

Sequential cross-border mergers[☆]

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Keywords:

Endogenous mergers ; Merger policy ; Tariff-jumping FDI ; Endogenous split of surplus

JEL classification:

F10

F13

L13

L41

A B S T R A C T

This paper proposes a sequential merger formation game to study how trade policy can influence firms' choice between intra-national and cross-border mergers in an international Cournot oligopoly with a cost structure à la Perry and Porter [Perry, M. and Porter, R.H., 1985. Oligopoly and the Incentive for Horizontal Merger. *American Economic Review* 75(1), 219–227.]. We find that the equilibrium market structure depends heavily on: (i) the level of trade costs; and (ii) whether or not active antitrust authorities are incorporated within the sequential merger game. In addition, it is shown that whenever mergers occur in equilibrium, they occur in waves and the merger wave comprises at least one cross-border merger.

Introduction

Cross-border mergers have clearly become an increasingly important characteristic of the industrial organization of most advanced countries. According to the UNCTAD's (2004) World Investment Report (henceforth WIR 2004), cross-border mergers constitute the key driver of global FDI since the late 1980s. In particular, "during the 1990s, cross-border mergers and acquisitions became a widely used mode of transnational corporation entry and expansion in virtually all industries. Indeed, they drove the FDI boom during the second half of the 1990s." (UNCTAD's WIR,

2004, p. 111).² Moreover, there is considerable evidence that cross-border mergers tend to occur in waves (see, for instance, Gaughan, 2002; Gugler et al., 2003; UNCTAD's, 2004 WIR (p. 142)).

Despite the obvious empirical relevance of cross-border mergers waves, previous literature has devoted very scarce attention to this topic.^{3,4} In this paper, an international Cournot oligopoly model is used to study the interplay between trade policy and the way merger waves shape the industrial structure. In particular, we analyze how trade policy can influence firms' choice between domestic and cross-border mergers in a sequential merger formation game with a cost structure à la Perry and Porter (1985).

[☆] We are grateful to the Editor Roman Inderst, an anonymous referee, Pierpaolo Battigalli, Antonio Cabrales, Giovanni Cespa, Jiawei Chen, Sven-Olof Fridolfsson, Massimo Motta, Matthias Messner, Tore Nilssen, Michele Polo and seminar participants at the 2006 IIOC (Boston), 2006 EARIE Conference (Amsterdam), 2006 Conference on Globalization and Corporate Restructuring (Stockholm), Bocconi University, Catholic University in Milan and at the Oslo University for their valuable comments on earlier versions of this paper. Financial support from Bocconi University and Fundação para a Ciência e a Tecnologia is gratefully acknowledged.

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² Gugler et al. (2003), in the largest cross-national comparison of the effects of mergers to date, analyze a total of 11574 worldwide merger deals during the period 1981 to 1998. They find that roughly one fifth of the deals are cross-border mergers (22%). In addition, their analysis shows that there is an upward trend in the percentage of mergers which are cross-border (this percentage rises from 21.2% in 1991–92 to 25.5% in 1997–98). Interestingly, this upward trend is particularly pronounced for EU countries, where the percentage of all mergers in the sample which were cross-border rose from 24.2% in 1991–92 to 39.8% in 1997–98.

³ Two noteworthy exceptions are Neary (2007) and Salvo (2004).

⁴ There exists, however, a strand of the literature on Multinational Enterprises (MNEs) that studies the choice between greenfield and acquisition FDI. See, for example, Caves (1996), Nobäck and Persson (2002) and Nocke and Yeaple (2008).

Apart from discussing the relationship between trade policy and merger formation, we regard the main contribution of this paper as being two-fold. First, while most of the existing models on mergers do not deal with the dynamics of the merger processes, as they simply compare the pre-merger situation with a post-merger situation,⁵ this paper considers a sequential merger formation process which takes into account that a merger might trigger other mergers. This allows us to study the formation of merger waves. Second, and perhaps most importantly, we incorporate active Antitrust Authorities (henceforth AAs) within our merger formation game. In particular, and consistent with what happens in most countries, we assume that whenever firms plan to be involved in a merger, they must notify the merger project to an Antitrust Authority (henceforth AA), which can either authorize or block the merger.^{6,7} The AA decision is taken in order to maximize total welfare, measured by the sum of consumers' and producers' surplus. In such a context, analyzing the optimal merger decisions involves not only a standard merger profitability analysis, but also a study of the strategic interaction between the merging firms and the AA which is called to take a decision on the merger proposal.

A relevant question that should be posed at this point is what should be the allocation of jurisdiction in merger control in our model. Shall a merger proposal be reviewed at the level of a supra-national AA (denoted SNAA) or should the merger proposal revision be conducted by a national AA (denoted NAA)? We assume that there exists a SNAA (say, a community-wide merger authority) in addition to two other NAAs, one for each (member) country. The SNAA examines merger proposals involving firms located in more than one country and maximizes total welfare, whereas NAAs examine merger proposals involving only firms from their specific country and maximize national welfare (the sum of consumers' and producers' surplus for national consumers and producers).⁸

We contrast two different games. In the first one, which we call the *laissez-faire* model, following Horn and Persson (2001b), we analyze the role of national and cross-border mergers as determinants of market structure in an international Cournot oligopoly model. The analysis of the endogenous determination of mergers is only based on a profitability analysis and the merger formation game does not incorporate active Antitrust Authorities. We depart from Horn and Persson (2001b), however, in the way the merger process is modelled. While in Horn and Persson (2001b) the merger process is treated as a (static) cooperative game of coalition formation, where the players are free to communicate and write binding agreements, in this paper the

merger process is modelled as a sequential noncooperative game of coalition formation. The sequentiality which characterizes the merger formation will allow us to discuss not only whether mergers occur in waves in equilibrium, but also how equilibrium merger waves are formed. Since benefits from a merger are, by construction, large in our model, the *laissez-faire* game will always lead to the creation of a worldwide monopolist.⁹ However, market concentration will tend to reduce consumers' surplus. So, in the second game, where we depart from the *laissez-faire* model by introducing active AAs in the model, it turns out that the formation of a worldwide monopolist may or may not be allowed by welfare-maximizing AAs which control mergers.

The analysis discloses that the equilibrium market structure depends heavily on: (i) the level of trade costs; and (ii) whether or not active Antitrust Authorities are incorporated within the sequential merger game. In addition, it is shown that whenever mergers occur in equilibrium, they occur in waves and the merger wave comprises at least one cross-border merger. Also, and contrary to common wisdom that trade liberalization induces waves of cross-border mergers, the richer model where AAs are encompassed as active players of the merger formation game shows that no mergers (and, therefore, no cross-border merger waves) occur in equilibrium when trade physical costs are at a sufficiently low level.

The intuition behind this last result is simple. Cross-border mergers have a positive effect on welfare since they reduce trade costs. In particular, the international firm resulting from a cross-border merger is able to avoid paying the trade physical cost since it owns a plant in each country (the so called *tariff-jumping effect* of cross-border mergers). On the other hand, there is an effect on prices: in this setting, a merger always leads to an increase in the market price due to the output contraction by the merging parties and this has the well known negative effect on welfare, the so called dead-weight loss. Now, for sufficiently low values of the trade cost, the *tariff-jumping effect* of cross-border mergers plays no significant role in the welfare analysis. So, this positive effect on welfare is countervailed by the negative welfare effect due to the increase in price, which in turn implies that any merger proposal is blocked by the relevant AA evaluating it.

The paper continues as follows. Section 2 introduces the basic model, which is chosen as the simplest possible setting where the elements we are interested in could emerge. Section 3 analyzes the *laissez-faire* model where the merger formation game is only based on a merger profitability analysis (there is no antitrust enforcement). Section 4 analyzes the richer and more realistic setting where active AAs are incorporated within the proposed merger formation game and discusses whether the full equilibrium outcome of the proposed sequential merger game will result in the socially optimal market structure. In Section 5 we study an extension to the model with active AAs where the impact of different efficiency levels on the qualitative results is investigated. Section 6 discusses the robustness of the main results of the merger formation game with active AAs, considering the case where the acquisition price is a result of the actions taken by firms (i.e., is endogenous), a different rule for allocating the jurisdiction in merger control, and a completely myopic merger review policy. Finally, Section 7 concludes.

Basic model

We consider an international oligopoly with four ex-ante identical firms located in two countries, a national country *A* and a foreign country *B*. Firms 1 and 2 are located in country *A*, whereas firms 3 and 4 are located in country *B*.

⁹ It is worth noting at this point that there is empirical evidence that mergers to monopoly indeed occurred and played a very important role in the shaping of the industry structure of advanced economies. According to Gaughan (2002), the first merger wave, which occurred in the period between 1897 and 1904, featured a transformation of the US economy from one of many small companies to larger companies, sometimes monopolistic firms dominating an industry. For that reason, it has been said that the first merger wave was a *merger toward monopoly period*.

⁵ Exceptions are Nilssen and Sorgard (1998), Gowrinsankaran (1999), Fauli-Oller (2000), Horn and Persson (2001a)), Salvo (2004) and Fridolfsson and Stennek (2005).

⁶ Antitrust merger policy and enforcement are very important determinants of the structure of industries. However, as highlighted by Besanko and Spulber (1993, p. 2), "the theoretical literature in economics has generally focused on the profit and welfare effects of horizontal mergers (e.g. Perry and Porter, 1986) and has not emphasized the policy-making and enforcement aspects of antitrust."

