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Abstract: We construct a model in which oligopolistic firms decide between locating in a country where employment protection implies costly output adjustments and in one without employment protection. Using a two-period three-stage game with uncertainty, we demonstrate that location is influenced by both flexibility and strategic concerns. The strategic effects under Cournot work towards domestic anchorage in the country with employment protection while those under Bertrand do not. Strategic agglomeration can occur in the inflexible country under Cournot and even under Bertrand, provided uncertainty and foreign direct investment costs are low.

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INTRODUCTION

This paper contributes to the understanding of the complex interface between globalisation and labour standards by focussing on the effects of employment protection on the international location of economic activity.

In the past few decades the liberalisation of foreign direct investment (FDI) policies worldwide has led to an increase in the ease with which firms (and jobs) move across national borders. As a result, governments' rhetoric and policies increasingly betray concerns about their countries' ability to prevent domestic industry from relocating abroad and to attract and/or retain foreign investment.

Labour market institutions are commonly regarded as crucial in determining the location of economic activity, not least if they influence the *flexibility* with which firms can adjust output scale and employment levels to evolving economic conditions. Employment protection laws in particular are identified as a major source of inflexibility[1] since, by forcing them to under-produce during economic booms and over-produce when the economy slows down, high hiring and firing costs undermine firms' ability to adapt to fast changing competitive markets.[2] This view is supported by empirical work that finds that firms in countries characterised by a high degree of employment protection are less likely to reduce output after a negative shock (e.g. Bertola *et al* 2010).[3] Not only are the rigidities resulting from employment protection held responsible for the poor employment performance of many European countries (e.g. Lindbeck and Snower 1988; and Lazear 1990)[4], but also for hindering countries' ability to hold on to footloose industries. In particular, the substantial differences that exist between economies, even within the European Union, in hiring and firing restrictions[5] are seen as a source of unfair 'competitive advantage' for those locations

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[1] See, for instance, the OECD report (2004) that states that 'Laws on firing or layoffs and other employment protection regulations are thought by many to be a key factor in generating labour market "rigidity" …'.

[2] Several authors argue employment responses to shocks and/or the business cycle to be smaller when employment protection is higher (e.g. Bertola and Rogerson 1997; Garibaldi 1998; Messina and Vallanti 2007).

[3] In earlier work, Bentolila and Bertola (1990) find that firing costs are likely to have reduced employment variation in Europe.

[4] However, Nickell (1998) finds that hiring and firing restrictions typically do not have a decisive role on overall rates of unemployment.

[5] The OECD Employment Protection index (2008) ranges from 1.09 and 1.39 in the UK and Ireland respectively to 3.11 and 3.39 in Spain and Luxembourg respectively.

with lower employment adjustment costs[6] and, increasingly, recommendations are put forward that the state-mandated redundancy payments – that were introduced in many European countries from the late 1950s to the early 1970s – are dismantled.

In this paper our aim is to study the effects of inflexibilities arising from employment protection on firms' location decisions.[7] We address this issue by focussing on firms' location decisions when the prospective host countries are developed countries with quite similar labour costs but differences in labour market legislations.

Existing empirical evidence suggests that the effects of employment protection on the location decision of multinational corporations are not that clear-cut. The majority of the empirical work on this issue focuses on the relationship between a host country's employment legislation and its inward FDI. Cooke (1997) finds that host countries' restrictive legislation governing layoffs have had a negative effect on US FDI abroad. Moran (1998) summarises evidence from investor surveys and mentions labour regulations, in particular "flexibility in hiring and laying off workers", as one of the main concerns for firm location in transition and developing economies. More recently, Nicoletti *et al* (2003) and Görg (2005) also find evidence that employment protection can have a negative effect on inward FDI. Javorcik and Spatareanu (2005) obtain results that suggest that, other things being equal, the more flexible a FDI host country's labour market is relative to that in the source country, the higher the probability of inward FDI taking place. They also find that labour market flexibility matters more for firms in the service sector than in manufacturing. Haaland *et al* (2002) find that western MNEs locating in Eastern Europe tend to prefer locations with more flexible labour markets. However, Leibrecht and Scharler (2009) find that while FDI flows are higher in countries with lower unit labour costs, hiring and firing rigidities do not have statistically significant effects on FDI flows. Dewit, Görg and Montagna (2009) examined the relationship between employment protection and outward FDI and find that a high domestic level of employment protection tends to discourage outward FDI, suggesting that strict employment protection in a firm's

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[6] In a theoretical paper, Cuñat and Melitz (2012) show how international differences in labour market regulations can indeed generate a comparative advantage.

[7] As such, we are not concerned with studying the *general* existence of inflexibilities in inter-temporal output adjustments (as is the case in Lapham and Ware 1994 and Jun and Vives 2004; note that these papers are not concerned with firms' location decisions).

home country makes it reluctant to relocate abroad and thus keeps domestic firms "anchored" at home.

In this paper, we contend that labour market inflexibility may not necessarily hinder a country's ability to attract and/or retain economic activity. Our argument is that if employment protection is a source of inflexibility and if firms have market power (as is likely to be the case for most MNEs which are typically larger than other firms), then employment protection can also plausibly be a source of commitment. This view finds theoretical support in the strand of the industrial organisation literature that emphasises how commitment (i.e. inflexibility) is a source of strategic advantage and suggests that the effects of employment protection on the location of industry may be more nuanced than what is maintained by the conventional view that countries with less stringent employment protection are more attractive to internationally mobile firms. We shall therefore investigate how region-specific flexibility affects location decisions when firms are oligopolistic and act strategically.[8] In a non-strategic set-up, flexibility only entails advantages for a firm. This is not necessarily true when firms act strategically, since flexibility then implies lack of commitment power. To capture the effects of flexibility versus those of commitment we develop a model in which oligopolistic firms play a two-period three-stage game. The first time period is divided into a location setting stage and a market stage. Specifically, in period one, production locations are chosen in the first stage of the game. In stage two, firms observe the location decisions and set period-one market actions (outputs under Cournot and prices under Bertrand) given period one demand but with uncertainty about period two's demand. In period two which coincides with stage three, the uncertainty regarding that period's demand is resolved and firms choose their market actions for that period. The multi-stage feature of the game implies that actions taken in earlier stages are observed by rivals when they are choosing their actions at later stages of the game. Thus, firms' earlier actions can strategically affect rivals' behaviour in later stages.[9] Firms producing in locations

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[8] The inflexibility resulting from employment protection is conceptually different from the rigidities resulting from other sources, such as, for instance, capital cost adjustments. Employment protection adjustment costs are *location-specific* rather than firm-specific, i.e., they are *common* to all firms in a given location – and a firm changing location would face different degrees of inflexibility in the presence of inter-country differences in employment protection.

[9] One can contrast this with the open-loop equilibrium, which is often considered to be a useful theoretical benchmark for comparison. In that case, firms would not observe their rival's actions when choosing their own. Instead, one should think of all the actions being chosen simultaneously. Then,

where employment is less flexible may benefit from the potential advantages obtained by the commitment power that such inflexibility implies.

Our analysis will be driven by two substantive questions. First, could location-specific sources of inflexibility create strategic advantages that affect local anchorage of domestic firms as well as a country's ability to attract production of internationally mobile firms? To explore the relationship between employment protection and firm location, we combine ideas from different strands of the literature, and apply these to a set-up in which firms' locations are endogenous. By emphasising the effect of oligopolistic interaction on the relationship between employment protection and the location of industry our paper fills an important gap in the literature. Second, we ask when we can expect to find strategic clustering in the same regions and when strategic geographical dispersion is more likely. In addressing this question, the paper complements the economic geography literature, which is mainly concerned with agglomeration formation in non-strategic set-ups.[10]

The paper also contributes to the theoretical literature on FDI. A large body of the theoretical work on firm location has focussed on market access and local costs of production as the central determinants of a country's ability to attract FDI and retain domestic firms. Seminal contributions include Smith (1987) and Horstmann and Markusen (1987, 1992).[11] In some recent work, firms with different levels of productivity are sorted into domestic firms, exporters and firms that do FDI (e.g., Helpman, Melitz and Yeaple 2004). More recently, a significant body of work has emerged that studies the role of labour market institutions in firm location. The bulk of this literature has focussed on the part played by labour unions.[12] Relatively less explored, despite its prominence in policy debates, is the relationship between employment protection and firm location. Notable exceptions are Haaland *et al* (2002) and Haaland and Wooton (2007) who analyse the location decision of a single multinational choosing between a more and a less flexible location. These papers, however, focus on the monopoly case and thus abstract from issues of strategic

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there is no incentive to strategically affect rivals' actions (Tirole 1988 provides a detailed explanation of the difference between a multistage game and the open-loop benchmark). While a useful device for theoretical comparison, this hypothetical benchmark would, of course, fail to capture the intertemporal aspect of the issue here.

[10] See, for instance, Krugman (1991) and Fujita, Krugman and Venables (1999).

[11] For surveys on multinationals and FDI, see Caves (1996) and Barba-Navaretti and Venables (2004).

[12] Early contributions include Bughin and Vannini (1995), Zhao (1995, 2001), and Leahy and Montagna (2000).

interaction between firms which can be influenced by the flexibility of the labour market. Among earlier papers that focus on the flexibility considerations in location choice, though not on the role of employment protection, de Meza and Van der Ploeg (1987) and Sung and Lapan (2000) respectively consider the role of cost and exchange rate uncertainty in providing a rationale for setting up plants in different countries. By contrast, in our paper *strategic* behaviour is at the forefront. As such, our work is linked to the Industrial Organisation literature on adjustment costs, flexibility and strategic behaviour. The effect of adjustment costs on strategic behaviour in the product market has been discussed in set-ups without location decisions (see Lapham and Ware, 1994; Jun and Vives, 2004). In a recent paper, Kessing (2006) has developed a model without location choice in which, by reducing flexibility, employment protection acts as a commitment device that can affect a rival's behaviour. Our paper has, however, a very different focus to his. Kessing considers a contest, an all-pay auction, between rival firms for a given (large-scale) contract. In his framework, price and quantity decisions are not modelled. By contrast, our model uses a standard oligopoly framework, distinguishing between Cournot and Bertrand competition, and highlights the fact that the results depend on the mode of competition and hence on the specific features of the oligopolistic industry. Another key difference from Kessing is that market uncertainty is modelled in our set-up, which allows us to study the trade-off firms face between commitment and flexibility. Furthermore, importantly, unlike Kessing (2006), our framework allows us to endogenise firms' location in the context of a trade-off between retaining flexibility and benefitting from commitment.

We show that the effect of employment protection legislation on location patterns strongly differs depending on whether firms compete in prices or quantities. With quantity competition, a firm producing in a country with a relatively inflexible labour market (i.e., with relatively strict employment protection) has a strategic advantage over a rival that produces in a country with a flexible labour market (i.e., in the absence of employment protection), as it can use employment protection as a commitment mechanism to secure a large future market share at the expense of its flexible rival. This makes the inflexible location *strategically* attractive. When competing in prices, *both* firms will engage in strategic pricing as long as one firm is located in the inflexible location. The strategic pricing of the firm in the flexible location harms the firm in the inflexible location and hence the flexible location

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becomes *strategically* attractive: both firms locating in the flexible location eliminates such harmful rival strategic pricing. Thus, our model provides a theoretical rationale for the ambiguity that emerges from the empirical literature on the effects of employment protection on FDI and firm location.

The model is presented in Section 1. The determinants of location for a monopolist firm are analysed in Section 2. In Sections 3 and 4, we analyse, respectively, the location decisions of oligopolistic firms under Cournot and under Bertrand competition. In section 5, some possible extensions of the model are discussed. Section 6 concludes the paper.

I. THE MODEL

Two firms plan to launch new products, which are imperfect substitutes, to be sold in an integrated market.[13] One firm, the Home firm, has its headquarters in the country named "Home", while the other, referred to as the Foreign firm, has its headquarters in the country named "Foreign". Each has to decide where to locate its production plant: either in "Home" or in "Foreign". We assume that the fixed costs of setting up a plant are sufficiently high to ensure that each firm chooses to have one plant only. Competition takes place during two periods, with firms choosing "actions" – outputs under Cournot and prices under Bertrand competition – in each period. The respective demand functions for the Home and the Foreign firm for period one are given by

(1a) $\quad p_1 = a - q_1 - e q_1^*,$

and

(1b) $\quad p_1^* = a - q_1^* - e q_1.$

In period two, the firms' respective demand functions are:

(2a) $\quad p_2 = a - q_2 - e q_2^* + u,$

and

(2b) $\quad p_2^* = a - q_2^* - e q_2 + u,$

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[13] In order to bring out more sharply the effects on location of inter-country asymmetries in labour market rigidities, we choose to abstract from trade-cost jumping considerations. The effects of relaxing this assumption will be discussed in Section 6.2.

where $0 \le e < 1$ is an inverse measure of product differentiation[14], and $a > 0$. The Home firm's price and output are denoted by p and q, respectively. Variables referring to the Foreign firm are starred. Subscripts 1 and 2 indicate the time period. In period one, demand for that period is observed but there is uncertainty about future demand. Hence, a stochastic component, u, enters the demand function for period two and is defined over the support $[\underline{u}, \bar{u}]$ (which is restricted to guarantee interior solutions), with mean $Eu=0$ and variance σ^2. The uncertainty is resolved at the start of period two. To ensure non-negative prices, we assume $a \ge \max\{q_1 + eq_1^*, q_1^* + eq_1\}$ and $a + u \ge \max\{q_2 + eq_2^*, q_2^* + eq_2\}$.

