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ABSTRACT

An Equilibrium Approach to International Merger Policy

I treat international merger policy as a repeated veto game. I derive optimal equilibria and consider a series of comparative statistics and extensions.

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Keywords: merger policy and repeated games

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1 Introduction

In a world that is increasingly global, merger policy seems to follow the trend. The GE/Honeywell merger and other related cases show that large mergers must be approached from an international perspective. They also show that different merger authorities may have different evaluations of the welfare impact of a merger, different utility functions, or both. Whichever is the case, the fact is that any proposed merger of significant size must pass at least the U.S. and the EU tests.

As a solution to the problem of merger policy in a global world, former Assistant Attorney General Joel Klein proposed the creation of a world-wide merger authority.[1] However, this solution is unlikely to be feasible, both politically and informationally. Politically, the problems stem from the near impossibility of enforcement at the international level. Informationally, there is the problem inherent in centralized decision making.[2]

In this paper, I propose a solution to the enforcement problem. Specifically, I propose the equilibrium self-enforcement of merger policy in a repeated interaction context. The idea of using repeated interaction to enforce cooperative agreements is obviously not novel. However, the specific nature of the game played between antitrust authorities warrants a specific analysis.

2 Repeated merger policy games

Over time, a number of merger proposals take place, some among firms in a given country, some among firms from different countries. Whichever is the case, the welfare impact of a specific merger is likely to be different in different countries. In addition to differences in location, the impact of the merger may differ because different countries place different weights on profits and consumer surplus.[3] Given a merger proposal, antitrust authorities in each country must decide whether or not to approve the merger.

I model this situation as a repeated game between two countries. In each

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[1] "I ... believe that, whatever happens on antitrust at the WTO ..., we should move in the direction of a Global Competition Initiative, cautiously and on an exploratory basis, but in the end I think such a development is almost inevitable" (Klein, 2000). For a different perspective, see Fox (1998).

[2] In this regard, see Barros and Cabral (1994), Neven et al (1994), Bacchetta et al (1997), Head and Ries (1997), Neven and Röller (2000).

[3] Barros and Cabral (1994), Neven and Röller (2001) and others develop models that suggest possible sources of divergence across antitrust authorities. I take a reduced-form approach that is consistent with all of these models.

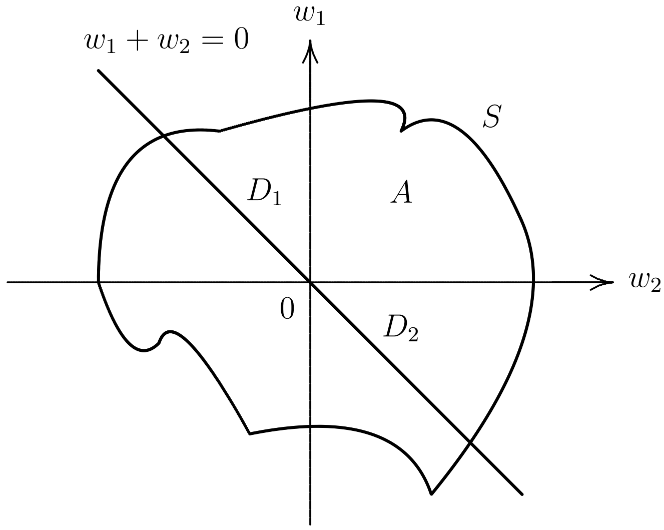

Figure 1: Agreement and disagreement over merger decisions.

period of the repeated game, Nature determines whether a merger is proposed (probability ρ). Nature also determines the welfare impact of the merger in country i, w_i ($i = 1, 2$), according to the continuous c.d.f. $F(w_1, w_2)$. If a merger is proposed, then each country's merger authority decides whether to approve the merger. Finally, I make the important assumption that a merger only takes place is approved by *both* merger authorities.