⁷ Merger review in a dynamic context is also analyzed in Motta and Vasconcelos (2005) and in Nocke and Whinston (2007). Like the current paper, these studies investigate situations where the AA adopts a forward-looking review policy, i.e., forecasts the (final) welfare effects of the proposed merger given the fact that this merger might trigger future mergers. However, in contrast to the current paper, these two studies: (i) limit the discussion on mergers involving firms from the same market (country); and (ii) restrict attention to consumers' surplus maximizing AA.

⁸ In the European Union a merger has national or community dimension depending on where the sales are realized. In particular, a merger is national, and therefore should be examined by the relevant Member State AA, if "each of the undertakings concerned achieves more than two-thirds of its aggregate Community-wide turnover within one and the same Member State" (see Council Regulation (EC) No 139/2004 of January 2004 on the control of concentrations between undertakings (the EC Merger Regulation), Official Journal of the European Union L24, 29.01.2004, pages 1–22.). So, by assuming that the AA in charge of studying a merger depends on the nationality of the firms, we are implicitly assuming that, when a merger between two firms from the same country is proposed, more than two-thirds of each undertaking's turnover is realized within that country (Member State), while this might not be the case. However, the analysis in Section 6.2 will suggest that this does not seem to be a crucial assumption of the model.

The industry is assumed to be symmetric in terms of market demand. We adopt the segmented market hypothesis, where firms compete *à la Cournot*, maximizing profits by choosing sales in each market independently. Demand is assumed to be linear, with the inverse demand function in market j , $j=A, B$, given by

$$p^j(X^j) = a - X^j, \quad (1)$$

where p^j and X^j denote, respectively, price and total sales in country j , and $a > 0$ is a demand parameter.

Following Perry and Porter (1985), we assume that what distinguishes firms is the amount of capital they own. The total supply of capital in the industry is assumed to be fixed, which is normalized to be one.¹⁰ Let k_i be the fraction of the industry capital stock owned by firm i . In addition, let x_i^j denote the quantity sold by firm i in market j . The cost function of a firm that produces x_i units of output, where $x_i = x_i^A + x_i^B$, and owns a fraction k_i of the capital stock is given by¹¹

$$C_i(x_i, k_i) = \frac{2(x_i)^2}{k_i}, \quad (2)$$

where $k_i \in \{1/4, 1/2, 3/4, 1\}$ and $\sum_i k_i = 1$. Notice that the marginal cost function is linearly increasing in output and rotates about the origin as the proportion of capital owned by firm i (k_i) increases or decreases. So, in this setting a merger brings together the capital of the merging firms under a larger resulting firm whose marginal cost is lower than that of any of the merging parties for any positive given level of output, thereby creating additional incentives to merge.¹² In addition, the gains from a merger are divided between the merging firms in proportion to the stock of capital they each own.¹³

Assume that firms play a sequential merger formation game before Cournot competition takes place in the oligopolistic international market. The game starts from a status quo symmetric industry structure where each of the four firms is endowed with 1/4 of the industry capital stock. Two types of firms can result from this game: national and international firms. A merged entity is national if it is composed of merging parties which all belong to the same country. A merged firm is instead international if it results from the combination of merging parties coming from both countries. Assume also that the physical trade costs associated with exporting one unit of output from one country to the other are exogenous and equal t .

In what follows, we make the following assumptions.

Assumption 1. Assume that $a > 19t$.

Assumption 2. Only bilateral mergers can occur and each production plant continues to exist after a merger.

The first assumption is simply to ensure that, at the status quo industry structure, trade between countries takes place. With regards to the second assumption, two comments are in order. First, the fact that we restrict attention to bilateral mergers does not imply that merger waves are ruled out. It simply implies that merger waves must consist of a series of bilateral mergers. Second, the fact that each

production plant continues to exist after a merger implies that in case there is a cross-border merger, the resulting international firm is able to serve the two markets without incurring any trade cost (this is the so called *tariff-jumping effect* of cross-border mergers).

Let us now introduce some notation regarding the identification of different market structures which can result from the merger formation game. Let a market structure M_i be a partition of the set of firms $N = \{1, 2, 3, 4\}$ into coalitions. Due to the symmetry of the model and following Horn and Persson (2001b), the feasible possible final market structures can be divided in the following nine categories of market structures:

1. No merger: $M_A = \{1, 2, 3, 4\}$.
2. One domestic national merger: $M_B = \{12, 3, 4\}$.
3. One foreign national merger: $M_C = \{1, 2, 34\}$.
4. One cross-border merger without bias: $M_D = \{13, 2, 4\}$.
5. Cross-border merger with a domestic bias: $M_E = \{123, 4\}$.
6. Cross-border merger with a foreign bias: $M_F = \{134, 2\}$.
7. Two national mergers: $M_G = \{12, 34\}$.
8. Two cross-border mergers: $M_H = \{13, 24\}$.
9. Complete Monopoly: $M_I = \{1234\}$.

In what follows, we study two distinct merger formation models. In the first one, mergers that increase the joint profit of its participants will take place.¹⁴ In the second model, we study a richer (and more realistic) game where in order for a merger to go through, it has to be not only desired by parties, but also accepted by the relevant AA.¹⁵ So, the equilibrium outcome of the proposed merger game depends both on a profitability analysis and on the strategic interaction between the merging parties and the AAs.

The *laissez-faire* model

In this section, we follow the previous literature where Antitrust Authorities are not incorporated in the merger formation game, but we depart from it in that we allow for a merger to complete monopoly (see, for instance, Horn and Persson (2001b)¹⁶). More specifically, we analyze a very simple sequential merger formation model where the merger process is fully endogenized.¹⁷ In particular, starting from a situation with four ex-ante identical firms, any two-firms merger is allowed and the merger process follows the following rules. In the first stage, firm 1 is given the opportunity to merge with its national rival firm 2 or with a foreign firm (say, firm 3). If firm 1 decides not to merge, product market competition takes place between the four firms in the status quo industry structure. If instead firm 1 does merge with a rival, then, in the second stage, one of the firms not involved in the first merger is given the opportunity to merge with any of its rivals. If the game arrives at the second stage, we let firm 2 be the firm which has the opportunity of merging at that stage, in case it was not involved in the merger that took place in the first stage. Otherwise, firm 3 is the one which has the power to decide whether to merge with a rival in the second stage. Lastly, after this second (eventual) merger, there is a final

¹⁰ As pointed out by Perry and Porter (1985), this assumption rules out the possibility of de novo entry into the industry.

¹¹ This is a special case of the cost structure proposed by Perry and Porter (1985). A similar cost structure was used by Vasconcelos (2005) to analyze the possible pro-competitive effects of a merger.

¹² It is important to note, however, that a merger in this setting "generates no synergies" in the sense of Farrell and Shapiro (1990). As pointed out by these authors, in a quadratic cost model *à la* Perry and Porter (1985), after a merger "the combined entity M can perhaps better allocate outputs across facilities ("rationalization"), but M 's production possibilities are no different from those of the insiders (jointly) before the merger" (p. 112).

¹³ In Section 6.1 we study an extended version of our (endogenous mergers) game where the model predicts how merging firms split the surplus. The qualitative results are shown to be largely consistent with the ones obtained when using this simple (but exogenous and unmodelled) sharing rule.

¹⁴ In Cournot competition, mergers are usually unprofitable with symmetric firms and constant marginal cost (Salant, Switzer and Reynolds, 1983). However, it is well-known that merger profitability can increase if costs are quadratic and firms are asymmetric. These are exactly the two sources of merger profitability explored in this (first) merger formation model. In particular, what introduces the asymmetry in the setup is the existence of trade costs.

¹⁵ Some extensions to this richer model (e.g. endogenizing the acquisition price) are discussed in Section 6.

¹⁶ Even though, in their model, whenever a monopoly makes a larger profit than the aggregate profit of all firms in more decentralized structures, a monopoly would be formed, the authors assume that a worldwide monopoly would never be permitted by competition authorities.

¹⁷ Notice, however, that the way we model the merger process is different from Horn and Persson (2001b). While in their paper, the merger process is treated as a (static) cooperative game of coalition formation, in the current paper it is modelled as a sequential noncooperative game of coalition formation.