We assume that the Home and Foreign country differ in one important respect. In Home, strict employment protection regulations prevail. These cause firms to incur hiring and firing costs if, after an unexpected change in demand, they want to deviate from the period-one production (and hence employment) level. By contrast, employment protection regulations in Foreign are lax and expansions or reductions in production can be carried out without incurring any adjustment costs. The profit functions for the Home and the Foreign firm are respectively given by[15]

(3a) $\pi = R_1 + R_2 - C$,

and

(3b) $\pi^* = R_1^* + R_2^* - C^*$,

where R_t denotes the Home firm's revenue in period t (with $t=1,2$) and C stands for its total cost. Total costs depend on the location chosen by the firm and on whether it engages in FDI or not. The expressions in (4) give the cost function for each firm in each location:

		Home location	Foreign location
(4)	Home firm: C	$cq_1 + cq_2 + \Lambda + \varphi$	$cq_1 + cq_2 + \varphi + \delta$
	Foreign firm: C*	$cq_1^* + cq_2^* + \Lambda^* + \varphi + \delta$	$cq_1^* + cq_2^* + \varphi$

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[14] Strictly speaking, the model could allow for homogeneous products ($e=1$) with Cournot behaviour, but not with Bertrand behaviour.

[15] We assume that the discount factor is one (in subsection 6.3 we discuss the effects of a smaller discount factor).

In order to abstract from location-specific cost differences, we assume that the marginal cost of production (c) is the same in both locations. It is of course possible, but by no means certain, that the mere presence of employment protection raises marginal costs – e.g. by increasing workers' bargaining power and thus indirectly pushing up wages[16]; however, we choose to abstract from this type of effect as the impact on location choice of inter-country marginal cost differences is straightforward. Adjustment costs (Λ and Λ^*) are, however, location specific as they are paid in period two only if the firm locates in the inflexible (Home) location. These are denoted by $\Lambda \equiv (\lambda/2)(q_2 - q_1)^2$ and $\Lambda^* \equiv (\lambda/2)(q_2^* - q_1^*)^2$ for the Home and Foreign firm, respectively. The λ-parameter ($\lambda > 0$) measures the degree of inflexibility. Our convex adjustment costs specification reflects the stylised fact that larger changes in employment levels are more expensive than smaller changes. When laying off a large number of workers, a firm is more likely to lose more experienced and productive employees, and marginal severance costs may need to be higher when cutbacks are larger. The greater the number of newly hired employees, the higher is the marginal cost of adjustment. Likewise, the marginal cost of increasing working hours rises if overtime must be paid.[17] The firm's fixed cost of setting up a plant in its native country is denoted by φ. However, if it locates abroad, its fixed costs are $\varphi + \delta$, with $\delta > 0$ representing the additional costs associated with FDI.[18] These typically consists of what Blonigen (2006) calls "access-to-information costs", e.g., information and network costs associated with setting up a plant in a foreign country (including dealing with foreign languages and coordination of suppliers) and acquiring knowledge of the local regulatory environment (such as foreign laws, a foreign taxation system and foreign ownership restrictions). The parameter δ should be interpreted in this broad sense. It can be thought of as reflecting the barriers to FDI and will shrink as the degree of globalisation increases.

Firms play a two-period three-stage game, acting simultaneously in each stage. The sequence of decisions is shown in Figure 1. In period one, production locations, Home (*H*) or Foreign (*F*), are chosen (stage one). There are four possible location

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[16] Lazear (1990) argues that in perfect labour markets severance payments do not affect wages as their effects can be offset by suitably designed labour contracts. Leonardi and Pica (2007) provide empirical support for Lazear's theoretical results.
[17] Hamermesh (1996, Ch.6) provides a survey of employment adjustment cost specifications.
[18] This was first formalised by Hirsch (1976).

equilibria: two in which both firms choose the same location, (*H,H*) and (*F,F*), and two in which firms choose a different location, (*H,F*) and (*F,H*). For each location pair, the first letter refers to the Home firm's location choice, whereas the second indicates the Foreign firm's location choice. No FDI occurs in the (*H,F*)-equilibrium, while both firms engage in FDI in the (*F,H*)-equilibrium. In stage two, period-one actions are determined given demand for period one but with uncertainty about demand in period two. In period two, the uncertainty is resolved and firms choose their actions after having observed actual demand for that period (stage three).

[Figure 1 about here]

Firms' location decisions are influenced both by non-strategic and strategic factors. The non-strategic aspects of the production location choice are examined first.

II. EMPLOYMENT PROTECTION AND THE LOCATION DECISION OF A MONOPOLIST FIRM

To focus on the non-strategic determinants of location, we initially consider the limit case of *e=0*, when the products are no longer substitutes and so each firm becomes a monopolist. In the absence of strategic behaviour, only cost and flexibility considerations will determine firms' location decisions.

In period two, the firm maximises period-two profits, π_2, which is equal to $R_2 - cq_2 - \Lambda$ if the firm produces in Home and is $R_2 - cq_2$ if the firm produces in Foreign. Optimal period-two outputs for firms producing in Home and Foreign are, respectively, given by:

$$(5a) \qquad q_2^H = \frac{A + \lambda q_1^H + u}{2 + \lambda} \qquad \text{and} \qquad q_2^F = \frac{A + u}{2},$$

with $A \equiv a - c$.

In period one, output is determined by maximising expected profit over the two periods. When the firm produces in Home, its total profit is equal to $\pi_1(q_1) + \pi_2(q_2, q_1, u) = (A - q_1)q_1 + (A - q_2 + u)q_2 - (\lambda/2)(q_2 - q_1)^2 - \Phi$, where Φ is the fixed costs incurred by the firm, which depends on whether the firm locates in its domestic economy ($\Phi = \varphi$) or abroad ($\Phi = \varphi + \delta$); expected profits are given by

$\pi_1(q_1) + E\pi_2(q_2, q_1, u)$.   When the firm produces in Foreign, its profit is

$\pi_1(q_1) + \pi_2(q_2, u) = (A - q_1)q_1 + (A - q_2 + u)q_2 - \Phi$, with expected profits given by

$\pi_1(q_1) + E\pi_2(q_2, u)$. Maximising expected profits with respect to q_1 and using the

expressions in (5a) yields the same first-period output of

(5b) $q_1^H = q_1^F = \dfrac{A}{2}$,

irrespective of where the monopolist is located. Combining expressions (5a) and (5b),

period-two output of a firm located in Home can be rewritten as $q_2^H = \dfrac{A}{2} + \dfrac{u}{2 + \lambda}$.

To explain how a firm's location choices are determined, it will prove useful

to decompose expected maximised profits ($E\pi$) as

(6) $E\pi = \pi_0 + \int_{\underline{u}}^{\overline{u}} (\pi(u) - \pi_0) f(u) du$.

The first term of expression (6), $\pi_0 \equiv \pi(Eu) = \theta - \Phi$, denotes deterministic profits,

where θ is deterministic *operating* profit and Φ is the (earlier defined) fixed costs

incurred by the firm. The second term in (6) represents the expected profit gain from

demand shocks. Because maximised profits are convex in u, this term is non-negative

and increasing in σ^2. In fact, we are able to write $\int_{\underline{u}}^{\overline{u}} (\pi(u) - \pi_0) f(u) du = \gamma \sigma^2$,

where γ reflects the firm's ability to exploit unexpected demand shocks. Thus,

expected maximised profits are $E\pi = \theta + \gamma \sigma^2 - \Phi$. Given the costs of FDI, δ,

locations are determined with each firm bearing in mind deterministic operating

profits, θ, as well as expected profit gains from demand shocks, $\gamma \sigma^2$.

For a monopolist firm, deterministic *operating* profits are independent of the

production location (i.e., $\theta^H = \theta^F = (q_1)^2 + (Eq_2)^2$) since $q_1^H = q_1^F = q_1$ and

$Eq_2^H = Eq_2^F = Eq_2$. However, expected gains from flexibility are higher in Foreign

than in Home (i.e., $\gamma^F = 1/4$ and $\gamma^H = 1/(2(2 + \lambda))$, hence $\gamma^F > \gamma^H$).   The

monopolist's θ- and γ-values for each location are reported in Table A.1.

The location choice of a *Foreign* monopolist is intuitive: it will always

produce in Foreign since this entails maximum flexibility without incurring the cost of

FDI. For a *Home* monopolist, the location decision involves a trade-off between the

costs of FDI and the flexibility benefits associated with producing in Foreign. With

uncertainty, the firm anticipates it may face adjustment costs in Home, while there

will be no adjustment costs if it produces in Foreign. High uncertainty increases the value of flexibility.[19] Thus, when uncertainty is high and provided FDI-costs are not prohibitive, the Home monopolist will produce in Foreign. There is a critical level of uncertainty above which the Home monopolist will choose to produce in Foreign and below which it will choose to locate in Home. More specifically, the monopoly firm settles in Home rather than Foreign if $E\pi^H > E\pi^F$, which implies $\sigma^2 < 4\delta(2+\lambda)/\lambda$ (so, in the absence of demand uncertainty, $\sigma^{2.} = 0$, the Home monopolist will not be affected by employment protection and hence has no reason to locate in Foreign). The critical σ^2-level is depicted as a function of λ in Figure 2. As the figure shows, the critical threshold decreases in the degree of labour market inflexibility in Home (λ). It also increases in the FDI cost (δ) (in terms of Figure 2, the locus shifts up as δ increases).

[Figure 2 about here]

III. EMPLOYMENT PROTECTION AND LOCATION UNDER COURNOT COMPETITION

When products are substitutes, i.e. for *e* > 0, firms behave as duopolists and their location decisions involve both strategic and non-strategic considerations. From section 3 we know that Cournot and Bertrand competition both converge to the monopoly case at *e*=0. As *e* increases, the strategic effects become stronger and the two types of oligopolistic behaviour give rise to divergent location patterns. In this section, we derive the location pattern under Cournot competition; the location pattern for the case in which firms are Bertrand competitors will be derived in section 5. For expositional clarity, we explain the nature of the strategic effects in detail in the case in which each firm produces domestically, that is, the Home firm produces in Home and the Foreign firm in Foreign (i.e., (*H,F*)). The strategic behaviour in the other possible location equilibria will be discussed at the end of each subsection, referring to Table 1, which reports the strategic term in all possible location combinations.

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[19] This is in line with the real option value approach in Dixit and Pindyck (1994).

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Employment protection and output decisions

Firms' production locations affect their market actions. Solving the game backwards, we first consider the firms' output choice in period two, in which locations and period-one outputs have already been chosen. When each firm produces domestically, (i.e., in the (*H,F*)-case), period-two profits for the two firms are respectively: $\pi_2 = R_2 - cq_2 - \Lambda$ and $\pi_2^* = R_2^* - cq_2^*$ which are maximised with respect to outputs to obtain the second-period reaction functions:

(7a) $q_2 = (A + u - eq_2^* + \lambda q_1)/(2 + \lambda)$,

and

(7b) $q_2^* = (A + u - eq_2)/2$.

Expressions (7a) and (7b) clearly suggest that a firm's location has implications for its flexibility. The Home firm's reaction function responds less to unexpected demand shocks than its rival's does ($\partial q_2 / \partial u < \partial q_2^* / \partial u$ from (7a) and (7b))[20]. The firm in Home is also less responsive to changes in rival output (i.e., $e/(2+\lambda) < e/2$). Also, due to adjustment costs, the Home firm's reaction function depends positively on its own past output, as captured by the term in q_1. Solving expressions (7a) and (7b), we obtain:

(8a) $q_2 = \dfrac{(2-e)(A+u) + 2\lambda q_1}{2(2+\lambda) - e^2}$,

and

(8b) $q_2^* = \dfrac{(2+\lambda-e)(A+u) - e\lambda q_1}{2(2+\lambda) - e^2}$.

We now turn to stage two of period 1. It is useful to write the firms' profit functions as:

$$\pi = \pi_1(q_1, q_1^*) + \pi_2(q_2, q_2^*, q_1, u)$$
(9a) $$= (a - q_1 - eq_1^*)q_1 - cq_1 + (a - q_2 - eq_2^* + u)q_2 - cq_2 - (\lambda/2)(q_2 - q_1)^2 - \varphi,$$

and

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[20] As Bertola *et al* (2010), employment protection reduces output – and hence employment – variability.

$$\pi^* = \pi_1^*(q_1, q_1^*) + \pi_2^*(q_2, q_2^*, u)$$

(9b) $$= (a - q_1^* - eq_1)q_1^* - cq_1^* + (a - q_2^* - eq_2 + u)q_2^* - cq_2^* - \varphi.$$

Being uncertain about the demand in period two, firms simultaneously determine their outputs for period one by maximising total expected profits ($E\pi$ and $E\pi^*$) with respect to first-period outputs. With $E\pi = \pi_1(q_1, q_1^*) + E\pi_2(q_2, q_2^*, q_1, u)$ and $E\pi^* = \pi_1^*(q_1, q_1^*) + E\pi_2^*(q_2, q_2^*, u)$, and since $E\left[\dfrac{\partial \pi_2}{\partial q_2}\dfrac{dq_2}{dq_1}\right] = 0\ ^{21}$, the first-order condition for the Home firm's first-period output can be written more compactly as

(10a) $$\frac{dE\pi}{dq_1} = \frac{\partial E\pi}{\partial q_1} + E\left[\frac{\partial \pi_2}{\partial q_2^*}\frac{dq_2^*}{dq_1}\right] = 0.$$

The first-order condition for the Foreign firm's first-period output is

(10b) $$\frac{dE\pi^*}{dq_1^*} = \frac{\partial E\pi^*}{\partial q_1^*} = 0.$$

In (10a), the term in squared brackets captures the strategic effect. This strategic term is positive ($\partial \pi_2 / \partial q_2^* = -q_2 < 0$ and $dq_2^* / dq_1 < 0$), implying that the firm in Home strategically over-produces in period one (or, $\partial E\pi / \partial q_1 < 0$). Over-production has to be interpreted relative to a hypothetical situation in which, given firms' location choices, first-period actions are not observed. Then, in what is often called an "open-loop" equilibrium, second-period actions cannot be contingent on first-period actions. In this hypothetical benchmark, firms cannot act strategically (see Tirole 1988).

