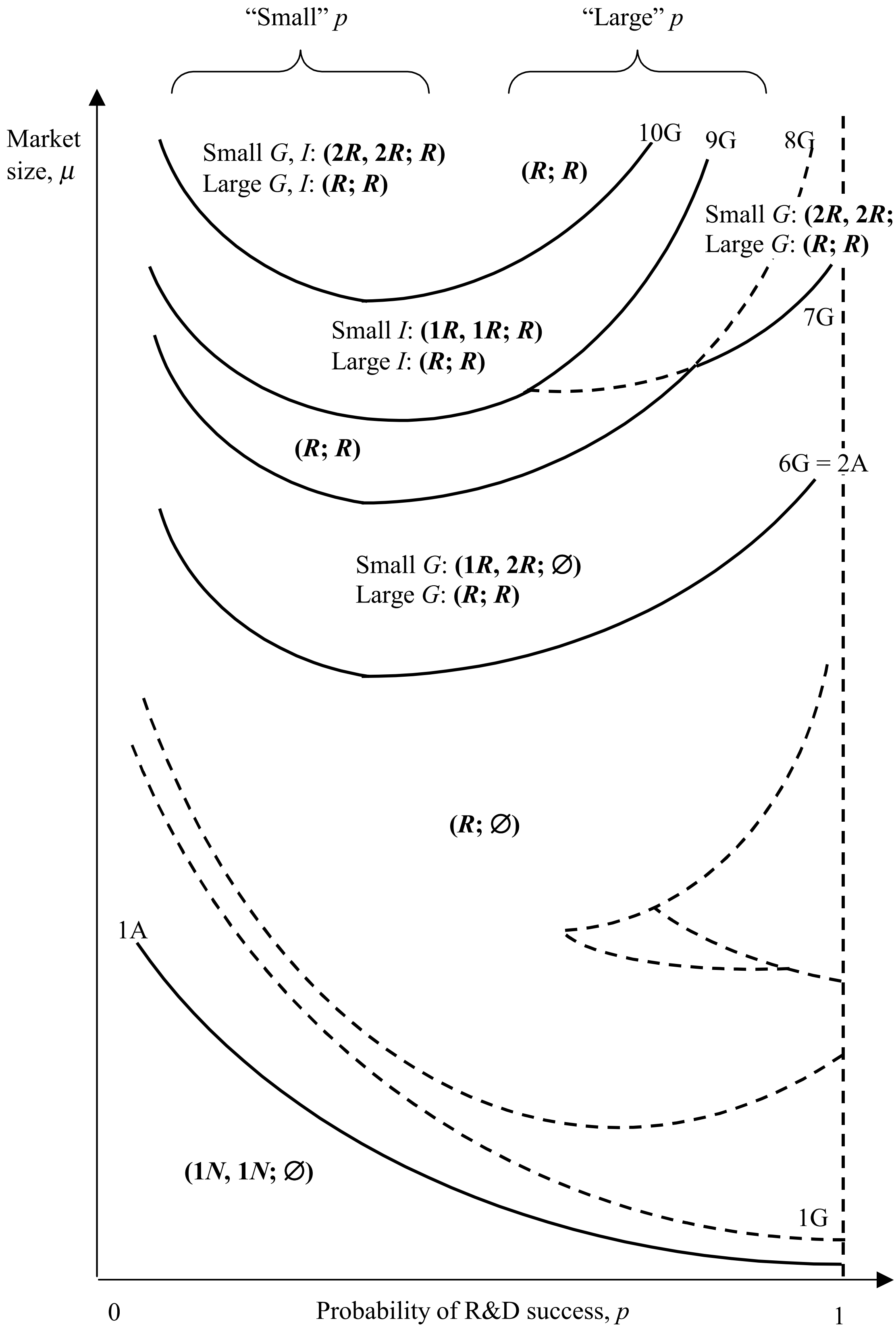

Figure 4B: Equilibrium Industrial Structures if Trade is Costly (i.e. "large" *t*)