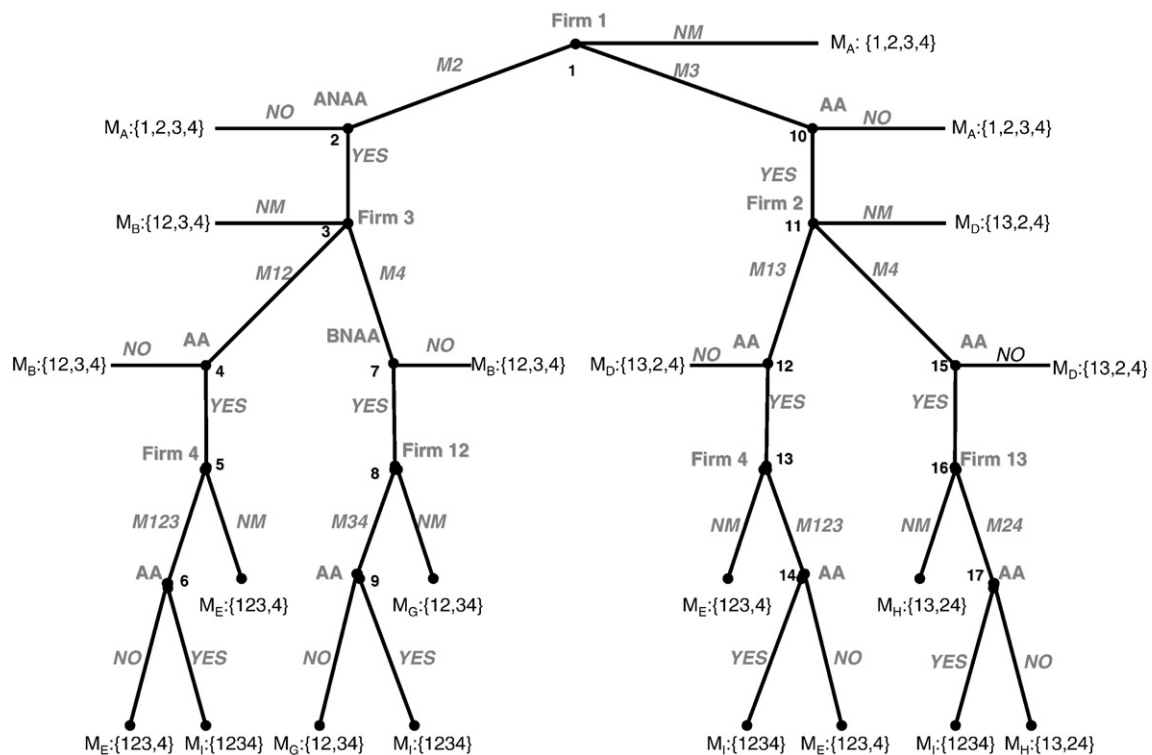


Fig. 1. The merger game with active AAs.

stage of the game where we let the outsider to this second merger have the opportunity to merge with its rivals into a complete monopoly.

We assume that, at each stage of the game, the firm making the proposal will opt for the merger that yields it the highest profits subject to the condition that the merger must also yield an increase in profits to the firms that receive the proposal.

Some additional notation must be introduced at this point. Let Π_i , M_K denote the profit earned by firm i when the equilibrium market structure is M_K . The following definition will play a central role in the identification of equilibrium market structures.

Definition 1. Market structure M_K is said to be strictly preferred to market structure M_T by firm i , denoted $M_K \succ_i M_T$, if and only if $\Pi_{i,M_K} > \Pi_{i,M_T}$.

The equilibrium concept is subgame perfect Nash equilibrium (henceforth SPNE) in pure strategies and the final equilibrium outcome of this merger formation game is put forward in the following proposition.

Proposition 1. The final equilibrium industry structure induced by the laissez-faire sequential merger formation game is a complete monopoly, $M_I = \{1234\}$, for all $a > 19t$.

Proof. See Appendix B.1. \square

So, benefits from merging in our set up are large enough so that the sequential merger formation game always ends up leading to the formation of a worldwide monopolist. It is well known, however, that since mergers in our setting “generate no synergies” in the sense of Farrell and Shapiro (1990), they will always lead to a price increase (reduction in consumers’ surplus). This suggests that we if enrich the merger formation process so as to encompass welfare-maximizing AAs in the sequential merger game, it may no longer be the case that the sequential game will lead to a worldwide monopolist. In addition, it may well be the case that the presence of these active AAs may also affect the likelihood of an equilibrium with cross-border mergers. These intuitions will be confirmed in the next section.

The model with active antitrust authorities

In this section, starting from the same status quo industry structure $M_A = \{1, 2, 3, 4\}$, our aim is to investigate how trade policy influences firms’ choices between domestic and cross-border mergers in a situation where every merger proposal has to be submitted for approval to the relevant AA. So, in this context, and as already mentioned, the outcome of the merger formation game will depend not only on a merger profitability analysis, but also on the strategic interaction between potential merger parties and the AAs.

Three preliminary remarks are in order at this point. First, we assume that there are no administrative costs that firms must incur to submit a merger proposal to the relevant AA. Second, we assume that whenever a firm anticipates that a proposal is going to be rejected, then it does not even make it. Third, in the current section, both the SNAA and the NAAs are assumed to assess the merger according to the total welfare standard.¹⁸

Before Cournot competition takes place, firms play a six-stage game with the AAs, involving the following sequence of actions:

- In the *first stage*, firm 1 is given the opportunity to merge either with its national rival firm 2 or with the foreign firm 3. In the former case, it will have to ask Country A NAA (denoted ANAA) for authorization. In the latter, it will have to ask the SNAA for authorization. If no merger is proposed, the game ends and Cournot competition takes place amongst the four firms.
- In the *second stage*, the relevant AA chooses whether to accept or to refuse the merger proposal. If it does not authorize it, then product market competition occurs between the four firms in the status quo industry structure; otherwise the game moves to the following stage.
- In the *third stage*, if the relevant AA has approved the merger at stage 2, then one of the firms not involved in the first merger is given

¹⁸ As mentioned above, the SNAA examines merger proposals involving firms located in more than one country and maximizes (global) total welfare, whereas NAAs evaluate merger proposals involving only firms from their specific country and maximize national total welfare.

the opportunity to propose another merger. We let firm 3 be the firm which has the opportunity to propose a new merger with one of the other two firms in the industry, in case it was not involved in the previous merger. Otherwise, firm 2 is the one which has the power to propose a new merger with one of the other two firms in the industry. If no merger is proposed, then the merger game stops and market competition occurs. If instead there is a merger proposal, that merger proposal has to be submitted to the relevant AA for authorization.

- In the *fourth stage*, the relevant AA decides whether to authorize the merger proposed in the previous stage. If it vetoes the merger, the merger game stops and product market competition occurs. Otherwise, the game moves to the following stage in which a last merger round takes place.
- In the *fifth stage*, the firm not involved in the (second) merger proposed in the third stage (and approved in the fourth stage by the relevant AA) is given the opportunity to seek a merger to complete monopoly. If this firm decides not to propose a merger to monopoly, the merger game stops and market competition takes place. Otherwise, it will have to ask the SNAA for authorization.
- In the *sixth stage*, the SNAA decides whether or not to authorize the merger to complete monopoly and, after its decision has been taken, product market competition occurs.

The possible market structures that can arise when this (richer) merger formation game is played are illustrated in Fig. 1.

Some additional notation is needed at this point. Let TW_{M_K} denote total welfare under market structure M_K . In addition, let W_{j,M_K} , where $j=A, B$, denote the country j national welfare (the sum of consumers' and producers' surplus for national consumers and producers).

Definition 2. (i) Market structure M_K is said to dominate market structure M_T from the SNAA point of view, denoted $M_K >_{SN} M_T$, if and only if $TW_{M_K} > TW_{M_T}$; and (ii) Market structure M_K is said to dominate market structure M_T from the point of view of country j NAA, $j=A, B$, denoted $M_K >_j M_T$, if and only if $W_{j,M_K} > W_{j,M_T}$.

Proposition 2 identifies the final equilibrium industry structures which are induced by this merger formation game.

Proposition 2. The final equilibrium industry structures induced by the merger formation game with active AAs are: (i) $M_I = \{1234\}$, if $23.29t \leq a < 63.55t$; (ii) $M_H = \{13, 24\}$ if $19t < a < 23.29t$ or $63.55t \leq a < 470.92t$; and (iii) $M_A = \{1, 2, 3, 4\}$ if $a \geq 470.92t$.

Proof. See Appendix B.2. \square

This result is illustrated in Fig. 2.

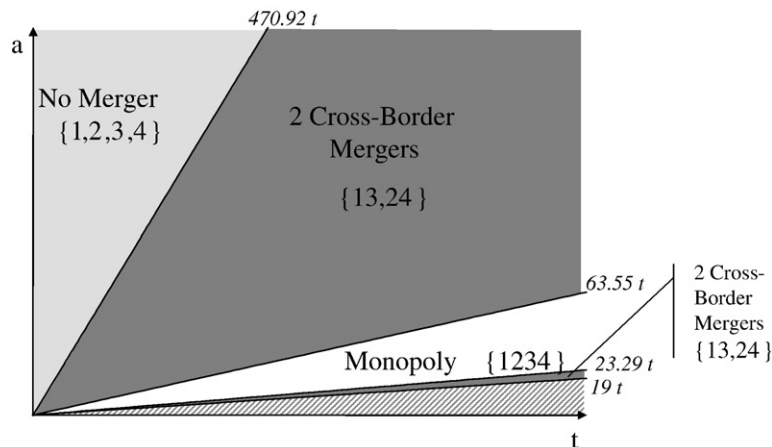


Fig. 2. Equilibria of the game with AAs.

The results are very different from the ones regarding the benchmark *laissez-faire* model presented in the previous section. In particular, four important messages can be obtained from the analysis of Fig. 2.

Firstly, notice that whenever mergers occur in equilibrium, they occur in waves. Secondly, the equilibrium merger wave comprises at least one cross-border merger. Thirdly, for $23.29t \leq a < 63.55t$, a wave of three mergers occurs in equilibrium leading to a complete monopolization of the industry. Lastly, and perhaps most importantly, the analysis reveals that no merger will occur for sufficiently low values of the trade physical cost t , which contrasts with the common wisdom that cross-border merger waves tend to be triggered by trade liberalization processes.