Intuitively, strategic production in period one is aimed at ensuring a large future market share. By choosing a high output level in period one, the Home firm is forced to keep its production in the next period at a relatively high level, since changing its output then will be costly. This commitment to keep production high in period two forces the rival firm to cut back its output. Meanwhile, there is no strategic behaviour by the firm in Foreign given that there is no intertemporal link between the Foreign firm's output choices.[22]

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[21] This follows from the second-period profit optimisation by the Home firm, implying $\partial \pi_2 / \partial q_2 = 0$. Similarly, $E\left[\dfrac{\partial \pi_2^*}{\partial q_2^*}\dfrac{dq_2^*}{dq_1^*}\right] = 0$ for the Foreign firm, because $\partial \pi_2^* / \partial q_2^* = 0$.

[22] When the Foreign firm produces in Home (i.e., in the (*H,H*) and in the (*F,H*) equilibrium, the strategic term is positive (see table 1).

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Evidently, the (*H,F*)-case is not the only possible location combination that can arise. Table 1 presents the strategic terms for both firms under Cournot competition for all possible location combinations. If both firms engage in FDI, (*F,H*), only the Foreign firm strategically over-produces in period one. In the cases in which only one firm faces adjustment costs ((*H,F*) and (*F,H*)), the firm in the inflexible home location has higher expected outputs and the firm in the flexible location has lower expected outputs than in the open loop equilibrium. However, the expected prices of both firms' outputs are lower than in the open loop so that the equilibrium is more competitive. If both firms produce in Foreign, (*F,F*), neither firm acts strategically. If both firms produce in Home, (*H,H*), then each firm behaves strategically and over-produces in period one. Our results are consistent with Jun and Vives (2004) who explored the strategic incentives for symmetric (i.e., each facing the same adjustment costs) firms only, using Markov perfect equilibria: firms facing symmetric adjustment costs produce higher expected outputs and hence the equilibria are more competitive than in the corresponding open loop equilibria.

[Table 1 about here]

Location patterns with employment protection

We now turn to stage one, in which firms simultaneously choose their production location. Taking the rival's location as given, each firm selects the location that yields the highest expected profits. As in the monopoly case, expected profits can be decomposed into fixed costs, Φ, deterministic operating profits, θ, and the expected profit gains from the demand shocks, $\gamma\sigma^2$. Unlike under monopoly and due to strategic interaction between the firms, the value of a firm's θ depends not only on its own location but also on the location of its rival.

Under Cournot competition, the Home firm's deterministic operating profits at the different location combinations are ranked as follows:

(11a) $\theta^{HF} > \theta^{FF} > \theta^{HH} > \theta^{FH}$.

while the ranking for the Foreign firm is given by

(11b) $\theta^{*FH} > \theta^{*FF} > \theta^{*HH} > \theta^{*HF}$.

where the first superscript refers to the location of the Home firm and the second one indicates the location of the Foreign firm. The derivations of θ and γ are given in Appendix A and the θ- and γ-values for each location combination are reported in

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table A.1. We will now provide some insights into this θ-ranking, which is solely determined by the strategic behaviour of firms.[23] Under Cournot competition, *given* its rival's location choice, a firm always attains higher deterministic operating profits θ at the inflexible location than at the flexible location because at the latter it is able to strategically commit to higher output. The firm thus obtains a gain in market share in both periods if its rival is flexible (resulting in the rankings $\theta^{HF} > \theta^{FF}$ and $\theta^{*FH} > \theta^{*FF}$) and avoids a loss in market share if its rival is inflexible (leading to $\theta^{HH} > \theta^{FH}$ and $\theta^{*HH} > \theta^{*HF}$). However, if both firms are in the inflexible location (H,H), the game has a prisoner's dilemma character, with firms producing higher output than when both firms produce in the flexible location (F,F). In (H,H), *both* firms' first-period strategic overproduction (see table 1) merely results in lower prices compared to (F,F); that is, deterministic operating profits are lower for both firms than in (F,F), when firms do not act strategically. Thus, $\theta^{FF} > \theta^{HH}$ and $\theta^{*FF} > \theta^{*HH}$.

The value of γ, which reflects the ability of firms to make use of flexibility to deal with demand shocks, also depends on the location combination. Obviously, for both firms this ability to exploit demand shocks is higher in (F,F) than in (H,H) (formally $\gamma^{FF} > \gamma^{HH}$ and $\gamma^{*FF} > \gamma^{*HH}$). Furthermore, a firm's γ is largest when it is flexible and its rival is located in the inflexible location: it then is the *only* firm that can fully adjust to unexpected shocks. Its expected profit gain from demand shocks is then largest (thus $\gamma^{FH} > \gamma^{FF}$ and $\gamma^{*HF} > \gamma^{*FF}$). Conversely, a firm's γ is smallest when it is inflexible and its rival is fully flexible. Given the above pair-wise rankings, the full ranking of the γ-parameters in the different location combinations for the Home and Foreign firm is given respectively by:

(12a) $\gamma^{FH} > \gamma^{FF} > \gamma^{HH} > \gamma^{HF}$,

and

(12b) $\gamma^{*HF} > \gamma^{*FF} > \gamma^{*HH} > \gamma^{*FH}$.

The analysis of the firm's location decisions involves many unwieldy algebraic expressions and we provide the detailed formal analysis in Appendix B. In

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[23] In the open-loop benchmark in which, given firms' location choices, first-period actions are not observed and firms cannot set output strategically, the θ-values for every location combination would be the same.

the text, to ease the exposition, we shall illustrate all the qualitatively different cases that can arise from different parameter combinations using relatively few diagrams. The figures are depicted in (σ^2, λ)-space, which means that they are drawn at given values of δ and e. We distinguish between two qualitatively different cases, depending on whether the FDI cost δ is high or low. First, we focus on a situation in which FDI costs are sufficiently high for the foreign firm always to remain located in its own country (subsection 4.2.1). This allows us to discuss in detail the home firm's choice between locating at home in the inflexible market or going abroad in search of flexibility. Second, we shall explore how increasing degrees of globalisation (in the form of falling values of δ) influence location patterns (subsection 4.2.2). In contrast to the FDI-cost, the degree of product differentiation (captured by the reciprocal of e) tends not to affect location patterns in a qualitatively significant way. We will briefly comment on the effects of e as we examine each case.

Domestic anchorage   Suppose that the fixed costs associated with FDI are so high that any potential strategic advantage to the Foreign firm of locating in Home would be dominated by the FDI-costs. Then, the Foreign firm will, even under certainty, produce in Foreign. Furthermore, as in the monopoly case, an increase in uncertainty increases the attractiveness of the Foreign location because of its flexibility advantages. *Given* that the Foreign rival produces in Foreign, we then need to examine where the Home firm will locate.

Figure 3a shows the location pattern that emerges in (σ^2, λ)-space. The negatively sloped locus represents the threshold uncertainty level at which the Home firm is indifferent between locating in Home and in Foreign, given that the Foreign firm will stay in Foreign, defined by $\sigma^2\big|_{F*}$ (for ease of comparison, the threshold uncertainty level at which a monopolist Home firm is indifferent between locating in Home and in Foreign is represented by the faint locus). In area I, the Home firm locates in home: it remains "domestically anchored". Note that this area includes the special case of certainty (i.e., at $\sigma^2 = 0$, which is along the horizontal axis); clearly, in the absence of uncertainty there is no longer a *flexibility* disadvantage from the existence of employment protection at home, but the *strategic* advantage associated with it remains. Thus, employment protection generates dynamic strategic effects

even in the absence of uncertainty'. However, when both uncertainty and domestic employment protection are sufficiently high (area II), the Home firm decides to produce in Foreign.

[Figures 3a, 3b and 3c about here]

As product differentiation increases (i.e., as e falls), the area with domestic anchorage shrinks. The reason for this lies in the fact that product differentiation weakens competition between firms and hence weakens firms' strategic incentive to commit to overproduction. Such commitment can only be obtained through the mechanism of employment protection, which is only present in Home. So, as product differentiation reduces strategic overproduction, the Home firm will be less willing to stay domestically anchored for the sake of the strategic advantages associated with it, and be more inclined to locate in Foreign for the flexibility advantages associated with that location choice. In terms of Figure 3a, an increase in product differentiation will move the locus separating areas I and II inwards and downwards (in the limit case when e falls to zero, the $\sigma^2\big|_{F*}$-locus coincides with the faint locus, i.e., the threshold uncertainty level at which a monopolist Home firm is indifferent between locating in Home and in Foreign).

Globalisation and strategic agglomeration   One of the defining characteristics of the current wave of globalisation is that large firms have become increasingly footloose. In our model this is captured by falling FDI-costs (δ). As δ falls, other location equilibria, beside (H,F) and (F,F), start to emerge. Figures 3b and 3c show the location pattern under quantity competition for increasing but incomplete and complete globalisation, respectively. With increasing globalisation (i.e., ever lower δ), it is easier for firms to invest abroad: hence, the cost to the Home firm of acquiring flexibility by investing in Foreign falls. In Figure 3b, the threshold uncertainty locus below which the Home firm produces domestically (i.e., the negatively sloped curve) is now lower than in Figure 3a. The area in which the Home firm is located in Home has shrunk (areas Ia and Ib in Figure 3b), meaning that domestic anchorage is less easily sustained, while FDI by the Home firm into the Foreign location becomes relatively more important. This is reflected in an

enlargement of area II in Figure 3b, in which (*F,F*) is the unique equilibrium. When low FDI costs are combined with low uncertainty, strategic considerations in the location decision become relatively more important. In fact, when uncertainty is low and the degree of employment protection in the Home location is high, even the Foreign firm will now find it worthwhile to pay the FDI costs and locate in Home. In Figure 3b, this is shown by the appearance of another locus (which remained in the negative orthant at higher levels of FDI costs), along which the Foreign firm is indifferent between locating in Home or Foreign given that the Home firm is located in Home (defined by $\left(\sigma^2\big|_H\right)^*$). Below this positively sloped locus, the Foreign firm produces in Home given that the Home firm produces there. It is the relatively increased importance of strategic concerns that encourages inward FDI at the inflexible location, leading to the (*H,H*)-equilibrium (in area Ib in Figure 3b). The Foreign firm actually has to jump a barrier and set up its plant in the Home location to avoid ending up in the worst possible strategic position ($\theta^{*HH} > \theta^{*HF}$, see expression (11b)). The (*H,H*)-equilibrium is an example of *strategic agglomeration*, in the sense that this agglomeration would not occur in the absence of strategic behaviour.

As globalisation deepens and δ falls further, regions in which domestic anchorage prevails become smaller still. In the limit, with complete globalisation ($\delta = 0$), firms effectively lose their nationality. The loci from Figure 3b have now reversed their positions ($\sigma^2\big|_{F*} < \left(\sigma^2\big|_H\right)^*$). The resulting location patterns are shown in Figure 3c. Even then, firms may want to locate in the inflexible Home location. In fact, at sufficiently low levels of uncertainty, (*H,H*) is the unique equilibrium under Cournot competition.

The location effects of deepening globalisation prove to be qualitatively robust to changing degrees of product differentiation. It is worth mentioning that as product differentiation increases (and $e > 0$ falls), strategic agglomeration still occurs, but at lower levels of uncertainty.

IV. EMPLOYMENT PROTECTION AND LOCATION UNDER BERTRAND COMPETITION

With Bertrand competition firms' actions are now prices. Nesting the case with Bertrand competition in the model outlined in section two requires inverting the demand system given in expressions (1a)-(1b) and (2a)-(2b). Thus, we obtain

(13a) $q_1 = \alpha - \beta(p_1 - ep_1^*)$ and $q_2 = \alpha - \beta(p_2 - ep_2^*) + v$,

and

(13b) $q_1^* = \alpha - \beta(p_1^* - ep_1)$ and $q_2^* = \alpha - \beta(p_2^* - ep_2) + v$,

with $\alpha \equiv a/(1+e)$, $\beta \equiv 1/(1-e^2)$ and $v \equiv u/(1+e)$. We assume $\alpha/\beta \geq \max\{p_1 - ep_1^*, p_1^* - ep_1\}$ and $(\alpha+v)/\beta \geq \max\{p_2 - ep_2^*, p_2^* - ep_2\}$, thus ensuring non-negative outputs in each period.

Employment protection and price decisions

As under Cournot competition, we first concentrate on the case in which each firm produces domestically (i.e., the (*H,F*)-case).

Starting with the final stage of the game, the second-period price reaction functions are given by

(14a) $p_2 = \big((1+\beta\lambda)(\alpha+v) + \beta c - \beta\lambda q_1(p_1,p_1^*) + \beta e(1+\beta\lambda)p_2^*\big)/(\beta(2+\beta\lambda))$,

and

(14b) $p_2^* = (\alpha + v + \beta c + \beta e p_2)/2\beta$,

for the Home and the Foreign firm respectively. The Home firm's price reaction function responds more to unexpected demand shocks than its rival's (i.e., $\partial p_2/\partial v > \partial p_2^*/\partial v$ from (14a) and (14b)). Since the firm in Home is less flexible in output, unexpected demand shocks will be translated in larger price fluctuations. For the same reason, the Home firm's optimal second-period price is more responsive to changes in its rival's price (or, $e(1+\beta\lambda)/(2+\beta\lambda) > e/2$). The Home firm's past output level enters negatively in its second-period price reaction function. As output is sticky in the presence of employment protection, a higher output in period one is associated with a higher output in period two and therefore with a lower price. Solving for second-period prices, we obtain:

(15a) $p_2 = \dfrac{(2+e)(1+\beta\lambda)(\alpha+v) + [2+e(1+\beta\lambda)]\beta c - 2\beta\lambda q_1}{\beta[2(2+\beta\lambda) - e^2(1+\beta\lambda)]}$,

and

(15b) $p_2^* = \dfrac{[2+e+\beta\lambda(1+e)](\alpha+v)+(2+e+\beta\lambda)\beta c - e\beta\lambda q_1}{\beta[2(2+\beta\lambda)-e^2(1+\beta\lambda)]}$.

Inspection of (15a) and (15b) reveals that a high Home output in period one leads to low second-period prices for both firms. Intuitively, with employment protection, a high Home output in period one will give rise to a high Home production level in period two, that will translate into low period-two prices for both the Home and – since prices are strategic complements – the Foreign firm. Note that under Bertrand competition, the Home firm cannot choose its period-one output directly as q_1 depends on the Home firm's first-period price and on that of its rival (see expression (13a)). The dependence of second-period prices on *both* firms' period-one prices has important implications for firms' price setting in period one, to which we now turn.