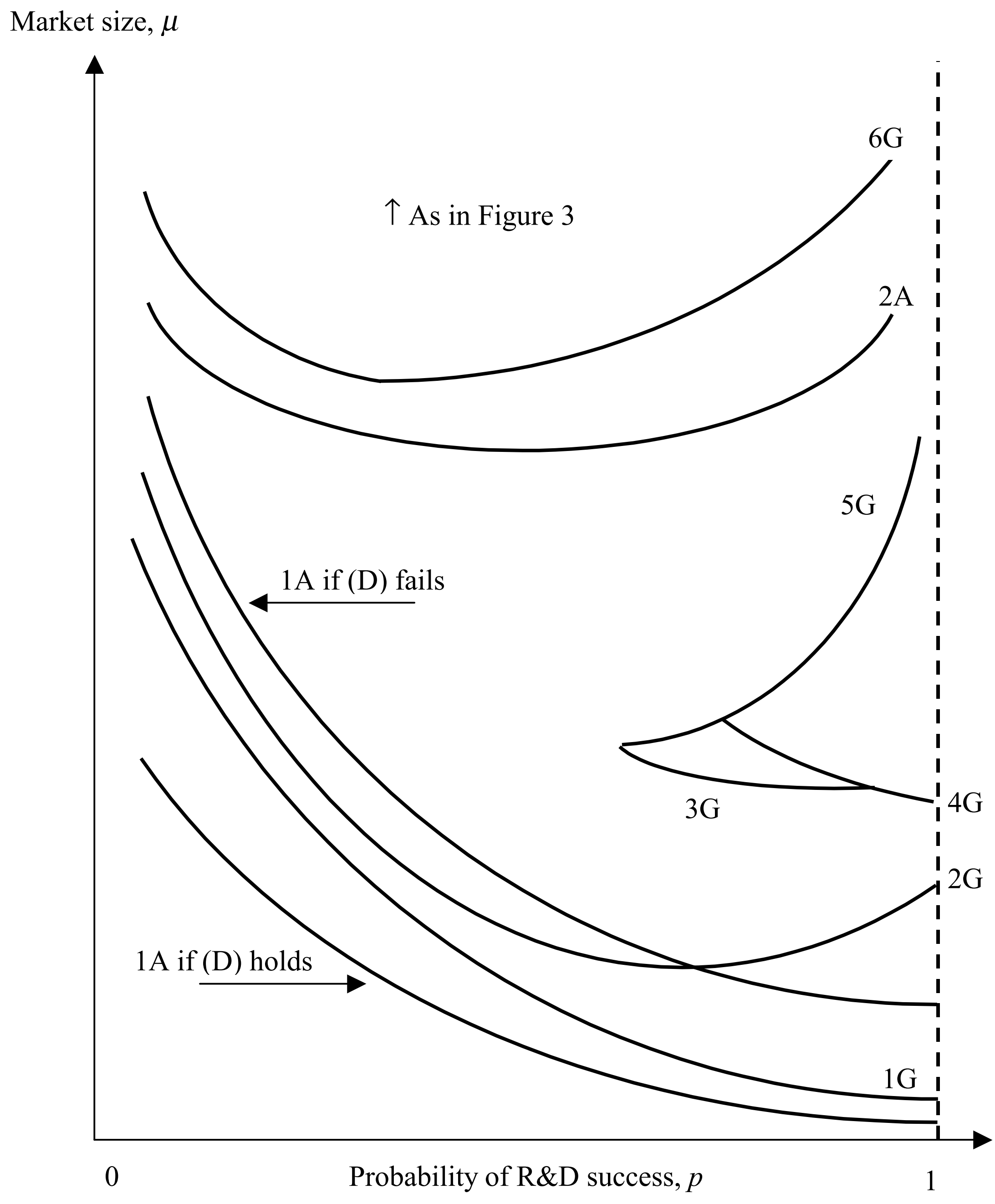

Figure 5: Equilibria in the A and G Subgames Compared

Note: μ(2A) = μ(6G) iff $t \geq 0.5$; otherwise, they are as plotted.