The intuition that underlies this last result is simple. When evaluating the welfare impact of a given merger at the second stage of the game, the relevant AA takes into account the relative magnitude of the two following countervailing effects induced by the merger. First, since quantities are strategic substitutes, after the merger, the merging parties contract output. Each merging party internalizes the negative externality it inflicts on the other merger participants when it makes its output decision and, as a result, the combined output of the insiders decreases, leading to an increase in prices in market A for a national merger and to an increase in prices in both countries for a cross-border merger. Second, in case of a cross-border merger, there is the *tariff-jumping effect* of the merger, which stems from the fact that international firms are able to avoid paying the trade physical cost since they have a plant in each country. This gain is clearly reduced as the trade tariff falls.

Now, if we take the demand parameter \hat{a} as given and consider a sufficiently low value for the trade cost t , then clearly the second effect plays no significant role in the welfare analysis performed by the relevant AA. As a consequence, for small values of the trade cost t , the negative effect on consumers' surplus plays a decisive role in that welfare analysis. This in turn implies that, starting from the no merger industry structure $M_A = \{1, 2, 3, 4\}$ and considering the cases in which the physical trade cost assumes sufficiently low values, any merger proposal will be blocked by the relevant AA at the second stage of the game.

In concluding this section, let us compare the equilibrium outcomes induced by our endogenous merger formation game with the socially optimal ones. In order to do so, we investigate what would be, from an ex-ante point of view, the SNAA first-best choice if it could choose amongst all market structures that can result from the merger game. The outcome of this exercise is illustrated in Fig. 3.

So, comparing Figs. 2 and 3, one concludes that the proposed merger game introduces a distortion from the SNAA first-best scenario. In particular, there exists a region in Fig. 2 where the worldwide monopolist is the final equilibrium outcome, while $M_I =$

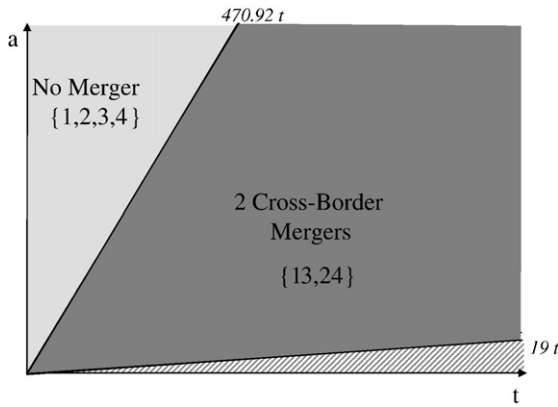


Fig. 3. SNAA first-best market structures.

{1234} is never a socially optimal market structure.¹⁹ The reason why, in the proposed merger formation game, the AAs may decide to accept a complete monopolization of the market even if it would not be ex-ante optimal to do so is simply the fact that they carry out comparisons (from the point of view of total welfare) between $M_I = \{1234\}$ and a subset of the possible final market structures.²⁰ In addition, and perhaps more interestingly, it turns out that a social planner would not allow any mergers when transportation costs are (sufficiently) low, just as in the equilibrium of the game with AAs (but differently from the “laissez-faire” equilibrium).

Extension: efficiency levels

In this section, we study an extension to the model with active Antitrust Authorities introduced in Section 4, where the impact of different efficiency levels on the qualitative results is investigated.

As mentioned above, our cost structure is a special case of the one proposed by Perry and Porter (1985). In particular, the cost function of a firm owning k_i units of capital is:

$$C_i(x_i, k_i, e) = \frac{e(x_i)^2}{2k_i}, \quad (3)$$

where $k_i \in \{1/4, 1/2, 3/4, 1\}$, $\sum_i k_i = 1$ and $e \geq 0$. In the previous analysis we have assumed that $e = 4$.

Notice that from Eq. (3), simple algebra shows that

$$\frac{\partial^2 C_i}{\partial x_i \partial k_i}(x_i, k_i, e) = -\frac{ex_i}{k_i^2}. \quad (4)$$

We analyzed the SPNE of the six-stage game presented in Section 4 for different values of e and concluded that there are two different classes of equilibrium outcomes: (i) $e \in \{0, 1, 2\}$; and (ii) $e > 4$.

First, for $e \in \{0, 1, 2\}$ the results are qualitatively the same. In particular, given a demand parameter a , the equilibrium market structure is “no merger” for low values of the trade cost t and a wave of two cross-border mergers for t sufficiently high. The next proposition formalizes this result for $e = 2$.

Proposition 3. *The final equilibrium industry structures induced by the merger formation game with active AAs and $e = 2$ are: (i) $M_H = \{13, 24\}$ if $11t < a < 155.37t$ and (ii) $M_A = \{1, 2, 3, 4\}$ if $a \geq 155.37t$.*

¹⁹ Even if complete monopolization of the industry is a priori forbidden, it is straightforward to show that there still exists a distortion from the SNAA first-best choice.

²⁰ The equilibrium path leading to the complete monopolization of the market is a sequence of two national mergers, followed by a third merger. The AAs then have to compare the monopoly market structure with the other market structures along that path; so they cannot consider the sequence of two cross-border mergers as an alternative (which in the end turns out to be superior in terms of total welfare).

Proof. Omitted. \square

Second, for $e > 4$ we obtained an equilibrium outcome qualitatively equivalent to the one presented in Fig. 2 ($e = 4$).

The difference between the equilibrium outcomes in the two cases just described is due to the fact that in the first class of results (i.e., for “low” values of e), the SNAA will not approve a merger (between firms 12 and 34) leading to complete monopolization of the market.

It might be not completely clear, however, how this decision is related to the level of firms’ efficiency, e . The intuition behind this result is as follows. In case e is “high”, total cost is high (firms are inefficient) and, therefore, the market price is also high in market structure {12, 34}. This implies that in the pre-merger situation, firms are operating in the high price elasticity region of the (linear) demand curve, which will make the worldwide monopolist resulting from a merger between firms 12 and 34 unable to raise the price too much. If instead e is “low”, the equilibrium price corresponding to market structure {12, 34} will be low. So, pre-merger, firms will be operating in the region of the demand curve where price elasticity is low. This being the case, after a merger, the resulting monopolist will be able to increase price more than in situations where parameter e assumes high values. Hence, the lower the value assumed by parameter e , the stronger will be the negative effect on consumers’ surplus due to the increase in concentration. This explains why the SNAA does not accept the merger between firms 12 and 34 for low values of e .

We can conclude that, regardless of the value of e , we have that: (i) no mergers occur in equilibrium whenever the trade physical costs are sufficiently low; and (ii) whenever mergers occur in equilibrium, they encompass cross-border merger waves. In addition, when the parameter e is sufficiently high, it may as well happen that the final equilibrium outcome of the merger game is a complete monopolized industry. So, our qualitative results proved to be robust to changes in the level of efficiency.

Discussion

Endogenous acquisition price

A limitation of our analysis is the assumption on the exogenous sharing rule: we have assumed that the merged entity’s profits are distributed between the merging parties in proportion to the capital holdings of each participant, while it is more reasonable to have the acquisition price as being a result of the actions taken by players.²¹

To address this issue we study a modified version of our endogenous mergers game where the model predicts how merging firms split the surplus.²² In particular, in this modified version of our

²¹ It is worth remarking that in a previous version of the paper the qualitative results have been shown to be robust to the use of an alternative exogenous sharing rule, inspired on the Shapley value reasoning. For the sake of illustration, take the initial market structure M_A and suppose firms 1 and 2 merge, leading to the final industry structure M_B . According to this alternative (and richer) exogenous sharing rule, firm 1’s share of the profits of the merged entity (firm 12) is the average of firm 1’s incremental contribution to the merger (i.e., $\pi_{12,MB} - \pi_{2,MA}$) and its incremental contribution when entering the market (i.e., $\pi_{1,MA} - 0$). Therefore, firm 1’s share of firm 12’s profit if is given by $\pi_{1,MB} = \frac{1}{2}(\pi_{12,MB} - \pi_{2,MA}) + \frac{1}{2}(\pi_{1,MA} - 0) = \frac{1}{2}(\pi_{12,MB} + \pi_{1,MA} - \pi_{2,MA})$. So, although exogenous, this alternative sharing rule takes into account the outside option of each merging party in the division of the surplus amongst firms involved in a merger.

²² Predicting the split of the surplus amongst merging parties is an issue of utmost importance which has been neglected by most papers in the literature on endogenous merger formation. Two noteworthy exceptions are Inderst and Wey (2004) and Fridolfsson (2007). Inderst and Wey (2004) introduce a model of takeover where (symmetric) potential acquirers participate in an auction in which the target firm is allowed to set an optimal reserve price. A key result of their model is that if both insiders and outsiders gain from a merger, then the acquirer is made strictly worse off than an outsider, i.e., a free-rider problem between acquirers arises. This free-rider problem, which is exacerbated by the target’s optimal reserve pricing policy, leads to a takeover with probability less than one. Fridolfsson (2007), on the other hand, considers a framework where mergers are mutually excluding and highlights several mechanisms which lead firms to pursue mergers that are harmful to consumers, i.e., anti-competitive mergers, rather than pro-competitive ones. Key to his findings is the fact that the endogenous split of surplus in the former type of merger is more favorable to bidding firms.

game, we assume that, at each merger stage, the firm who has the right to propose the merger makes a take-it-or-leave-it offer to the chosen target firm.²³

The qualitative results derived in Section 4 turn out to be *largely confirmed* by this modified merger formation game, the unique difference being that when the merger acquisition price is endogenized, there is *no region* of parameter values for which the monopoly industry structure M_I is the final equilibrium outcome.²⁴ The reason for this is, however, easy to understand and it is related to the way producers' surplus is allocated between the two nationalities. In Section 4 the merger wave leading to complete monopoly is composed of two sequential national mergers followed by a final merger to monopoly. In addition, the distribution of profits between merging parties was simply based on the "accounting" value of the capital each participant brings to the table. Therefore, when BNAA is called to decide (at node 7 of Fig. 1) on a (second national) merger between firms 3 and 4, it accepts the merger for $a < 63.55t$ since it anticipates that the merger process will end up in a complete monopoly ultimate industry structure and the induced increase in country B's profits (given by $(1/2)\Pi_{1234,M_I} - \Pi_{3,M_B} - \Pi_{4,M_B}$) more than compensates for the induced decrease in consumers' surplus.