In stage two, firms simultaneously set first-period prices, taking into account their effect on future prices. For convenience, we rewrite the profit functions as:

(16a) $\begin{aligned}\pi = {}&(p_1 - c)[\alpha - \beta(p_1 - ep_1^*)] + (p_2 - c)[\alpha - \beta(p_2 - ep_2^*)+v] \\ &- (\lambda/2)[(\alpha - \beta(p_2 - ep_2^*)) - (\alpha - \beta(p_1 - ep_1^*)+v)]^2 - \varphi\end{aligned}$,

and

(16b) $\pi^* = (p_1^* - c)[\alpha - \beta(p_1^* - ep_1)] + (p_2^* - c)[\alpha - \beta(p_2^* - ep_2)+v] - \varphi$.

Total differentiation of firms' expected profits $E\pi = \pi_1(p_1, p_1^*) + E\pi_2(p_2, p_2^*, p_1, p_1^*, v)$ and $E\pi^* = \pi_1^*(p_1, p_1^*) + E\pi_2^*(p_2, p_2^*, v)$ with respect to first-period prices yields the first-order conditions for period one. Since $\partial E\pi_2/\partial p_2 = 0$ and $\partial E\pi_2^*/\partial p_2^* = 0$ (from the last stage), these are given by:

(17a) $\dfrac{dE\pi}{dp_1} = \dfrac{\partial E\pi}{\partial p_1} + E\left[\dfrac{\partial \pi_2}{\partial p_2^*}\dfrac{dp_2^*}{dp_1}\right] = 0$,

and

(17b) $\dfrac{dE\pi^*}{dp_1^*} = \dfrac{\partial E\pi^*}{\partial p_1^*} + E\left[\dfrac{\partial \pi_2^*}{\partial p_2}\dfrac{dp_2}{dp_1^*}\right] = 0$.

In the *(H,F)*-case, $\partial E\pi/\partial p_1 = \partial \pi_1/\partial p_1 + E(\partial \pi_2/\partial p_1)$ and $\partial E\pi^*/\partial p_1^* = \partial \pi_1^*/\partial p_1^*$; also, the strategic term in (17a) is positive ($E[(\partial \pi_2/\partial p_2^*)(dp_2^*/dp_1)] > 0$, as shown in table 1), which implies that the firm in Home strategically *over*-prices in period one ($\partial E\pi/\partial p_1 < 0$). Unlike in the Cournot case, the firm in Foreign also has an incentive to behave strategically. That firm strategically *under*-prices (i.e., since

$E[(\partial\pi_2^*/\partial p_2)(dp_2/dp_1^*)] < 0$, as reported in Table 1, $\partial E\pi^*/\partial p_1^* > 0$ from (17b)). Furthermore, even though its output is fully flexible, the strategic effect (per unit of output) for the firm in Foreign is larger in absolute value than that for the firm in Home.

The intuition for the strategic behaviour in the Bertrand case is quite subtle. Under Bertrand competition, a firm's strategic pricing in period one is aimed at increasing the future price of its rival's product. This in turn raises its own second-period profit. From expressions (15a) and (15b), we know that future prices can be pushed up by a low Home output level in period one. Since firms choose prices, *both* firms can manipulate the Home firm's period-one output by choosing period-one prices strategically: the Home firm aims to keep q_1 low by increasing its product price, while the Foreign firm makes sure q_1 is kept low by selling its own product at a low price. Each firm's strategic pricing behaviour pushes up the Home firm's expected price in the next period and – because prices are strategic complements – also the Foreign firm's expected price in period two. So, employment protection can act as a facilitating device for driving future expected prices up, even if only one firm is located in a country with employment protection laws and in spite of the fact that prices are chosen non-cooperatively.

So far, only the (*H,F*)-case has been discussed. In the (*F,H*)-case, the Home firm (now located in the flexible Foreign location) will act strategically by under-pricing in period one, while its Foreign rival (now located in Home and hence inflexible in output) will choose to over-price. We find that the firm in the flexible location produces higher expected outputs and the firm in the inflexible location produces lower expected outputs than in the corresponding open-loop equilibrium. This contrasts with our Cournot results. Under Bertrand, in (*H,F*) and (*F,H*) the market is more competitive in the first period but less competitive in the second period than in the open-loop case. If both firms produce in Foreign, (*F,F*), neither firm sets prices strategically. If both firms produce in Home, (*H,H*), then both firms will strategically under-price in period one (see Table 1): even though a concern for high future prices gives each firm an incentive to keep its first-period production low (by strategically over-pricing in period one), it creates an even greater incentive for firms to keep their rival's first-period production low (by strategically under-pricing

in period one).[24] Again, in this case – as in the Cournot case – our results are consistent with Jun and Vives (2004) results for the Markov perfect equilibrium under Bertrand competition. Firms facing symmetric adjustment costs produce higher expected outputs and hence the equilibria are more competitive than in the open-loop equilibrium.

Location pattern with employment protection

We now turn to stage one, in which firms simultaneously choose their production location, taking into account how locations affect expected profits. Again, expected profits can be decomposed into fixed set-up costs, Φ, deterministic operating profits, θ, and the expected profit gains from the demand shocks, $\gamma\sigma^2$.

The ranking of the γ-parameter in the different location combinations is given by expressions (12a) and (12b) for the Home and the Foreign firm, respectively. Thus, although the actual values of the γ-parameter differ, the ranking is the same as under Cournot competition and the intuition is also the same.

We now discuss the ranking of the θ-values when firms set prices. As explained in the previous subsection, being inflexible encourages the rival firm to strategically under-price in period one in order to reduce the inflexible firm's first-period output and so raise its price in the future. This aggressive strategic behaviour by its rival hurts an inflexible firm's operating profit. Hence, when facing a flexible rival, firms have, from a purely strategic point of view, an incentive to favour the flexible over the inflexible location. Formally, $\theta^{FF} > \theta^{HF}$ and $\theta^{*FF} > \theta^{*FH}$ and, provided λ is not too large, $\theta^{FH} > \theta^{HH}$ and $\theta^{*HF} > \theta^{*HH}$ (we will return to what happens when λ is large below). Next, when comparing operating profits when *both* firms are in the inflexible location with those when *both* locate in the flexible foreign country, we have $\theta^{FF} > \theta^{HH}$ and $\theta^{*FF} > \theta^{*HH}$; this is because in (H,H) *both* firms strategically under-price, resulting in lower prices in both periods (while there is no strategic price setting in (F,F)). Furthermore, we have $\theta^{HH} > \theta^{HF}$, that is the

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[24] So, as in the Cournot case, firms strategically over-produce relative to the open loop. In (*H,H*) both firms experience output inflexibility and this lends to the model some features of Cournot competition. As pointed out by a referee, such Cournot elements are not unusual in multiple-stage games in which firms make decisions both about price and other variables (see, for instance, Lommerud-Sorgard 1997, in which firms first choose the number of product variants –a decision resembling a quantity choice–, then compete either à la Cournot or Bertrand).

inflexible (Home) firm's deterministic operating profits are higher if the Foreign rival is inflexible too. To understand why, recall that a firm always strategically under-prices when it faces an inflexible rival. Thus, the Foreign firm will under-price both at (H, H) and (H, F). However, its strategic aggressiveness, which harms the Home firm, will be strongest at (H, F), when it is itself flexible. Naturally, this reasoning also implies $\theta^{*HH} > \theta^{*FH}$. Hence, given the above pair-wise rankings under Bertrand, we always have the following ranking of deterministic operating profits for the Home firm.

(18a) $\quad \theta^{FF} > \theta^{HH} > \theta^{HF}$.

Similarly, we have the following ranking for the Foreign firm

(18b) $\quad \theta^{*FF} > \theta^{*HH} > \theta^{*FH}$.

The position that θ^{FH} and θ^{*HF} take in these rankings depends on the level of λ. In (F,H) and (H,F), the flexible firm strategically under-prices in period one to increase its profits in period two and it becomes increasingly aggressive in doing this the larger is λ. This commitment to under-pricing in period one leads to a lower rival price in that period that hurts the flexible firm's operating profit in these asymmetric cases. This becomes more serious the larger is λ. Hence, we find that, as long as the degree of employment protection (λ) is not too high, $\theta^{FH} > \theta^{FF}$ and $\theta^{*HF} > \theta^{*FF}$, but, as λ increases, θ^{FH} and θ^{*HF} fall and eventually, at very high λ, $\theta^{FH} < \theta^{HH}$ and $\theta^{*HF} < \theta^{*HH}$.

Again, since the analysis of firms' location decisions involves many unwieldy algebraic expressions (formally derived in Appendix B), graphs are used to ease the exposition. To enable direct comparison with the analysis under Cournot competition in subsection 4.2.1 above, we shall first focus on a situation in which firms incur a significant cost of FDI. This allows us to examine the extent to which strategic behaviour affects domestic anchorage when firms compete in prices (subsection 5.2.1). Second, we shall explore how increasing degrees of globalisation (in the form of falling values of δ) influences location patterns (subsection 5.2.2).

Domestic de-anchorage The location pattern under Bertrand competition for high FDI costs is shown in Figure 4a. Along the solid locus (i.e., at $\sigma^2 = \sigma^2\big|_{F*}$), the Home firm is indifferent between producing in Home and in Foreign. The home firm

chooses to produce in Home in area I and to locate in Foreign in area II. To enable comparison, the figure includes a dashed curve that represents the corresponding locus under Cournot competition (as depicted in Figure 3a) and a faint curve that represents the threshold uncertainty level at which a monopolist Home firm is indifferent between locating in Home and in Foreign (as depicted in Figure 2).[25]

[Figures 4a, 4b and 4c about here]

Given the same degree of product differentiation, competition is naturally tougher under Bertrand than under Cournot behaviour.[26] Hence, price competition makes it harder for firms to carry the costs of FDI. Based on these considerations alone, one would therefore expect the area with domestic anchorage to be larger under Bertrand than under Cournot competition. Indeed, if firms do not behave strategically in stage two (i.e., as in the open-loop benchmark), the area with domestic anchorage is larger under Bertrand than under Cournot competition. However, it is clear from Figure 4a that the opposite is true: the region in which domestic anchorage occurs is larger under Cournot (the region under the dashed curve) than under Bertrand competition (the region under the solid curve). This seemingly counterintuitive result can be explained by the s*trategic* considerations underlying firms' location decisions. Under Bertrand competition, given its rival's production in Foreign, the Home firm is, from a strategic point of view, better off when producing in Foreign ($(F,F)^B$ in area II) than in Home ($\theta^{FF} > \theta^{HF}$, see expression (18a)). By producing in Foreign, it avoids the massive first-period price undercutting by its rival that would occur if the Home firm were to produce in Home (this contrasts sharply with Cournot competition, where – as we saw earlier – the Home location holds strategic advantages). Hence, under Bertrand, the Home firm has an additional incentive to leave the country with employment protection – to escape its rival's harmful strategic pricing behaviour. Thus, there is a strategic de-anchorage effect when firms set prices.

As product differentiation increases (i.e. as e falls), strategic behaviour and hence the reason for strategic de-anchorage is diminished. As a result, the area in which (H,F) is the equilibrium expands (while it shrinks under Cournot competition). Importantly, the area in which the home firm stays at Home is always largest under Cournot behaviour.

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[25] In the figures, the maximum value for λ is limited to ensure the existence of all possible equilibria.
[26] This has been shown for one-shot oligopoly games (e.g., Dixon 1989).

Globalisation and strategic agglomeration   We now examine how the location pattern of firms changes as globalisation deepens.   Figures 4b and 4c show the location pattern under price competition for increasing but incomplete and complete globalisation, respectively.

As δ falls, the lower cost to the Home firm of acquiring flexibility by investing in Foreign is reflected in the $\sigma^2\big|_{F*}$-locus shifting closer towards the origin in Figure 4b.   Hence, the region in which the Home firm is located in Home has shrunk (area I in Figure 4b is smaller than area I in Figure 4a), meaning that domestic anchorage is even less easily sustained, while FDI from the Home firm into the Foreign location becomes relatively more important.   This is reflected in an enlargement of area II, in which (*F,F*) is the unique equilibrium.

Figures 4b and 3b confirm our previous finding that domestic anchorage is strongest in industries characterised by Cournot behaviour: the region in which the Home firm produces in Home is larger under Cournot (areas Ia+Ib in Figure 3b) than under Bertrand (area I in Figure 4b).

Under Bertrand competition, globalisation can, even at low levels of uncertainty, lead to FDI by the Home firm, as it tries to locate in the strategically favourable flexible Foreign location (resulting in (*F,F*)).   As shown in Figure 4b, provided that the level of employment protection in Home (λ) is sufficiently high, the (*F,F*)-equilibrium occurs even at certainty ($\sigma^2 = 0$); hence, strategic agglomeration can occur in Foreign. In this case, the Home firm is willing to incur the FDI-cost purely for strategic reasons ($\theta^{FF} > \theta^{HF}$, see expression (18a)).   This effect is so strong that, with complete globalisation ($\delta = 0$), the Home firm never wants to locate in Home *if* the Foreign firm stays in Foreign (hence, the $\sigma^2\big|_{F*}$ -locus disappears from the positive orthant).   However, firms may want to locate in the inflexible Home location, given that the rival does the same (which is reflected diagrammatically in the appearance of the $\left(\sigma^2\big|_H\right)^*$-locus).   In fact, (*H,H*) can be an equilibrium (together with (*F,F*)) under Bertrand competition, but only at very high degrees of employment protection.   This (*H,H*)-equilibrium is also an example of strategic agglomeration because, at high λ, $\theta^{*HH} > \theta^{*HF}$: given that the Home firm

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produces in Home, the Foreign firm sets up production in Home too, thus avoiding an unfavourable strategic position.

So, whereas strategic agglomeration occurs only in the location with the inflexible labour market under Cournot competition, it can occur both in the location with the inflexible and in the one with the flexible labour market under Bertrand competition.