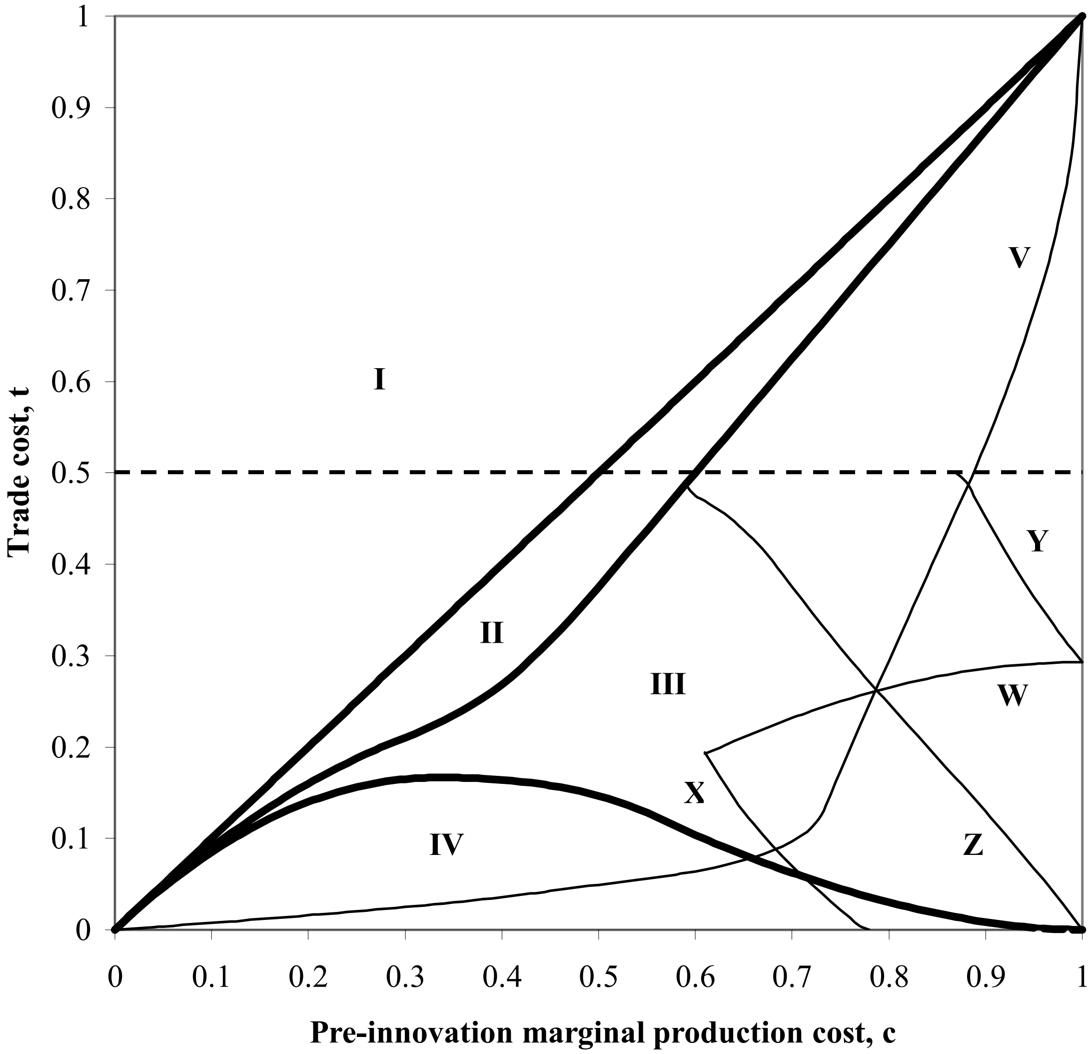

Figure 6: "Permissible" Levels of Marginal Cost Variables

Note: Regions are labelled I-IV and inter-regional boundaries are **bold**. Loci W, Y and Z lie entirely in region III, and loci V and X cross between regions III and IV; all five are referred to in the Appendix.