Consider the stage game where a merger is proposed and the values of w_i are observed. A natural equilibrium of this game is for the merger to go through if and only if $w_i \geq 0$ for both i. The problem with this equilibrium is that many efficient mergers are vetoed. Figure 1 depicts this problem. Let S be the set of possible values of (w_1, w_j). Efficient mergers correspond to points to the NE of the second diagonal, $w_1 + w_2 \geq 0$. This area can be subdivided into three subregions. In region A, the merger is welfare improving for both countries. In region D_1, the merger increases Country 2's welfare but decreases Country 1's welfare (by a lower amount). Finally, in region D_2 the opposite is true: Country 1's welfare increases but Country 2's decreases (by a lower amount). In the static equilibrium considered above, only mergers in Region A go through. Mergers lying in Regions D_i, though efficient, are not approved.

Consider now the infinite repetition of the above stage game, making the additional assumptions that the values of w_i are independently distributed across periods and that both countries have a common interest rate r. Define

$\delta \equiv \frac{\rho}{1+r}$, the effective discount factor.[4] The basic intuition from repeated game theory suggests that the set of attainable payoffs in the repeated game is larger than the set of stage equilibria. In other words, there are mergers that would not be approved in a static equilibrium but might be approved in a dynamic equilibrium. The intuition is that each country will refrain from pursuing its short-run interest as this might reduce future payoff. I make this point more precise in the next section.

3 Maximal concession equilibria

Consider a set of equilibrium strategies $x_i^t(w^t, h^t),\ i = 1, 2$, indicating the probability that country i approves the proposal submitted at time $t, w^t = (w_1^t, w_2^t)$, given a history h^t of past decisions by both countries. I focus on the set of equilibria, optimal equilibria, that maximizes joint discounted payoff, $\sum_{t=1}^{\infty} \int_S x_1^t(w^t, h^t) x_2^t(w^t, h^t)(w_1^t + w_2^t)\, dF(w)$, subject to the constraint that the strategies $x_i^t(w^t, h^t)$ form a subgame perfect Nash equilibrium. My first result characterizes the structure of optimal equilibria.

Proposition 1 *The following is an optimal equilibrium. Intially, we start in a "cooperative phase." Along this phase, a merger proposal is approved by both countries if and only if (i) $w_1 + w_2 \geq 0$, (ii) $w_1 \geq -l_1$, and (iii) $w_2 \geq -l_2$. If any of the players deviates from these equilibrium strategies, then play reverts to a "punishment" phase where no merger is ever approved.*

This result is in line with well-know results in the repeated-game literature. The novel aspect here is the precise nature of the "cooperative" phase, namely the fact that each country approves efficient mergers up to a maximum "concession" level $-l_i$. In words, each country is willing to accept a negative welfare impact $-l_i$ in the short run in return for the other country not vetoeing future efficient mergers where country i stands to gain but country j loses (by a smaller amount). Figure 2 illustrates the result. In this figure, the mergers belonging to the shaded region are approved along the equilibrium path. Notice that, if δ is less than one and S is sufficiently large, then there will still be efficient mergers that are not approved in equilibrium. For a finite S, it can be shown that there exists a $\bar{\delta}$ such that, if $\delta > \bar{\delta}$, then all efficient mergers are approved in equilibrium (folk theorem).

In the next three sections, I consider some comparative statics and extensions of the optimal equilibrium when $\delta > \bar{\delta}$.

[4]That is, δ reflects both the length between periods and the probability that a merger proposal arises in each period.

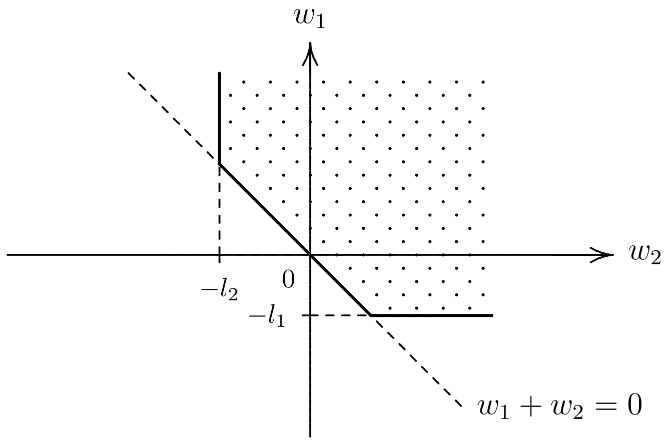

Figure 2: Optimal equilibrium: proposed mergers in the shaded region are approved (along the equilibrium path).