The location effects of deepening globalisation prove to be qualitatively robust to changing degrees of product differentiation. As product differentiation increases (*e* falls), strategic agglomeration still occurs, but only at lower levels of uncertainty.

V. EXTENSIONS

In this section we explore the implications of modifying some of the assumptions of our model. Specifically, we discuss what would happen if firms were not to choose their locations simultaneously. We also briefly discuss ways in which trade costs could be incorporated into the model, as well as the implications of relaxing the implicit assumption that the discount factor is unity and how endogenous factor prices, either due to the presence of unions or general equilibrium effects, might be expected to alter the results.

Sequential location choices

In our analysis we have assumed that firms choose production locations simultaneously. It is of theoretical interest, however, to explore how sequential location choices affect firm location patterns.

When FDI-costs are high or intermediate (Figures 3a-3b and 4a-4b), the location pattern with sequential decisions is not different from the one observed under simultaneous decisions.[27] When FDI-costs are low or non-existent (Figures 3c and 4c), the location pattern changes slightly. While nothing changes in the areas with a unique location outcome, only the (*F,F*)-equilibrium will survive in the regions with multiple equilibria (area II in Figure 3c and area I in Figure 4c). The reason for this lies in the fact that the firm that moves first can "pick" the equilibrium in which its expected profits are highest. From a pure flexibility perspective, each firm prefers agglomeration in Foreign to agglomeration in Home (from (12a) and (12b),

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[27] The reason for this is that, in each area of Figures 3a-b and 4a-b, the location choice of at least one firm is a dominant strategy.

$\gamma^{FF} > \gamma^{HH}$ and $\gamma^{*FF} > \gamma^{*HH}$). Furthermore, both firms also prefer (*F,F*) to (*H,H*) for strategic reasons, both under Cournot (from (11a) and (11b)) and under Bertrand competition (from (18a) and (18b)). Hence, irrespective of which firm moves first, the equilibrium that emerges in the areas considered will always be (*F,F*). Hence, in a completely globalised world, sequential location decisions work against agglomeration in Home. Note, however, that strategic agglomeration in the Home country is not completely eliminated when location decisions are made sequentially: (*H,H*) remains the unique location outcome in area I of Figure 3c.

Trade costs

In our analysis we have chosen not to model trade costs explicitly given our aim to focus on how the location decision is affected by differences in local labour markets. This flexibility factor can be seen in sharper relief when we abstract from trade-cost jumping reasons for doing FDI. Our approach follows other related papers in the employment protection and FDI literature, in particular those of Haaland *et al* (2002) and Haaland and Wooton (2007), in assuming that the firms sell on to a single integrated market, such as could exist in a customs union.[28] In such a scenario, even though the market for the final good is integrated, countries' labour market institutions differ − as is indeed the case between EU member states. The model could clearly be extended to take account of non-integrated final goods markets, separated by trade costs. A natural way to do this would be to employ the reciprocal markets framework, first pioneered by Brander (1981) and Brander and Krugman (1983). Clearly, incorporating trade costs and market segmentation in this manner into our model would overlay a proximity-concentration trade-off on the existing flexibility-commitment trade-off . However, doing so would have the drawback of adding considerably to the complexity of the model without necessarily providing many interesting additional insights as can be obtained from studying the two issues separately. Basically, firms would export rather than do FDI when trade costs are relatively low and FDI costs are relatively high, whereas they would do FDI when the relative FDI costs are low enough. The parameter values (trade costs and FDI costs) at which they will switch would depend on the degree of employment protection, the degree of uncertainty and the mode of competition. However, qualitatively, the

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[28] This assumption is also typical of the strategic trade policy literature.

manner in which these employment protection and flexibility factors affect location will be analogous to how they affect location in our model with integrated markets.

The discount factor

We have implicitly assumed that the firms do not discount future profits, i.e., the discount factor is unity. Lower levels of the discount factor lead to a reduction in strategic behaviour as the strategic actions are taken in the first period but reap benefits only in the second. Thus, for instance, the first-order condition for a quantity setting firm located in the inflexible location that was given in (10a) becomes

$$\frac{dE\pi}{dq_1} = \frac{\partial E\pi}{\partial q_1} + E\left[\rho\frac{\partial \pi_2}{\partial q_2^*}\frac{dq_2^*}{dq_1}\right] = 0, \text{ where the discount factor is represented by } \rho.$$

As ρ falls towards zero, all the θ-values under Cournot converge since the differences between these depend only on strategic behaviour. Likewise, all the Bertrand θ-values get closer to each other as the value of ρ falls. The benefits of flexibility also accrue in the second period and so the γ-values all go to zero as ρ goes to zero. Since the setup costs – including the FDI costs – are incurred upfront in period one, these become relatively more important in determining location when the discount factor is lower. When the discount factor goes to zero, issues of flexibility and commitment disappear and firms then locate in their own country to minimise setup costs.

Endogenous factor prices

Throughout the paper we have assumed that the marginal cost of production (*c*) is constant and the same in both locations. In doing so, we have abstracted from general equilibrium effects on factor prices as well as the possibility of wages being set in a union-bargaining framework.

The partial equilibrium approach that we follow in this paper – in line with most of the oligopoly literature – can be justified by seeing firms as small relative to the size of the factor market and the economy as a whole, even though they are large in their particular industry. Although our model is already too complex to be nested in a general equilibrium framework[29], it is nevertheless worthwhile to briefly discuss

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[29] There are as yet few papers that model oligopoly in general equilibrium, with Neary's GOLE framework being a notable exception (see Neary 2009).

how general equilibrium effects on factor prices might affect the results. As we show, agglomeration equilibria ((H,H) or (F,F)) can emerge. In a general equilibrium setting, such agglomeration in one country would likely cause factor prices in that country to rise, as shown in the economic geography literature.[30] Higher factor prices in a particular location would make it less attractive; that is, they would work as a countervailing force, dampening the degree of agglomeration somewhat. By ignoring such general equilibrium effects and focussing instead on the behaviour of firms within industries we are able to bring out the effects of strategic interaction in the clearest possible way.

We have also abstracted from the role of unions in this paper. If employment protection is strengthened, union wages may increase in countries with strong unions, in which case the potential strategic advantage associated with strict employment protection would be mitigated by the strategic disadvantage implied by high wages. However, it is by no means certain that this scenario is the most likely one. Leonardi and Pica (2007) present evidence that, with strict employment protection and union wage bargaining, firms make workers prepay the severance cost. Thus, even in the presence of unions, increases in employment protection do not necessarily imply higher wages. Modelling the possible interaction between employment protection and wages would be important if we were to derive the optimal level of employment protection. This is, however, beyond the scope of this paper.

VI. CONCLUSIONS

We have explored how differences in labour market flexibility affect location decisions when future demand is uncertain and firms act strategically. When demand uncertainty is high, firms will cluster in countries where the labour market is relatively flexible, thus avoiding costly redundancy packages during economic slowdowns and expensive overtime payments or hiring costs in economic booms.

However, when firms act strategically, they may be willing to forego flexibility and produce in countries where the labour market is relatively inflexible in order to obtain strategic advantages. This is the case when the firms engage in Cournot behaviour. Under quantity competition an inflexible location allows a firm to commit to high future output, which makes the inflexible location more attractive at

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[30] See, for instance, Fujita, Krugman and Venables (1999).

low levels of uncertainty. This strategic advantage helps to maintain domestic anchorage of firms in locations with strict labour regulations. Under price competition however, a firm located in the inflexible country faces aggressive pricing from its flexible rival in period one. As a result, the inflexible location is unfavourable both from a strategic and a flexibility perspective. Hence, both strategic and flexibility incentives work against domestic anchorage under Bertrand competition.

We have shown that deepening globalisation can lead to a greater tendency for the development of strategic agglomeration. This is the case under both Cournot and Bertrand competition. Under Cournot competition, firms facing low FDI-costs cluster in the inflexible location when uncertainty is low. Such clustering has however a prisoner's dilemma character, with firms all producing higher output and enjoying less flexibility than they would in a location with lower labour adjustment costs. Under Bertrand competition, this can also occur, but only at very high levels of employment protection and when uncertainty is very low. In fact, when strategic agglomeration occurs under price competition, it does so mainly in the flexible location as firms flee the strategically unfavourable inflexible location.

When formulating policy lessons from this analysis, one should proceed with caution. We have *not* derived *optimal* employment protection levels in this paper, nor have we allowed for a link between employment protection and firms' marginal costs – as might exist if, by strengthening workers' bargaining power employment protection results in higher wages. Throughout this paper, we have assumed that the level of employment protection is exogenous. This is a reasonable assumption since the political reluctance to change employment protection regulations, once these are in place, is often strong. It does not, however, preclude policy makers from using location-dependent fiscal incentives to increase the attractiveness of their region. Our analysis suggests that countries with strict labour regulations will find it less difficult to achieve domestic anchorage of key industries, by using fiscal incentives, when firm behaviour is approximated by Cournot rather than by Bertrand competition.[31] Thus,

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[31] Whether firms' behaviour is better described by Cournot or by Bertrand competition is a matter for empirical investigation on an industry-by-industry basis. There exists a substantial empirical literature on this issue (for a survey, see Martin (2002), Ch.7).

we have highlighted a potentially important *additional* channel through which employment protection might affect location incentives, which may strengthen in some circumstances the effectiveness of other policies aimed at increasing the attractiveness of a region to investors. In so doing, the paper points to a potentially fruitful empirical agenda.

Different labour market policies are typically studied in isolation and this paper is no exception. However, as evidenced by current debates about *flexicurity*, employment protection and unemployment insurance are tightly linked – with the OECD (2005) and the European Commission (2010) endorsing reforms (along the lines of those that have taken place in Denmark and, with some variations, in Austria and the Netherlands) that accompany reductions in the levels of hiring and firing restrictions with the provision of *security* to the unemployed (such as good unemployment insurance). The theoretical literature in this area is still in its infancy. Among the notable exceptions are Blanchard and Tirole (2008), and Lommerud and Straume (2011) – which includes a valuable survey of the limited literature in the area. The implications of introducing a flexicurity-type policy mix in our model would depend on how the unemployment benefits that replace employment protection are paid for. State funded unemployment benefits will eliminate the inflexibility mechanism highlighted in this paper. However, as shown by Blanchard and Tirole (2008), who examine theoretically the joint determination of unemployment benefits and employment protection, a first-best policy entails financing unemployment benefits by layoff taxes on firms. Although, in the absence of general equilibrium effects as is the case in our paper, the introduction of such a policy mix should not alter the qualitative nature of our results, this remains a promising direction for future research.

APPENDIX A - DECOMPOSITION OF MAXIMISED EXPECTED PROFITS

Under Cournot competition

First, consider the (H,F)-case. The first-order conditions for second- and first-period outputs chosen by the Home firm ((7a) and (10a), respectively) can be rewritten as:

(A.1) $(p_2^{HF} - c) - \lambda(q_2^{HF} - q_1^{HF}) = q_2^{HF}$,

and

(A.2) $(p_1^{HF} - c) + \lambda(Eq_2^{HF} - q_1^{HF}) + \lambda \xi^{HF} Eq_2^{HF} = q_1^{HF}$,

with

$$\xi^{HF} \equiv e^2 / \Delta^{HF} \text{ and } \Delta^{HF} \equiv 2(2 + \lambda) - e^2.$$

Multiplying both sides of (A.1) by q_2^{HF} and both sides of (A.2) by q_1^{HF}, we obtain:

(A.3) $(p_2^{HF} - c)q_2^{HF} - \lambda(q_2^{HF} - q_1^{HF})q_2^{HF} = (q_2^{HF})^2$,

and

(A.4) $(p_1^{HF} - c)q_1^{HF} + \lambda(Eq_2^{HF} - q_1^{HF})q_1^{HF} + \lambda \xi^{HF} Eq_2^{HF} q_1^{HF} = (q_1^{HF})^2$.

Adding (A.3) and (A.4) and rearranging terms, we obtain:

(A.5)
$$(p_1^{HF} - c)q_1^{HF} + (p_2^{HF} - c)q_2^{HF} - \frac{\lambda}{2}(q_2^{HF} - q_1^{HF})^2 - \frac{\lambda}{2}(q_2^{HF})^2 - \frac{\lambda}{2}(q_1^{HF})^2$$
$$+ (1 + \xi^{HF})\lambda Eq_2^{HF} q_1^{HF} = (q_1^{HF})^2 + (q_2^{HF})^2.$$

From (9a) and (A.5) follows:

(A.6)
$$\pi^{HF} = (p_1^{HF} - c)q_1^{HF} + (p_2^{HF} - c)q_2^{HF} - \frac{\lambda}{2}(q_2^{HF} - q_1^{HF})^2 - \varphi$$
$$= \left[1 + \frac{\lambda}{2}\right](q_1^{HF})^2 + \left[1 + \frac{\lambda}{2}\right](q_2^{HF})^2 - (1 + \xi^{HF})\lambda Eq_2^{HF} q_1^{HF} - \varphi$$

Since $E(q_2^2) = (Eq_2)^2 + \operatorname{var} q_2$ (and $\operatorname{var} q_2^{HF} = \frac{(2 - e)^2}{(\Delta^{HF})^2}\sigma^2$), we can write expected profits in the (H,F)-case as:

(A.7) $E\pi^{HF} = \theta^{HF} + \gamma^{HF}\sigma^2$,

with

$$\theta^{HF} \equiv \left[1 + \frac{\lambda}{2}\right][(q_1^{HF})^2 + (Eq_2^{HF})^2] - (1 + \xi^{HF})\lambda Eq_2^{HF} q_1^{HF},$$

and

$$\gamma^{HF} = \left[1 + \frac{\lambda}{2}\right]\frac{(2 - e)^2}{(\Delta^{HF})^2}.$$

Following a similar procedure to obtain the maximised expected profit decomposition for the Foreign firm, expected Foreign profits can be written as:

(A.8) $E\pi^{*HF} = \theta^{*HF} + \gamma^{*HF}\sigma^2 - \varphi$,

with

$$\theta^{*HF} \equiv (q_1^{*HF})^2 + (Eq_2^{*HF})^2 \text{ and } \gamma^{*HF} \equiv \frac{(2-e+\lambda)^2}{(\Delta^{HF})^2}\sigma^2.$$

Equilibrium first-period and expected second-period outputs for both firms are found by solving (8a),(8b), (10a) and (10b).