		Constraint		
		(A)	(B)	(D)
Region	I	Fails		
	II	Holds	Fails	
	III	Holds	Holds	Holds
	IV	Holds	Holds	Fails

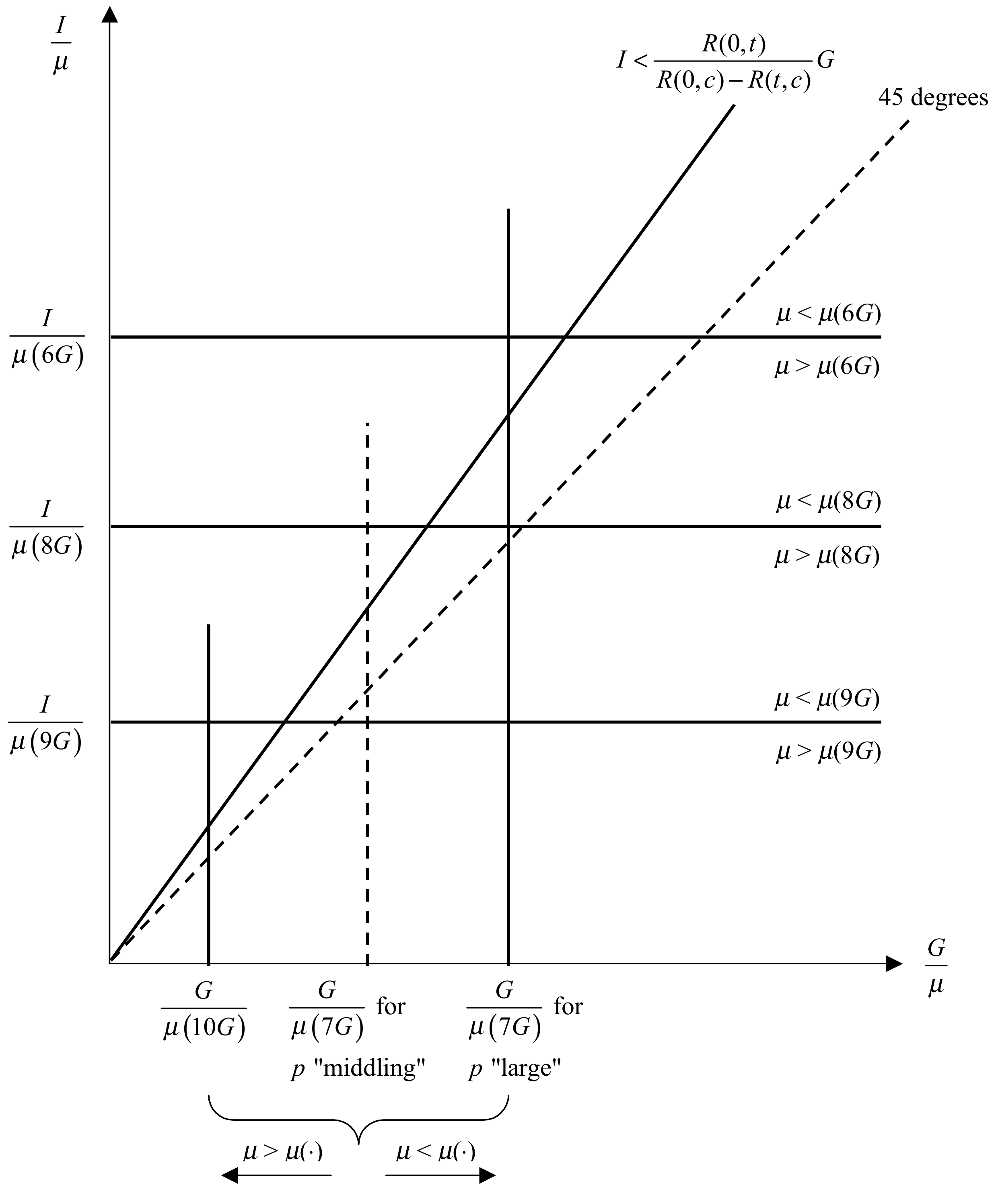

Figure 7: Equilibria in the G Subgame for $\mu > \mu(6G)$