Notice, however, that when the producers' surplus is instead distributed on the basis of the (more reasonable) "market" value of the capital belonging to each merging party (as it is the case in the modified game studied in the current section), then the opportunity cost of the firm receiving the bid must be taken into account in that distribution, which will obviously affect the share in profits of an international merged firm going to each country. Take the same merger proposal mentioned above (that in which firm 3 proposes a merger with firm 4). Now, when BNAA is called to review that proposal, it anticipates that if it decides to approve the merger and if, subsequently, firm 12 bids in a take-it-or-leave-it manner for firm 34, then the acquisition price at this second merger will be Π_{34,M_C} (i.e., firm 34's outside option), which is exactly the total profit earned by country B's firms in case the merger process ends up in a complete monopoly industry structure. This in turn implies that, in the revised version of the model where the acquisition bid is endogenously determined, the increase in country B's profits when we move from market structure $M_B = \{12, 3, 4\}$ to $M_I = \{1234\}$ (now given by $\Pi_{34,M_C} - \Pi_{3,M_B} - \Pi_{4,M_B}$) would never compensate for the induced decrease in consumers' surplus. This explains why in the extended version of the merger formation model where the acquisition price is endogenous, BNAA makes a different decision when reviewing a merger proposal where firm 3 proposes a merger with 4, ruling out a complete monopoly industry structure as a final equilibrium outcome of the merger game.²⁵

²³ As the reader can easily anticipate, the main difficulty in analyzing such a modified version of our model is to understand what is the outside option of the chosen target firm (i.e., what would be its payoff in the continuation game in case it said "no" to the merger proposal). A detailed description of the assumed bargaining protocol is provided in Appendix C.

²⁴ The final equilibrium industry structures induced by the merger formation game with active AAs and endogenous acquisition price are: (i) $M_H = \{13, 24\}$ if $19t < a < 470.92t$; and (ii) $M_A = \{1, 2, 3, 4\}$ if $a \geq 470.92t$.

²⁵ It is important to note, however, that we have also analyzed another extended version of our merger formation game where apart from endogenizing the acquisition price, we also assume that all merger proposals are reviewed by the SNAA. In that version of the model, the final equilibrium outcome fully confirms the one depicted in Fig. 2. In particular, the region of parameter values for which $M_I = \{1234\}$ is the final equilibrium outcome remains. The intuition is simple. When called to make a decision on a merger between firms 3 and 4, the SNAA does not care about the way the profits are allocated when moving from the current market structure to the ultimate market structure this merger will lead to if approved (it only cares about the increase in profits in the continuation game if it approves the proposed merger). This being the case, for some parameter region, the SNAA will approve the proposed merger since it anticipates that the ultimate market structure this merger will lead to is the complete monopoly and, therefore, the increase in global profits will more than compensate for the decrease in consumers' surplus resulting from the monopolization of the industry.

EU allocation of jurisdiction in merger control

Another limitation of our analysis is that we have assumed that the allocation of jurisdiction in merger control in our model depends on the nationality of the firms. However, in Europe, for instance, the European Commission (EC) Merger Regulation makes a distinction between mergers that have and mergers that do not have a "Community dimension" depending on *where the sales are realized*.²⁶ In particular, a merger is national, and therefore should be examined by the relevant Member State AA, if "each of the undertakings concerned achieves more than two-thirds of its aggregate Community-wide turnover within one and the same Member State".²⁷

We developed a modified version of our endogenous merger game where the rule for the allocation of jurisdiction is the EU one. In this modified version of our model, we will obviously still have the SNAA deciding on any cross-border merger. However, as far as the two possible national merger proposals are concerned,²⁸ according to the EU rule described above, they will only be judged by the national AA in case at least two-thirds of the sales are achieved within the country.²⁹

The qualitative results obtained in Section 4 turn out to be fully confirmed in this modified version of our sequential merger formation game. In particular, there are equilibrium outcomes with no cross-border mergers (and even no mergers of any sort), and equilibria with two cross-border mergers, but no equilibria with just one cross-border merger. In addition, low transportation costs are more likely to lead to equilibria with no mergers. Therefore, the (admittedly simplified) way we have chosen to allocate jurisdiction in merger control in our basic model does not appear to be a crucial assumption in the analysis.

Myopic antitrust authorities

In the previous analysis it has been implicitly assumed that the AAs were forward looking, i.e., whenever faced with a merger proposal, the relevant AA was able to correctly anticipate the *ultimate* market structure this merger would lead to. So, it is natural to wonder what would be the equilibrium outcome of the proposed six-stage game if instead the AAs were myopic. By analyzing a modified version of our endogenous merger game where the AA which is called to decide upon a given merger proposal judges it without considering that further mergers might occur, one concludes that its full equilibrium outcome confirms our qualitative results. It is worth remarking, however, that in this modified version of our model there is no region of parameter values where the final equilibrium market structure is the complete monopoly. Remember that in Section 4 the merger wave leading to complete monopoly is always started with a national merger between firm 1 and 2. However, if this national merger proposal is submitted to a myopic ANAA, it will always be rejected. The reason is that the ANAA considers that the induced market structure would be $M_B = \{12, 3, 4\}$, which is always dominated by $M_A = \{1, 2, 3, 4\}$ from a total welfare point of view. ANAA fails to anticipate that this merger would be followed by subsequent ones and the resulting ultimate market structures obtained in this process could be preferred to the status quo industry structure $M_A = \{1, 2, 3, 4\}$.

²⁶ Put it another way, the analysis above implicitly assumed that mergers between two national firms had no "Community dimension" while all other mergers should be reviewed by the SNAA.

²⁷ See Council Regulation (EC) No 139/2004 of January 2004 on the control of concentrations between undertakings (the EC Merger Regulation), *Official Journal of the European Union* L24, 29.01.2004, pages 1-22.

²⁸ In node 2 of Fig. 1, a national merger between Country A's firms has to be examined. Moreover, in node 7 of the same Figure, a merger between the two firms located in Country B has to be reviewed.

²⁹ It turns out that in node 2 of Fig. 1, the relevant AA is Country A's AA if $a < 56t$, and the SNAA otherwise. In addition, in node 7 of the very same Figure, the authority who should judge the merger proposal between firms 3 and 4 is Country B's AA if $a < 42, 06t$, and the SNAA otherwise.

Conclusion

In this paper we use an international Cournot oligopoly model to study the interplay between trade policy and the way merger waves shape the industrial structure. In particular, we analyze how trade policy can influence firms' choice between domestic and cross-border mergers in a sequential merger formation game with a cost structure à la Perry and Porter (1985).

Apart from discussing the relationship between trade policy and merger formation, our main contribution here probably lies in the attempt of going beyond a static setting when analyzing the effects of mergers, and in explicitly considering the role of Antitrust Authorities in a sequential merger game.

It is shown that the equilibrium market structure depends heavily on: (i) the level of trade costs; and (ii) whether or not active Antitrust Authorities are incorporated within the sequential merger game. In addition, we show that whenever mergers occur in equilibrium, they occur in waves and the merger wave comprises at least one cross-

border merger. Also, and perhaps most importantly, in a model where AAs are encompassed as active players of the merger formation game, no mergers (and, therefore, no cross-border merger waves) occur in equilibrium when trade physical costs are at a sufficiently low level, which contradicts the common belief that trade liberalization induces waves of cross-border mergers.

We also identify conditions for the full equilibrium outcome of the sequential merger game to result in the socially optimal market structure. In addition, in an extended version of our basic framework, our model is able to endogenously predict the split of surplus amongst merging parties, an issue which has been neglected by most papers in the previous literature on endogenous mergers formation.