The decomposition of firms' expected profits in terms of θ, $\gamma\sigma^2$ and Φ for (H,H), (F,H) and (F,F) is obtained from a procedure that is similar to the one outlined for the (H,F)-case. Table A.1 reports the θ- and γ-expressions for the Home firm for each location combination under Cournot competition. The corresponding expressions for the Foreign firm are then easily obtained given that firms are ex-ante symmetric in everything except nationality: $E\pi^{*HH} = E\pi^{HH} - \delta$, $E\pi^{*HF} = E\pi^{FH} + \delta$, $E\pi^{*FH} = E\pi^{HF} - \delta$ and $E\pi^{*FF} = E\pi^{FF} + \delta$.

[Table A.1 about here]

Under Bertrand competition

Again, we first derive the θ- and γ-expressions for the (H,F)-case. The first-order conditions for second- and first-period prices chosen by the Home firm ((14a) and (17a), respectively) can be rewritten as:

(A.9) $\beta(p_2^{HF} - c) - \beta\lambda(q_2^{HF} - q_1^{HF}) = q_2^{HF}$,

and

(A.10) $\beta(p_1^{HF} - c) + \beta\lambda(Eq_2^{HF} - q_1^{HF}) - \beta\lambda\zeta^{HF}Eq_2^{HF} = q_1^{HF}$,

with

$$\zeta^{HF} \equiv e^2/\nabla^{HF} \text{ and } \nabla^{HF} \equiv 2(2+\beta\lambda) - e^2(1+\beta\lambda).$$

Multiplying both sides of (A.9) by q_2^{HF} and both sides of (A.10) by q_1^{HF}, we obtain:

(A.11) $\beta(p_2^{HF} - c)q_2^{HF} - \beta\lambda(q_2^{HF} - q_1^{HF})q_2^{HF} = (q_2^{HF})^2$,

and

(A.12) $\beta(p_1^{HF} - c)q_1^{HF} + \beta\lambda(Eq_2^{HF} - q_1^{HF})q_1^{HF} - \beta\lambda\zeta^{HF}Eq_2^{HF}q_1^{HF} = (q_1^{HF})^2$.

Adding (A.11) and (A.12) and rearranging terms, we obtain:

$$\text{(A.13)} \quad \beta(p_1^{HF} - c)q_1^{HF} + \beta(p_2^{HF} - c)q_2^{HF} - \beta\frac{\lambda}{2}(q_2^{HF} - q_1^{HF})^2 - \beta\frac{\lambda}{2}(q_2^{HF})^2 - \beta\frac{\lambda}{2}(q_1^{HF})^2$$
$$+ \beta\lambda(1 - \zeta^{HF})Eq_2^{HF}q_1^{HF} = (q_1^{HF})^2 + (q_2^{HF})^2$$

From (16a) and (A.13) follows:

$$\text{(A.14)} \quad \begin{aligned} \pi^{HF} &= (p_1^{HF} - c)q_1^{HF} + (p_2^{HF} - c)q_2^{HF} - \frac{\lambda}{2}(q_2^{HF} - q_1^{HF})^2 - \varphi \\ &= \left[\frac{1}{\beta} + \frac{\lambda}{2}\right](q_1^{HF})^2 + \left[\frac{1}{\beta} + \frac{\lambda}{2}\right](q_2^{HF})^2 - (1 - \zeta^{HF})\lambda Eq_2^{HF}q_1^{HF} - \varphi \end{aligned}.$$

Since $E(q_2^2) = (Eq_2)^2 + \operatorname{var} q_2$ (and $\operatorname{var} q_2^{HF} = \dfrac{(2+e)^2}{(1+e)^2(\nabla^{HF})^2}\sigma^2$), we can write

expected profits in the (H,F)-case as:

$$\text{(A.15)} \quad E\pi^{HF} = \theta^{HF} + \gamma^{HF}\sigma^2 - \varphi,$$

with

$$\theta^{HF} \equiv \left[\frac{1}{\beta} + \frac{\lambda}{2}\right][(q_1^{HF})^2 + (Eq_2^{HF})^2] - (1 - \zeta^{HF})\lambda Eq_2^{HF}q_1^{HF},$$

and

$$\gamma^{HF} = \left[\frac{1}{\beta} + \frac{\lambda}{2}\right]\frac{(2+e)^2}{(1+e)^2(\nabla^{HF})^2}.$$

Substituting (15a), (15b), (17a) and (17b) into expression (13a) yields optimal output levels in period one and two for the Home firm.

Following a similar procedure, to obtain the maximised expected profit decomposition for the Foreign firm, expected Foreign profits can be written as:

$$\text{(A.16)} \quad E\pi^{*HF} = \theta^{*HF} + \gamma^{*HF}\sigma^2 - \varphi,$$

with

$$\theta^{*HF} = (1/\beta)[(q_1^{*HF})^2 + (Eq_2^{*HF})^2] + \lambda\zeta^{*HF}Eq_2^{*HF}q_1^{*HF},$$

and

$$\gamma^{*HF} = \frac{[2 + e + (1+e)\beta\lambda]^2}{\beta(1+e)^2(\nabla^{HF})^2}.$$

The decomposition of firms' expected profits in terms of θ, $\gamma\sigma^2$ and Φ for (H,H), (F,H) and (F,F) is obtained from a similar procedure. Table A.1, reports the θ- and γ-expressions for each location combination under Bertrand competition.

APPENDIX B - DETERMINING THE LOCATION OUTCOMES

Crucial for solving the first stage of the game (in which firms choose locations) are the "location indifference" thresholds: for a given λ we calculate the critical σ^2-level at which a firm is indifferent between locations *given* the location of its rival.

So, *if* the Foreign firm chooses the Foreign location, the critical "location-indifferent" σ^2-level for the Home firm is given by the σ^2-level at which $E\pi^{HF} = E\pi^{FF}$. Since $E\pi^{HF} = \theta^{HF} + \gamma^{HF}\sigma^2 - \varphi$ and $E\pi^{FF} = \theta^{FF} + \gamma^{FF}\sigma^2 - (\varphi + \delta)$, the critical uncertainty threshold is $\sigma^2\big|_{F*} \equiv \dfrac{\theta^{HF} - \theta^{FF} + \delta}{\gamma^{FF} - \gamma^{HF}}$. For $\sigma^2 > \sigma^2\big|_{F*}$, $E\pi^{HF} < E\pi^{FF}$, hence the Home firm will locate in Foreign, given the Foreign firm's location in Foreign. For $\sigma^2 < \sigma^2\big|_{F*}$, $E\pi^{HF} > E\pi^{FF}$, hence the Home firm will produce in Home.

There is another critical location-indifferent σ^2-level for the Home firm, that is, the σ^2-level at which $E\pi^{HH} = E\pi^{FH}$, denoted by $\sigma^2\big|_{H*} \equiv \dfrac{\theta^{HH} - \theta^{FH} + \delta}{\gamma^{FH} - \gamma^{HH}}$. *If* the Foreign firm produces in Home, the Home firm also produces in Home for $\sigma^2 < \sigma^2\big|_{H*}$ but locates in Foreign for $\sigma^2 > \sigma^2\big|_{H*}$.

Similar thresholds exist for the Foreign firm. These are given by $\left(\sigma^2\big|_F\right)^* \equiv \dfrac{\theta^{*FH} - \theta^{*FF} - \delta}{\gamma^{*FF} - \gamma^{*FH}}$ and $\left(\sigma^2\big|_H\right)^* \equiv \dfrac{\theta^{*HH} - \theta^{*HF} - \delta}{\gamma^{*HF} - \gamma^{*HH}}$.

While these four thresholds are important in deriving firms' location choices, not all of them are binding in determining the actual location equilibrium.

The location pattern under Cournot competition

In Figure 3a, FDI costs are so that $\left(\sigma^2\big|_F\right)^* < 0$ and $\left(\sigma^2\big|_H\right)^* < 0$ for all values of λ; the Foreign firm therefore produces in Foreign. *If* the Foreign firm locates in Foreign, the $\sigma^2\big|_{F*}$-threshold –depicted in (σ^2, λ)-space– will be crucial in determining the location equilibria; it is the locus demarcating areas I and II. So, $E\pi^{HF} > E\pi^{FF}$ in area I, implying that (H,F) is the location equilibrium in that area. In area II, $E\pi^{HF} < E\pi^{FF}$, which means that (F,F) is the location equilibrium.

As δ falls, location of the Foreign firm in the Home country becomes a possibility (see Figures 3b and 3c). While δ is still high enough so that $\left(\sigma^2\big|_F\right)^* < 0$ for all λ-values, at sufficiently high values of λ we have $\left(\sigma^2\big|_H\right)^* > 0$. *Given* a Home location by the Foreign firm, to determine the location of the Home firm the $\sigma^2\big|_{H*}$-threshold is relevant. The ranking of the relevant thresholds is $\left(\sigma^2\big|_H\right)^* < \sigma^2\big|_{H*} < \sigma^2\big|_{F*}$ (note that $\sigma^2\big|_{H*}$ is not depicted in Figure 3b). For $\sigma^2 > \left(\sigma^2\big|_H\right)^*$ (areas Ia and II), the Foreign firm produces in Foreign, irrespective of what the Home firm does. *Given* that the Foreign firm produces in Foreign, the Home firm produces in Foreign if $E\pi^{HF} < E\pi^{FF}$ – that is, for $\sigma^2 > \sigma^2\big|_{F*}$ (area II) – and locates in Home if $E\pi^{HF} > E\pi^{FF}$ – that is for $\sigma^2 < \sigma^2\big|_{F*}$ (areas Ia and Ib). Hence, the equilibrium in area II is (F,F), while (H,F) is the outcome in area Ia. For $\sigma^2 < \left(\sigma^2\big|_H\right)^*$ (area Ib), the Foreign firm locates in Home, but only if the Home firm does too. Given the ranking of the relevant σ^2-thresholds, we know that in area Ib the Home firm always produces in Home ($E\pi^{HF} > E\pi^{FF}$ and $E\pi^{HH} > E\pi^{FH}$), hence (H,H) is the unique equilibrium in area Ib.

With complete globalisation, i.e. $\delta = 0$ (Figure 3c), firms effectively lose their nationality and become *ex ante* identical. Hence, $\sigma^2\big|_{H*} = \left(\sigma^2\big|_H\right)^*$ and $\sigma^2\big|_{F*} = \left(\sigma^2\big|_F\right)^*$. Unlike in Figure 3b, the $\sigma^2\big|_{F*}$-locus now lies below the $\sigma^2\big|_{H*}$-locus. Producing in Foreign is now a dominant strategy for each firm in area III (for $\sigma^2 > \sigma^2\big|_{H*}$, $E\pi^{HF} < E\pi^{FF}$ and $E\pi^{HH} < E\pi^{FH}$), while locating in Home is a dominant strategy for each firm in area I (for $\sigma^2 < \sigma^2\big|_{F*}$, $E\pi^{HF} > E\pi^{FF}$ and $E\pi^{HH} > E\pi^{FH}$). For $\sigma^2\big|_{F*} \leq \sigma^2 \leq \sigma^2\big|_{H*}$, $E\pi^{HH} > E\pi^{FH}$, but $E\pi^{HF} < E\pi^{FF}$; hence, (H,H) and (F,F) are the location equilibria in area II.

The location pattern under Bertrand competition

In Figure 4a, the Foreign firm never locates in Home as we assumed the FDI-costs are too high. Along the $\sigma^2\big|_{F*}$-locus, the Home firm is indifferent between locating in Home or Foreign. For $\sigma^2 < \sigma^2\big|_{F*}$, and hence (*H,F*) is the location equilibrium in area I; since $E\pi^{HF} < E\pi^{FF}$ in are II, (*F,F*) is the unique outcome in that area.

As FDI-costs fall, the location pattern under Bertrand competition remains qualitatively the same, which is obvious from comparing Figure 4a and 4b (Figure 4b only differs from Figure 4a in the size of area I, which has shrunk).

With complete globalisation, i.e. $\delta = 0$ (Figure 4c), $\sigma^2\big|_{F*} = \left(\sigma^2\big|_F\right)^*$ turns negative for all λ-values, while $\sigma^2\big|_{H*} = \left(\sigma^2\big|_H\right)^*$ remains negative for low λ-values but turns positive when λ is sufficiently high. Hence, in Figure 4c, (*F,F*) and (*H,H*) are the location outcomes in area I (where $E\pi^{HH} > E\pi^{FH}$ and $E\pi^{HF} < E\pi^{FF}$), while (*F,F*) is the unique location equilibrium elsewhere (at $\sigma^2 > \sigma^2\big|_{H*} = \left(\sigma^2\big|_H\right)^*$ –that is, in area II–, $E\pi^{HH} < E\pi^{FH}$ and $E\pi^{HF} < E\pi^{FF}$).

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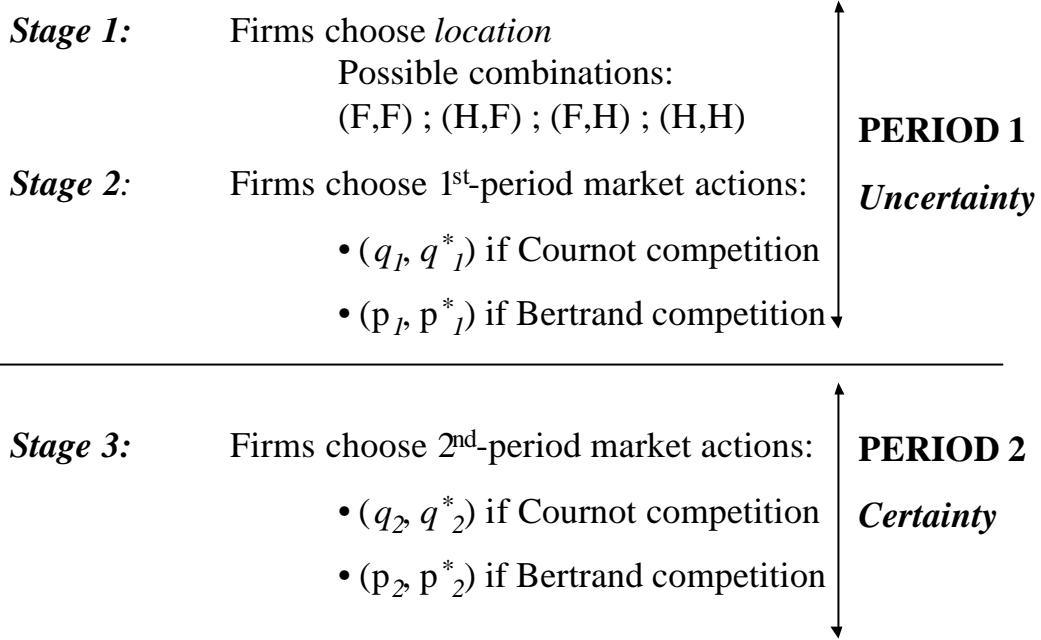
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Figure 1: The sequence of decisions

Stage 1:   Firms choose *location*
                 Possible combinations:
                 (F,F) ; (H,F) ; (F,H) ; (H,H)   **PERIOD 1**

Stage 2:   Firms choose 1st-period market actions: *Uncertainty*

 • (q_1, q^*_1) if Cournot competition

 • (p_1, p^*_1) if Bertrand competition

Stage 3:   Firms choose 2nd-period market actions: **PERIOD 2**

 • (q_2, q^*_2) if Cournot competition   *Certainty*

 • (p_2, p^*_2) if Bertrand competition

Table 1: The strategic terms in all possible location combinations

	Strategic term	(H,H)	(H,F)	(F,H)	(F,F)
COURNOT					
Home firm:	$E\boldsymbol{p}_{q^*_2} \dfrac{dq^*_2}{dq_1}$	$\dfrac{e^2 \boldsymbol{l}}{\Delta^{HH}} Eq_2^{HH}$	$\dfrac{e^2 \boldsymbol{l}}{\Delta^{HF}} Eq_2^{HF}$	0	0
Foreign firm:	$E\boldsymbol{p}^*_{q_2} \dfrac{dq_2}{dq^*_1}$	$\dfrac{e^2 \boldsymbol{l}}{\Delta^{HH}} Eq_2^{*HH}$	0	$\dfrac{e^2 \boldsymbol{l}}{\Delta^{FH}} Eq_2^{*FH}$	0
BERTRAND					
Home firm:	$E\boldsymbol{p}_{p^*_2} \dfrac{dp^*_2}{dp_1}$	$-\dfrac{e^2 \boldsymbol{bl}}{\nabla^{HH}} Eq_2^{HH}$	$\dfrac{e^2 \boldsymbol{bl}}{\nabla^{HF}} Eq_2^{HF}$	$-2\dfrac{e^2 \boldsymbol{bl}}{\nabla^{FH}} Eq_2^{FH}$	0
Foreign firm:	$E\boldsymbol{p}^*_{p_2} \dfrac{dp_2}{dp^*_1}$	$-\dfrac{e^2 \boldsymbol{bl}}{\nabla^{HH}} Eq_2^{*HH}$	$-2\dfrac{e^2 \boldsymbol{bl}}{\nabla^{HF}} Eq_2^{*HF}$	$\dfrac{e^2 \boldsymbol{bl}}{\nabla^{FH}} Eq_2^{*FH}$	0

Note: $\Delta^{HH} \equiv (2+\boldsymbol{l})^2 - e^2 > 0$; $\Delta^{HF} = \Delta^{FH} \equiv 2(2+\boldsymbol{l}) - e^2 > 0$

$\nabla^{HH} \equiv (2+\boldsymbol{bl})^2 - e^2(1+\boldsymbol{bl})^2 > 0$; $\nabla^{HF} = \nabla^{FH} \equiv 2(2+\boldsymbol{bl}) - e^2(1+\boldsymbol{bl}) > 0$
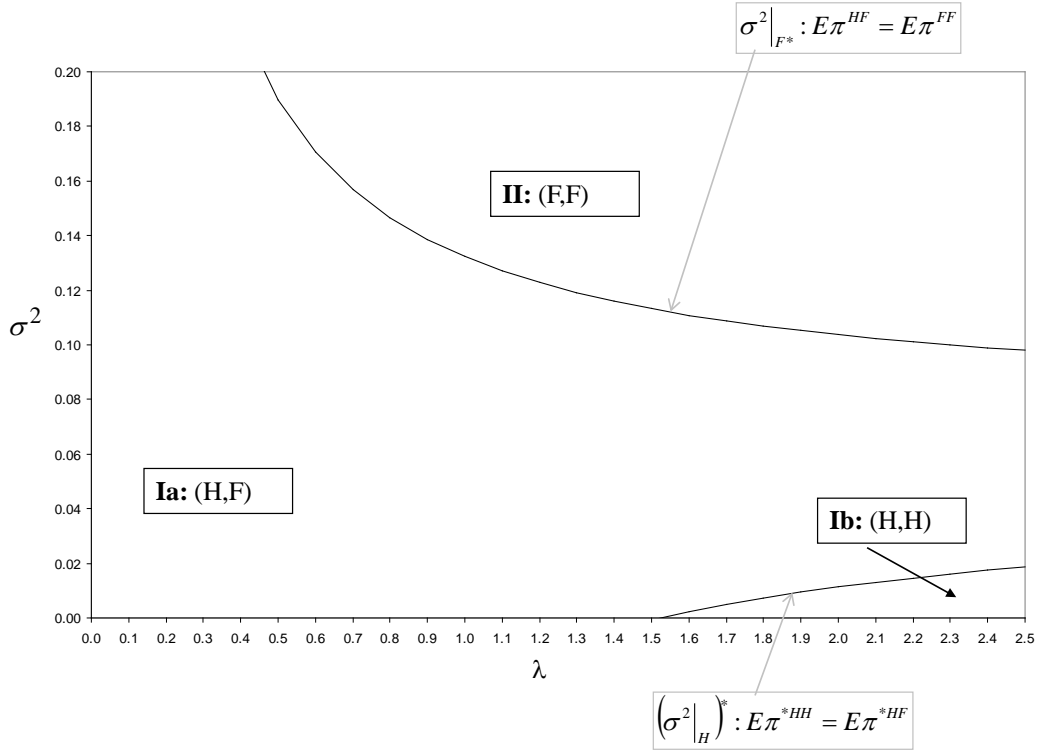
Figure 2: The location pattern of a monopolist from the Home country
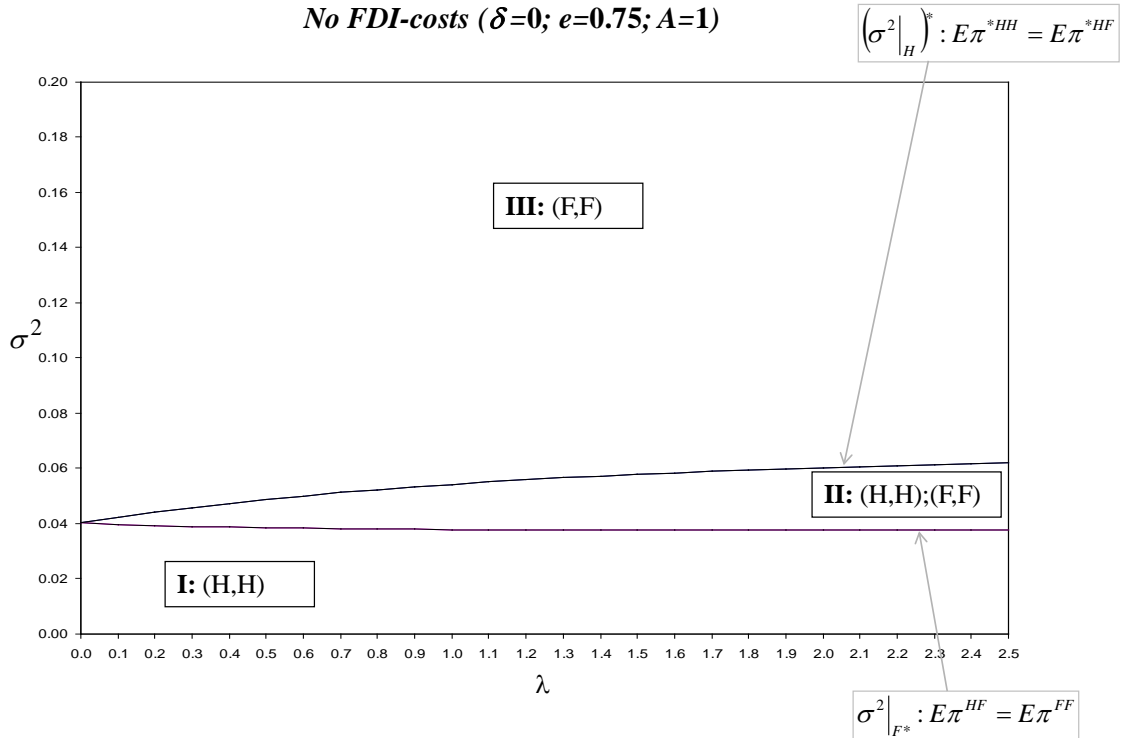**(δ=0.01; e=0; A=1)**
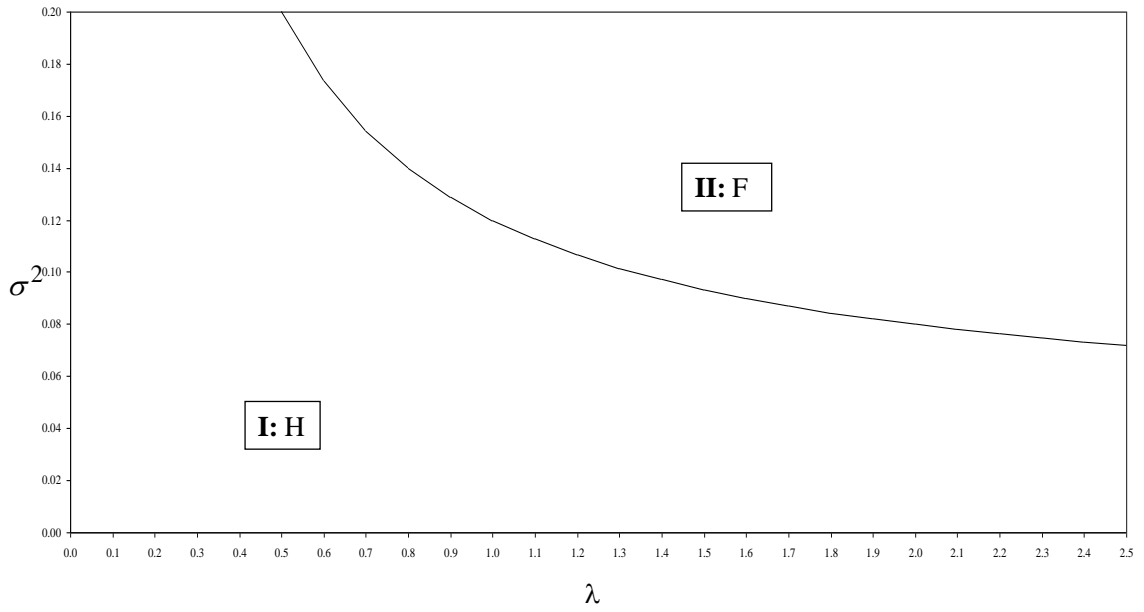
Figure 3a: The location pattern under Cournot competition: High FDI-costs
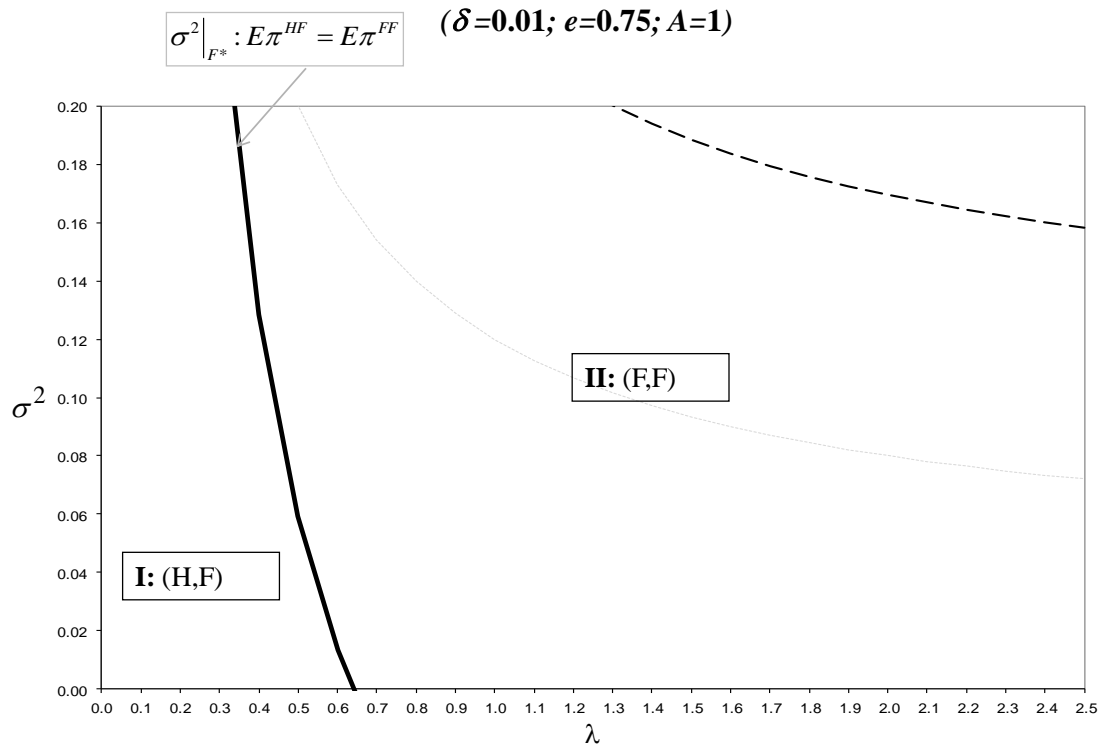**(δ=0.01; e=0.75; A=1)**
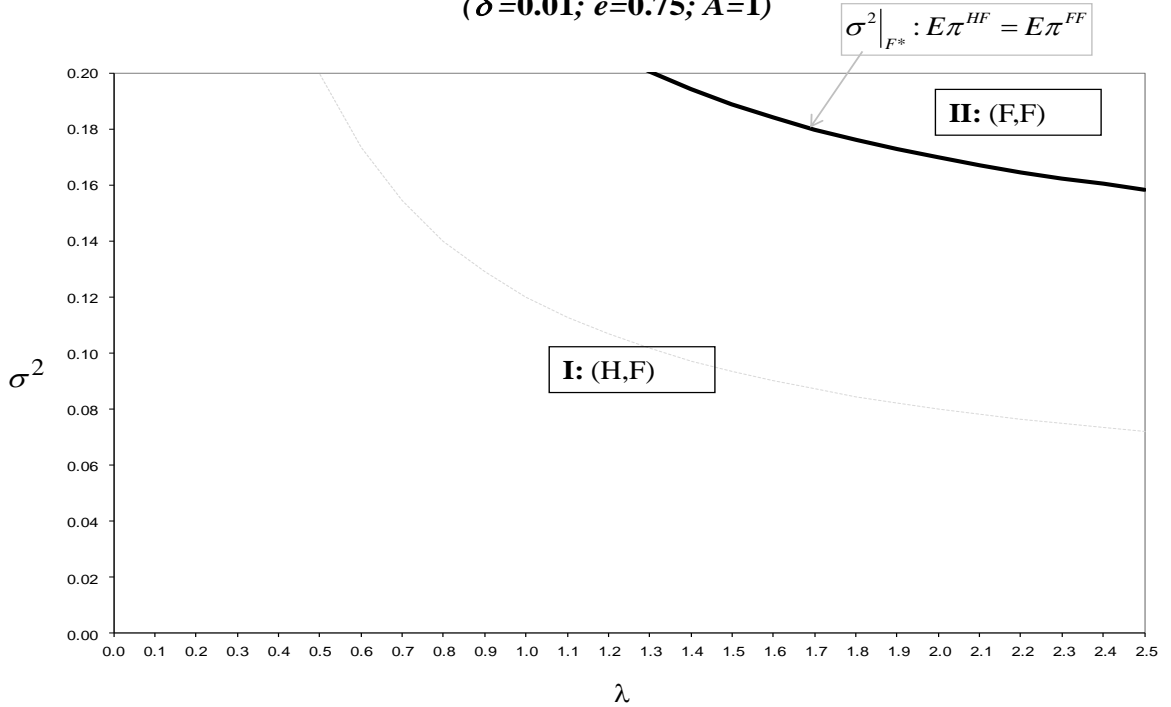
Figure 3b: The location pattern under Cournot competition with increased globalisation: Intermediate FDI-costs (δ=0.005; e=0.75; A=1)