Appendix A. Equilibrium profits and welfare

Fig. 4

Fig. 5

Market structure A	
Profits	
$\Pi_{1, MA} := \frac{34}{1369} a^2 - \frac{34}{1369} a t + \frac{693}{1369} t^2$	$\Pi_{2, MA} := \frac{34}{1369} a^2 - \frac{34}{1369} a t + \frac{693}{1369} t^2$
$\Pi_{3, MA} := \frac{34}{1369} a^2 - \frac{34}{1369} a t + \frac{693}{1369} t^2$	$\Pi_{4, MA} := \frac{34}{1369} a^2 - \frac{34}{1369} a t + \frac{693}{1369} t^2$
Welfare	
$CS_{A, MA} := \frac{2}{1369} (2a - t)^2$	$CS_{B, MA} := \frac{2}{1369} (2a - t)^2$
$W_{A, MA} := \frac{76}{1369} a^2 - \frac{76}{1369} a t + \frac{1388}{1369} t^2$	$W_{B, MA} := \frac{76}{1369} a^2 - \frac{76}{1369} a t + \frac{1388}{1369} t^2$
$TW_{MA} := \frac{152}{1369} a^2 - \frac{152}{1369} a t + \frac{2776}{1369} t^2$	
Market structure B	
Profits	
$\Pi_{12, MB} := \frac{9801}{197192} a^2 - \frac{9801}{197192} a t + \frac{313013}{394384} t^2$	$\Pi_{4, MB} := \frac{4913}{197192} a^2 - \frac{4913}{197192} a t + \frac{113377}{394384} t^2$
$\Pi_{3, MB} := \frac{4913}{197192} a^2 - \frac{4913}{197192} a t + \frac{113377}{394384} t^2$	
Welfare	
$CS_{A, MB} := \frac{1}{2} \left(\frac{67}{628} a - \frac{28}{157} t \right)^2$	$CS_{B, MB} := \frac{1}{2} \left(\frac{67}{628} a + \frac{45}{628} t \right)^2$
$W_{A, MB} := \frac{43693}{788768} a^2 - \frac{13553}{197192} a t + \frac{319285}{394384} t^2$	$W_{B, MB} := \frac{43793}{788768} a^2 - \frac{16637}{394384} a t + \frac{455533}{788768} t^2$
$TW_{MB} := \frac{43743}{394384} a^2 - \frac{43743}{394384} a t + \frac{1094103}{788768} t^2$	
Market structure D	
Profits	
$\Pi_{13, MD} := \frac{297}{98596} a t + \frac{9801}{197192} a^2 + \frac{9}{197192} t^2$	$\Pi_{4, MD} := -\frac{2601}{98596} a t + \frac{4913}{197192} a^2 + \frac{99973}{197192} t^2$
$\Pi_{2, MD} := \frac{2601}{98596} a t + \frac{4913}{197192} a^2 + \frac{99973}{197192} t^2$	
Welfare	
$CS_{A, MD} := \frac{1}{2} \left(\frac{67}{628} a - \frac{17}{628} t \right)^2$	$CS_{B, MD} := \frac{1}{2} \left(\frac{67}{628} a - \frac{17}{628} t \right)^2$
$W_{A, MD} := \frac{43743}{788768} a^2 - \frac{10949}{394384} a t + \frac{400199}{788768} t^2$	$W_{B, MD} := \frac{43743}{788768} a^2 - \frac{10949}{394384} a t + \frac{400199}{788768} t^2$
$TW_{MD} := \frac{43743}{394384} a^2 - \frac{10949}{197192} a t + \frac{400199}{394384} t^2$	

Fig. 4. Appendix A: Equilibrium profits and welfare I.

Appendix B. Proofs

B.1. Proof of Proposition 1

The proof of this proposition will consist in seeking the SPNE of the proposed game, following the usual backward induction procedure.

B.1.1. Analysis of stage 3

If the game gets to the third stage, two mergers have occurred previously; depending on which merger has occurred, we might have three possible scenarios which we discuss in turn.

Scenario A. Merger proposal by firm 4

If (1) firm 1 has merged with its national rival firm 2 and, after this first merger, 3 decided to join the merged entity; or (2) firm 1 has merged with its foreign competitor firm 3 and, after this first merger, 2 decided to join the merged entity; then at the last stage, firm 4 has to decide whether to join the already merged firms (M_{123}), forming a worldwide monopoly $M_I=\{1234\}$, or not to propose any merger (NM) and remain in market structure $M_E=\{123, 4\}$. Making use of the equilibrium profits presented in Appendix A, some algebra shows that $M_I >_4 M_E$ if $a < 395.2t$. Therefore, in case firm 4 is called to play at the last

Market structure E	
Profits	
$\Pi_{123, ME} := \frac{124146}{1661521} a^2 + \frac{3762}{1661521} a t + \frac{831017}{14953689} t^2$	$\Pi_{4, ME} := \frac{41650}{1661521} a^2 - \frac{45220}{1661521} a t + \frac{3433508}{14953689} t^2$
Welfare	
$CS_{A, ME} := \frac{1}{2} \left(\frac{134}{1289} a - \frac{697}{3867} t \right)^2$	$CS_{B, ME} := \frac{1}{2} \left(\frac{134}{1289} a + \frac{592}{3867} t \right)^2$
$W_{A, ME} := \frac{91742}{1661521} a^2 - \frac{85874}{4984563} a t + \frac{4781495}{89722134} t^2$	$W_{B, ME} := \frac{92010}{1661521} a^2 - \frac{52570}{4984563} a t + \frac{11657237}{44861067} t^2$
$TW_{ME} := \frac{183752}{1661521} a^2 - \frac{46148}{1661521} a t + \frac{9365323}{29907378} t^2$	
Market structure G	
Profits	
$\Pi_{12, MG} := \frac{18}{361} a^2 - \frac{18}{361} a t + \frac{185}{361} t^2$	$\Pi_{34, MG} := \frac{18}{361} a^2 - \frac{18}{361} a t + \frac{185}{361} t^2$
Welfare	
$CS_{A, MG} := \frac{1}{2} \left(\frac{2}{19} a - \frac{1}{19} t \right)^2$	$CS_{B, MG} := \frac{1}{2} \left(\frac{2}{19} a + \frac{1}{19} t \right)^2$
$W_{A, MG} := \frac{20}{361} a^2 - \frac{20}{361} a t + \frac{371}{722} t^2$	$W_{B, MG} := \frac{20}{361} a^2 - \frac{20}{361} a t + \frac{371}{722} t^2$
$TW_{MG} := \frac{40}{361} a^2 - \frac{40}{361} a t + \frac{371}{361} t^2$	
Market structure H	
Profits	
$\Pi_{13, MH} := \frac{18}{361} a^2$	$\Pi_{24, MH} := \frac{18}{361} a^2$
Welfare	
$CS_{A, MH} := \frac{2}{361} a^2$	$CS_{B, MH} := \frac{2}{361} a^2$
$W_{A, MH} := \frac{20}{361} a^2$	$W_{B, MH} := \frac{20}{361} a^2$
$TW_{MH} := \frac{40}{361} a^2$	
Market structure I	
Profits	
$\Pi_{1234, MI} := \frac{1}{10} a^2$	
Welfare	
$CS_{A, MI} := \frac{1}{200} a^2$	$CS_{B, MI} := \frac{1}{200} a^2$
$W_{A, MI} := \frac{11}{200} a^2$	$W_{B, MI} := \frac{11}{200} a^2$
$TW_{MI} := \frac{11}{100} a^2$	

Fig. 5. Appendix A: Equilibrium profits and welfare II.

stage of the game, if $19t < a < 395.2t$, it will merge with the firm resulting from the mergers at the previous stages (M_{123}), leading to the final market structure $M_I = \{1234\}$;³⁰ if instead $a \geq 395.2t$, firm 4 will decide not to merge (NM), remaining in the current market structure $M_E = \{123, 4\}$.³¹

Scenario B. Merger proposal by firm 12

If firm 1 has merged with its national rival firm 2 and, after this first merger, firm 3 decided to merge with firm 4, then, at the last stage, firm 12 has to decide whether to merge with firm 34 (M_{34}) forming a worldwide monopoly $M_I = \{1234\}$, or not to propose any merger (NM) and remain in market structure $M_C = \{12, 34\}$. Making use of the equilibrium profits presented in Appendix A, some algebra shows that $M_I >_{12} M_C$ for all parameter values. So firm 12 will decide to merge with firm 34 (M_{34}), inducing a complete monopolization of the market.

Scenario C. Merger proposal by firm 13

If firm 1 has opted for a cross-border merger with firm 3 and, after this first merger, firm 2 decided to merge with firm 4, then, at the last stage, firm 13 has to decide whether to merge with firm 24 (M_{24}), forming a worldwide monopoly $M_I = \{1234\}$, or not to propose any merger (NM) and remain in market structure $M_H = \{13, 24\}$. Making use of the equilibrium profits presented in Appendix A, some algebra shows that $M_I >_{13} M_H$ for all parameter values. So firm 13 will decide to merge with firm 24 (M_{24}), inducing a complete monopolization of the market.

B.1.2. Analysis of stage 2

If the game arrives at the second stage, then a merger involving firm 1 has occurred at the first stage. In addition, the specific subgame which is played at the second stage depends obviously on which firm merged with firm 1 at that first stage of the game. Two different scenarios should be distinguished, which we discuss in turn.

Scenario 1. Merger proposal by firm 3

If firm 1 has merged with its national rival firm 2 at the previous stage, then, at the second stage, firm 3 has to decide between the following three different options: (i) do not merge (NM) and remain in the industry structure $M_B = \{12, 3, 4\}$; (ii) merge with the merged entity which resulted from the previous merger stage (M_{12}), inducing a final market structure of the type $M_E = \{123, 4\}$ if $a \geq 395.2t$, and $M_I = \{1234\}$ if $19t < a < 395.2t$; and (iii) merge with firm 4 (M_4), the other outsider of the previous merger, leading to a final market structure of the type $M_I = \{1234\}$. Making use of the equilibrium profits presented in Appendix A, simple algebra shows that $M_I >_3 M_B$ and $M_I >_3 M_E$ for all parameter values. Moreover, we derive that $M_E >_3 M_B$ if $a < 2937, 035t$. Therefore, in case firm 3 is called to play at the second stage of the game, it will go for the complete monopolization of the market $M_I = \{1234\}$. This industry structure can be achieved, for all parameter values, by choosing strategy M_4 (at stage 2).