$$\left.\sigma^2\right|_{F^*} : E\pi^{HF} = E\pi^{FF}$$

II: (F,F)

Ia: (H,F)

Ib: (H,H)

$$\left(\left.\sigma^2\right|_H\right)^* : E\pi^{*HH} = E\pi^{*HF}$$

Figure 3c: The location pattern under Cournot competition with complete globalisation: No FDI-costs (δ=0; e=0.75; A=1)

$$\left(\left.\sigma^2\right|_H\right)^* : E\pi^{*HH} = E\pi^{*HF}$$

III: (F,F)

II: (H,H);(F,F)

I: (H,H)

$$\left.\sigma^2\right|_{F^*} : E\pi^{HF} = E\pi^{FF}$$

Figure 4a: The location pattern under Bertrand competition: High FDI-costs
(δ =0.01; e=0.75; A=1)

$\sigma^2\big|_{F^*} : E\pi^{HF} = E\pi^{FF}$

II: (F,F)

I: (H,F)

σ^2

λ

Figure 4b: The location pattern under Bertrand competition with increased globalisation: Intermediate FDI-costs (δ=0.005; e=0.75; A=1)

$\sigma^2\big|_{F^*} : E\pi^{HF} = E\pi^{FF}$

II: (F,F)

I: (H,F)

σ^2

λ
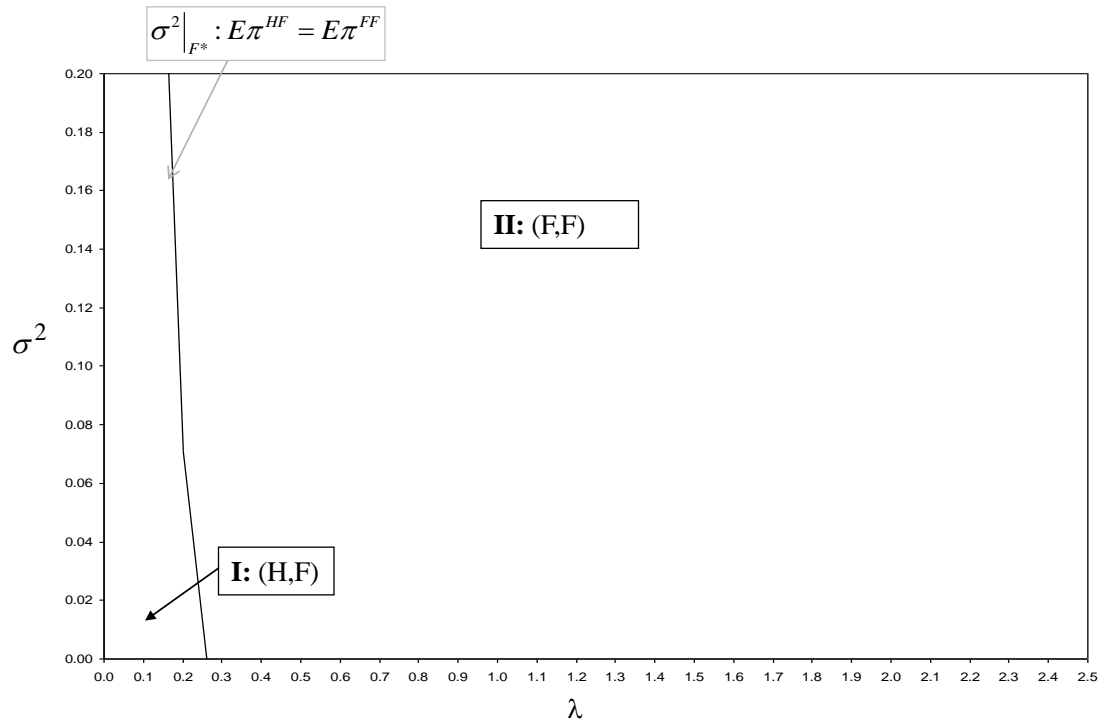
Figure 4c: The location pattern under Bertrand competition with complete globalisation: No FDI-costs ($\delta=0$; $e=0.75$; $A=1$)
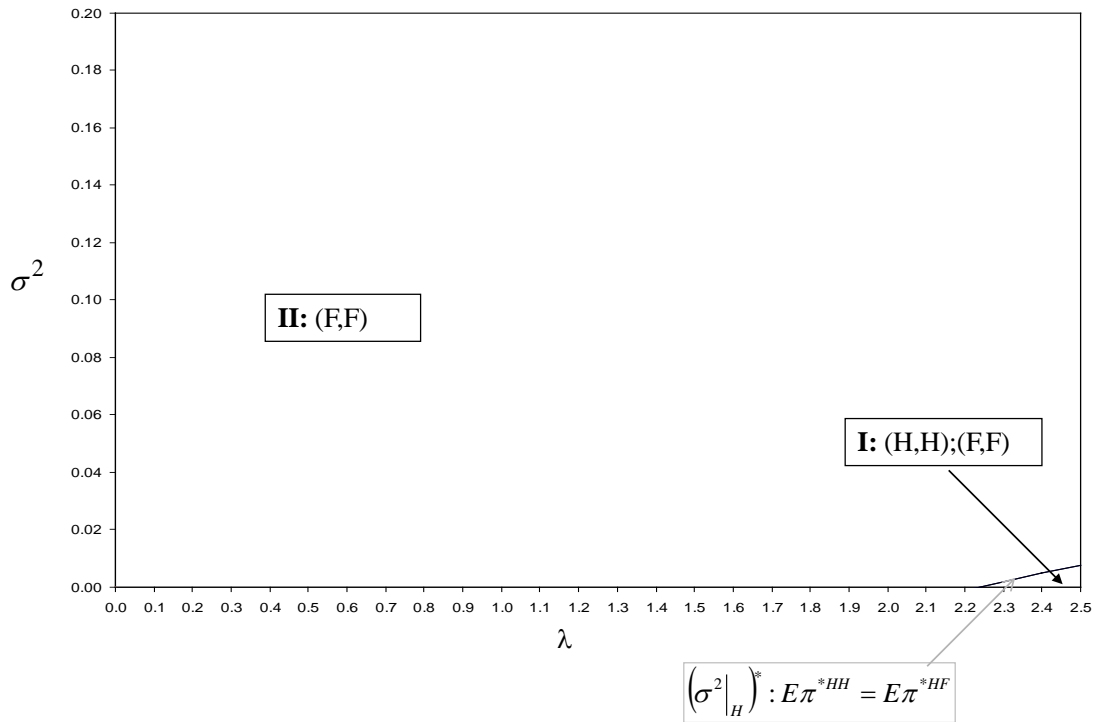
Table A.1: Decomposition of maximised expected profits for the Home firm

	MONOPOLY $(e = 0)$			
Location		**H**	**F**	
$E\pi$	$\theta^H + \gamma^H \sigma^2 - \varphi$		$\theta^F + \gamma^F \sigma^2 - (\varphi + \delta)$	
θ	$(q_1)^2 + (Eq_2)^2$			
γ	$1/[2(2+\lambda)]$		$1/4$	

	OLIGOPOLY $(0 < e < 1)$			
Location combination	**(H,H)**	**(H,F)**	**(F,H)**	**(F,F)**
$E\pi$	$\theta^{HH} + \gamma^{HH}\sigma^2 - \varphi$	$\theta^{HF} + \gamma^{HF}\sigma^2 - \varphi$	$\theta^{FH} + \gamma^{FH}\sigma^2 - (\varphi + \delta)$	$\theta^{FF} + \gamma^{FF}\sigma^2 - (\varphi + \delta)$

	COURNOT			
θ	$\left(1+\dfrac{\lambda}{2}\right)\left[(q_1^{HH})^2 + (Eq_2^{HH})^2\right]$ $-(1+\xi^{HH})\lambda Eq_2^{HH}q_1^{HH}$	$\left(1+\dfrac{\lambda}{2}\right)\left[(q_1^{HF})^2 + (Eq_2^{HF})^2\right]$ $-(1+\xi^{HF})\lambda Eq_2^{HF}q_1^{HF}$	$(q_1^{FH})^2 + (Eq_2^{FH})^2$	$(q_1^{FF})^2 + (Eq_2^{FF})^2$
γ	$\left(1+\dfrac{\lambda}{2}\right)\dfrac{(2-e+\lambda)^2}{(\Delta^{HH})^2}$	$\left(1+\dfrac{\lambda}{2}\right)\dfrac{(2-e)^2}{(\Delta^{HF})^2}$	$\dfrac{(2-e+\lambda)^2}{(\Delta^{FH})^2}$	$\dfrac{1}{(2+e)^2}$

	BERTRAND			
θ	$\left(\dfrac{1}{\beta}+\dfrac{\lambda}{2}\right)\left[(q_1^{HH})^2 + (Eq_2^{HH})^2\right]$ $-(1-\zeta^{HH})\lambda Eq_2^{HH}q_1^{HH}$	$\left(\dfrac{1}{\beta}+\dfrac{\lambda}{2}\right)\left[(q_1^{HF})^2 + (Eq_2^{HF})^2\right]$ $-(1-\zeta^{HF})\lambda Eq_2^{HF}q_1^{HF}$	$\dfrac{1}{\beta}\left[(q_1^{FH})^2 + (Eq_2^{FH})^2\right]$ $+\zeta^{FH}\lambda Eq_2^{FH}q_1^{FH}$	$\dfrac{1}{\beta}\left[(q_1^{FF})^2 + (Eq_2^{FF})^2\right]$
γ	$\left(\dfrac{1}{\beta}+\dfrac{\lambda}{2}\right)\dfrac{1}{(1+e)^2(2+\beta\lambda - e(1+\beta\lambda))^2}$	$\left(\dfrac{1}{\beta}+\dfrac{\lambda}{2}\right)\dfrac{(2+e)^2}{(1+e)^2(\nabla^{HF})^2}$	$\dfrac{1}{\beta}\dfrac{[2+e+(1+e)\beta\lambda]^2}{(1+e)^2(\nabla^{FH})^2}$	$\dfrac{1}{\beta}\dfrac{1}{(1+e)^2(2-e)^2}$

Note: $\xi^{HH} \equiv e^2/\Delta^{HH}$; $\xi^{HF} \equiv e^2/\Delta^{HF}$; $\Delta^{HH} \equiv (2+\lambda)^2 - e^2$; $\Delta^{HF} = \Delta^{FH} \equiv 2(2+\lambda) - e^2$; $\zeta^{HH} \equiv -e^2/\nabla^{HH}$; $\zeta^{HF} \equiv e^2/\nabla^{HF}$;

$\zeta^{FH} \equiv -2e^2/\nabla^{FH}$; $\nabla^{HH} \equiv (2+\beta\lambda)^2 - e^2(1+\beta\lambda)^2$; $\nabla^{HF} = \nabla^{FH} \equiv 2(2+\beta\lambda) - e^2(1+\beta\lambda)$.