Scenario 2. Merger proposal by firm 2

If firm 1 opted for a cross-border merger (with firm 3) at the first stage, then the firm which has to take a merger decision at the second

³⁰ As mentioned above, at each merger round, we check whether the firm receiving the merger proposal – in this specific case, firm 123 – has the incentive to merge with the firm making the proposal (in this case, firm 4).

³¹ It might seem counterintuitive to observe that a firm having the opportunity to merge to complete monopoly decides not to take this opportunity and decides to operate alone in the market facing a big and more efficient competitor. Notice, however, that this happens for large values of the demand parameter a . The higher the value of a is, the more severe is going to be output restriction by insiders (of the previous mergers). This in turn implies that the higher a is, the larger will be the free-riding profits for the outsider – firm 4. This result depends crucially on the (exogenous) way we model the split of surplus inside the merged entity. In the modified version of the merger formation game studied in Section 6.1, where the acquisition bid is endogenized, this counterintuitive result does not anymore hold.

stage is firm 2. This firm can take three different decisions: (i) do not merge (NM) and remain at the market structure $M_D = \{13, 2, 4\}$; (ii) merge with the merged entity resulting from the merger at stage 1 (M_{13}), leading to the market structure $M_E = \{123, 4\}$ if $a \geq 395.2t$, and $M_I = \{1234\}$ if $19t < a < 395.2t$; and (iii) merge with firm 4 (M_4), inducing a final market structure of the type $M_I = \{1234\}$. Using the equilibrium profits presented in Appendix A, we can derive that $M_I >_2 M_D$ and $M_I >_2 M_E$ for all parameter values. Hence, the behavior of firm 2, when it is called to make a merger decision at stage 2, is to choose a strategy leading to complete monopolization of the market, $M_I = \{1234\}$. This can be implemented, for all parameter values, by choosing M_4 .

B.1.3. Analysis of stage 1

At the first stage, firm 1 has three different options: (i) do not merge (NM) and remain in the industry structure $M_A = \{1, 2, 3, 4\}$; (ii) merge with the national competitor (M_2), inducing a final market structure of the type $M_I = \{1234\}$; and (iii) embark on a cross-border merger (M_3), leading to a final market structure of the type $M_I = \{1234\}$. Given the equivalence between the two merging options, we can summarize firm 1's choice as to decide whether or not to merge.

Simple algebra shows that, for all $a > 19t$ (Assumption 1), $M_I >_1 M_A$. So, firm 1, at the first stage of the game, will always choose to merge, inducing a complete monopolization of the market. This completes the proof of Proposition 1.

B.2. Proof of Proposition 2

The proof of this result will consist in seeking the SPNE of the proposed game, proceeding by solving it by backward induction.

B.2.1. Analysis of stage 6

If the game arrives at the sixth stage, then the SNAA has to decide whether or not to allow a merger between the two remaining firms in the industry leading to a complete monopolization of the industry, $M_I = \{1234\}$. As illustrated in Fig. 1, the SNAA can face a merger to monopoly proposal in three different situations, which we discuss in turn.

First, the SNAA might have to decide on a proposal by firm 4 to merge with firm 123. Since $M_I >_{SN} M_E$ only if $a < 27.98t$, the SNAA will authorize this merger if $a < 27.98t$ and will veto it otherwise.³²

Second, the SNAA might have to decide on a merger involving two national monopolists towards complete monopolization of the industry. Some algebra shows that $M_I >_{SN} M_C$ only when $a < 127.93t$. Hence, this merger to monopoly will be approved when $a < 127.93t$ and rejected otherwise.

Lastly, the SNAA might be called to decide on a merger between two international firms, resulting from two previous cross-border mergers. Some algebra shows, however, that, for all parameter values, the total welfare in the complete monopoly $M_I = \{1234\}$ is always lower than the total welfare associated with market structure $M_H = \{13, 24\}$, $M_H >_{SN} M_I$. Hence, after a wave of two cross-border mergers, the SNAA will *never* authorize a further merger to complete monopoly.³³

³² It may not be completely clear why the AA can decide to accept a merger proposal that would lead to the complete monopoly market structure M_I . The intuition for this result is as follows. In such a merger, we have different aspects affecting total welfare. On the one hand, there is a negative impact on welfare due to the fact that the merged entity contracts output so as to increase the market price, therefore reducing consumers' surplus. On the other hand, welfare is enhanced because of the *tariff-jumping effect*. When $t=0$, if there is a merger to complete monopoly, the negative impact of the merger on consumers' surplus is not compensated by any positive effect as the tariff-jumping argument does not apply. Now, as t increases, the merger has a positive impact on welfare as it implies the cost reduction associated with the tariff-jumping. Notice that the magnitude of this positive effect is increasing in t . So, for sufficiently high values of t , the SNAA realizes that a merger to complete monopoly is welfare enhancing.

³³ This is due to the fact that the *tariff-jumping argument* does not apply to this specific merger since the two firms in market structure M_H are both international.

B.2.2. Analysis of stage 5

If the game arrives at the fifth stage, a duopolistic structure has emerged from the previous stages of the game, and the firm not involved in the most recent of the previous mergers has to decide whether or not to seek a merger to monopoly. We will again have to distinguish three cases.

First, if firm 4 was not involved in any of the previous mergers, then it can decide at this stage either not to propose any further merger, and remain at market structure $M_E = \{123, 4\}$, or to propose a merger with firm 123. Simple algebra shows that $M_I >_4 M_E$ if $a < 395.2195t$. However, from the previous analysis, the SNAA will approve such a merger only if $a < 27.98t$. Hence, firm 4 will decide to propose a merger to monopoly if $a < 27.98t$ and will propose no merger otherwise.

Second, if there was a wave of mergers creating two national monopolies, then firm 12 (the national monopoly created by the first merger) has to decide whether to seek a merger leading to a complete monopoly. It is easy to show that this firm always prefers to be in a complete monopoly market structure than in a market structure composed of two national monopolies, $M_I >_{12} M_C$ for all parameter values. However, firm 12 anticipates its merger proposal to monopoly will only be accepted by the SNAA if $a < 127.93t$. Hence, the firm seeks a merger to complete monopoly only if $a < 127.93t$.

Lastly, if a wave of cross-border mergers occurred in the previous stages of the game, then the first international firm created by this wave – firm 13 – anticipates that the SNAA will never approve a further merger to complete monopoly. For this reason, firm 13 will not make any merger proposal.

B.2.3. Analysis of stage 4

In the fourth stage, the relevant AA has to decide whether to accept a merger proposed by one of the outsiders to the first merger. Four different cases must be considered here: two cases in which the merger is proposed by firm 3 and two other cases in which the merger is proposed by firm 2. These cases are analyzed in what follows.

First, in case the outsider to the first merger is firm 3 and it proposed a merger with the merged entity which resulted from the previous merger (M_{12}), then the merger proposal is reviewed by the SNAA. The SNAA anticipates that if it approves the merger proposal, then there are two different possible scenarios regarding the evolution of the merger formation process: (i) If $a < 27.98t$, then this merger will be followed by a subsequent merger leading to a complete monopoly market structure $M_I = \{1234\}$; and (ii) If instead $a \geq 27.98t$, then this merger will not be followed by another merger (and the induced market structure will therefore be $M_E = \{123, 4\}$). If the merger is not approved, the final market structure will be $M_B = \{12, 3, 4\}$. Now, some algebra shows that $M_E >_{SN} M_B$ if $a < 244.481t$ and $M_I >_{SN} M_B$ if $a < 107.09t$. So, the SNAA will decide to approve the merger if $a < 244.481t$ and to veto it otherwise.

Second, if the outsider to the first merger is firm 3 and it proposed to merge with firm 4 (M_4), then the merger proposal should be reviewed by Country B NAA (denoted BNAA). If the merger is rejected, the final market structure will be $M_B = \{12, 3, 4\}$. If however the merger is approved, then BNAA anticipates that: (i) If $a < 127.93t$, this merger will be followed by a subsequent one leading to complete monopolization of the industry; and (ii) If instead $a \geq 127.93t$, then this merger will not be followed by other merger and the final industry structure will be composed of two national monopolies, $M_C = \{12, 34\}$. Simple algebra shows that $M_B >_B M_C$ for all parameter values and $M_I >_B M_B$ only if $a < 63.55t$. So, BNAA will decide to approve the merger (expecting that the merger process will end up in a complete monopoly ultimate market structure) if $a < 63.55t$ and reject the merger otherwise (in which case the final industry structure is $M_B = \{12, 3, 4\}$).

Third, in case the outsider to the first merger is firm 2 and it proposed to merge with the merged entity resulting from the first merger (M_{13}), then the SNAA is called to make a decision on this merger proposal. The SNAA knows that if it rejects the merger, the

induced final market structure is going to be $M_D = \{13, 2, 4\}$. It also anticipates that when it accepts the merger, two different cases can occur: (i) if $a < 27.98t$, then the merger under analysis will be followed by a subsequent one leading to market structure $M_I = \{1234\}$; and (ii) if instead $a \geq 27.98t$, the merger will not be followed by a subsequent merger, which implies that the final market structure will be $M_E = \{123, 4\}$. Moreover, simple algebra shows that, for all parameter values, $M_D >_{SN} M_E$ and $M_D >_{SN} M_I$, which in turn implies that it is optimal for the SNAA is to (always) reject the merger proposal under analysis. A merger involving firms 13 and firm 2 would induce the creation a larger international firm yielding a “partial” *tariff-jumping effect*,³⁴ but the loss in consumers' surplus resulting from the output contraction (so as to raise price) by the merged entity would make this merger welfare detrimental.

Lastly, if the outsider to the first merger is firm 2 and if this firm proposed to merge with firm 4 (M_4), then it is again the SNAA that has to make a decision on the merger proposal. The SNAA knows that if it accepts the merger, then the induced final market structure is $M_H = \{13, 24\}$, whereas if it rejects it the merger game stops and the equilibrium industry structure is $M_D = \{13, 2, 4\}$. Since $M_H >_{SN} M_D$ if $a < 479.34t$, the SNAA will approve the cross-border merger between firms 2 and 4 in this specific region of parameter values and will reject it otherwise.

B.2.4. Analysis of stage 3

In the third stage, we have to check whether the outsider to the first merger will use the opportunity to propose a subsequent merger or not. We have to consider two different cases.

First, consider the case where a merger between firm 1 and 2 has previously occurred; firm 3 has now the opportunity to propose a new merger. Firm 3's preferences over the ultimate market structures its decision may lead to are as follows: (1) for all parameter values, $M_I >_3 M_B$ and $M_I >_3 M_E$ and (2) $M_E >_3 M_B$ if $a < 2937.035t$. Hence, firm 3, if called to play at stage 3, will take the following decisions:

- If $a < 27.98t$, then firm 3 is indifferent between merging with firm 12 (M_{12}) or merging with firm 4 (M_4) since in both cases the ultimate market structure the merger will lead to is $M_I = \{1234\}$.
- If $27.98t \leq a < 63.55t$, firm 3 decides to merge with firm 4 and the ultimate market structure this merger will lead to is again the complete monopoly one, $M_I = \{1234\}$.
- If $63.55t \leq a < 244.481t$, then firm 3 decides to merge with the merged entity resulting from the previous merger round (M_{12}) and the induced market structure is $M_E = \{123, 4\}$ since no further merger would be proposed along the equilibrium path.
- If instead $a \geq 244.481t$, then firm 3 anticipates that no merger would be approved by the relevant AA in the following stage of the game and, therefore, decides not to propose a merger at this stage, which in turn implies that the final market structure is $M_B = \{12, 3, 4\}$.

Second, suppose a merger between firms 1 and 3 has occurred, then firm 2 has the opportunity to propose another merger. Notice that, as explained above, a merger with firm 13 (M_{13}) would never be approved by the SNAA in the following stage of the game, which means that, at this stage, firm 2's decision amounts to a decision on whether or not to merge with firm 4. Simple algebra shows that, for all parameter values, firm 2 strictly prefers market structure M_H to market structure M_D , $M_H >_2 M_D$. As a result, it is very easy to conclude that firm 2 will only decide to propose a merger with firm 4 at stage 3

³⁴ It is worth comparing this choice of the SNAA with the decision it has to make in case firm 3 proposes a merger with firm 12, which has been analyzed in the first part of the discussion regarding stage 4. In that case, both merging parties are national and so both benefit from the *tariff-jumping effect* of the merger. In the present case, however, we have an already international firm merging with a national one, so the *tariff-jumping effect* applies only to firm 2. As a consequence, in the case under analysis, the *tariff-jumping effect* is only a “partial” effect which turns out not to compensate for the increase in price.

if $a < 479.34t$. This merger would not be followed by a subsequent merger to complete monopoly, which means that the final industry structure would be composed of two international firms with one half of the industry capital each (resulting from a wave of two cross-border mergers), $M_H = \{13, 24\}$.

B.2.5. Analysis of stage 2

In the *second* stage, in case firm 1 decided to submit a merger at the previous stage, the relevant AA is called to make a decision on the merger proposal. Two separate cases should be considered, depending on whether firm 1 decided to propose a merger with its national rival firm 2 or with foreign firm 3.

First, in case firm 1 proposed a merger with firm 2, then ANAA is called to make a decision at stage 2. ANAA anticipates that if it approves the merger, then there are three possible induced final market structures this merger will lead to: $M_I = \{1234\}$ (for $a < 63.55t$), $M_E = \{123, 4\}$ (for $63.55t \leq a < 244.481t$), and $M_B = \{12, 3, 4\}$ (for $a \geq 244.481t$). Now, comparing each of these possible market structures with the initial one ($M_A = \{1, 2, 3, 4\}$) in terms of (country A) national welfare, one has that: (1) $M_A >_A M_B$ for all parameter values; (2) $M_E >_A M_A$ if $34.27t < a < 93.65t$; and (3) $M_I >_A M_A$ if $23.29t < a < 84.50t$. As a result, if called to play at stage 2, ANAA will decide as follows:

- Accept the merger if $23.29t < a < 93.65t$, where in anticipates that the ultimate market structure this merger will lead to is $M_I = \{1234\}$ when $23.29t < a < 63.55t$ and M_E when $63.55t < a < 93.65t$.
- Reject the merger otherwise.

Second, in case firm 1 proposed a merger with firm 3, then this merger is reviewed by the SNAA at stage 2. The SNAA anticipates that if it approves the merger, then this merger can induce two possible final market structures: $M_H = \{13, 24\}$ if $a < 479.34t$, or $M_D = \{13, 2, 4\}$ otherwise. Comparing now these two possible final market structures with the initial one ($M_A = \{1, 2, 3, 4\}$) in terms of total welfare, one may conclude that: (1) $M_H >_{SN} M_A$ if $a < 470.92t$; and (2) $M_D >_{SN} M_A$ if $a < 462.79t$. Hence, the SNAA will decide to approve the merger (anticipating that the ultimate market structure this merger will lead to is $M_H = \{13, 24\}$) if $a < 470.92t$ and will veto it otherwise.

B.2.6. Analysis of stage 1

In the *first stage* of the game, firm 1 is given the opportunity to propose a merger either with its national rival firm 2 or with the foreign firm 3. This firm may, however, decide not to propose any merger.

If firm 1 proposes a merger with firm 2, then it anticipates that there are three possible final induced market structures this merger will lead to: (1) $M_I = \{1234\}$ if $23.29t < a < 63.55t$, (2) $M_E = \{123, 4\}$ if $63.55t < a < 93.65t$ and (3) $M_A = \{1, 2, 3, 4\}$ otherwise. If instead firm 1 proposes a merger with firm 3, it anticipates that, as explained above, this merger will only be accepted by the SNAA if $a < 470.92t$ and it will be followed by a subsequent cross-border merger (by firms 2 and 4) leading to the final market structure $M_H = \{13, 24\}$.

Now, studying firm 1's preferences over the possible final induced market structures, one may conclude that: (1) for all parameter values, $M_E >_1 M_A$, $M_H >_1 M_A$ and $M_I >_1 M_H$; and (2) $M_H >_1 M_E$ if $a > 46.73t$. Hence, one can summarize firm 1's optimal decisions at the first stage of the game as follows:

- If $19t < a < 23.29t$, firm 1 will decide to merge with firm 3 (M_3) and the final induced market structure this merger will lead to is $M_H = \{13, 24\}$.
- If $23.29t \leq a < 63.55t$, firm 1 will opt for merging with firm 2 (M_2) and the final induced market structure this merger will lead to is $M_I = \{1234\}$.
- If $63.55t \leq a < 470.92t$, firm 1 will decide to merge with firm 3 (M_3) and the final induced market structure this merger will lead to is $M_H = \{13, 24\}$.

- If instead $a \geq 470.92t$, firm 1 will propose no merger (NM) since it anticipates that no merger would be accepted by the relevant AA in the following stage of the game.

This completes proof of Proposition 2.

Appendix C. The assumed bargaining protocol

According to our bargaining protocol, two different types of cases should be distinguished which we discuss in turn.

Suppose first that there is only one possible target firm. If this is the case, then, if the target firm says "no" to the merger proposal, the merger formation game stops and the final market structure is the current one. This in turn implies that the outside option of the target firm is exactly its profit in the current market structure. Take, for instance, node 5 in Fig. 1. At this specific node, firm 4 may bid in a take-it-or-leave-it manner for firm 123. Moreover, in case it decides to make the bid, the bid price will be equal to the profit that firm 123 would make in market structure $M_E = \{123, 4\}$, i.e., Π_{123, M_E} . This implies that firm 4 will, at this specific node, propose a merger to monopoly if and only if $\Pi_{1234, M_I} - \Pi_{123, M_E} > \Pi_{4, M_E}$, which turns out to be always true. Firm 4 always finds it profitable to merge with firm 123.

Consider now the situations in which the firm making the merger proposal has two possible target firms.³⁵ If this is the case, we assume that if the (first approached) target firm says "no" to a merger proposal, then the proposer can subsequently propose an alternative merger to the other possible target firm. If, however, this second target firm also rejects the merger proposal, then the merger formation game stops.

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³⁵ For instance, at node 3 of Fig. 1, firm 3 has to decide between: (i) no merger proposal (NM), (ii) merge with firm 12 (M12); and (iii) merge with firm 4 (M4).

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