4 Contagious leniency

Suppose that one of the countries changes its utility function. Specifically, I consider the case when one of the countries becomes more lenient towards mergers. For example, if a country places an increasing relative weight on firm profits, then this is likely to increase the welfare impact of the merger (in other words, for a given merger the value of w_i is higher). I model "increased leniency" by assuming that the distribution of w is given by $F(w_1 - \alpha, w_2)$ and considering an increase in α (that is, Country A becoming more lenient). The main result is that an increase in leniency by one of the countries leads *both* countries to increase their maximum concession levels l_i. That is, in terms of optimal equilibrium strategies, leniency is "contagious:"

Proposition 2 (contagious leniency) $\partial\, l_i \,/\, \partial\, \alpha > 0$, *i=1,2. In words, as a country becomes more lenient towards mergers (increase in* α*) both countries increase their levels of mutual concession (*$-l_i$*).*

Notice that this result uses the fact that the punishment path implies a payoff that is not a function of α. This is true for an optimal equilibrium path, where the punishment phase reduces each country to its minimax level. In a different, perhaps more realistic, grim-strategy equilibrium, the punishment phase consists of reversion to the static Nash equilibrium $x_i(w) = 1$ iff $w_i \geq 0$. In that case, additional constraints must be imposed on the distribution $F(w)$ for Proposition 2 to be true. In Cabral (2003), I show that this holds for the case of a uniform distribution.

5 Remedies

In the previous sections, I have made the assumption that merger proposals are exogenously given and there is nothing merger authorities can do about it other than approve or veto them. In practice, we know this is not the case. Specifically, it is frequently the case that mergers are conditionally approved. For example, in the recent GE/Honeywell merger proposal, the EU requested a series of asset sales as a condition for giving its approval (eventually, GE refused the offer and the EU blocked the merger).

I model the possibility of asset sales by changing the structure of the stage game. In the previous sections, I have assumed that a merger proposal w is exogenously given, and each country then simultaneously approves or vetoes the merger. Now I suppose that, if $w_i < 0$, then country i has the option of requesting a change in the terms of the merger as a condition for the approval.

The typical request by country i would be some form of asset transfer. Naturally, such operation would imply a change in welfare impact both for country i *and* for country j. Accordingly, I model the possibility of merger remedies by assuming that utility can be transferred across countries according to $\Phi(w'; w) = 0$. In words, starting from merger proposal w, all points w' such that $\Phi(w'; w) = 0$ are attainable by means of merger remedies.

Typically, the implicit plot of $\Phi(w; w') = 0$ will have a slope lower than one: in order to increase country i's welfare by one dollar, country j's welfare is decreased by more than a dollar. For example, GE's asset divesture as part of the Honeywell deal would increase EU's welfare (given its impact on GE's European competitors and, possibly, European consumers). However, its impact on GE's profit is likely to have a greater negative impact on US welfare than the positive impact in the EU.

My main result in this section is that the possibility of asset sales increases the set of approved mergers.

Proposition 3 (remedies) *Suppose that the distribution of w is symmetric about the main diagonal. Then, along the cooperative phase of an optimal equilibrium, both countries approve a merger (with no remedies) if $w_1 + w_2 \geq 0$ and $w_i \geq -l_i$, i=1,2. If $w_i < -l_i$ and there exists a w' such that $\Phi(w'; w) = 0$ and $w'_i = -l_i$, then player j proposes w' and both countries approve the merger. Otherwise, the merger is vetoed by both players.*

Figure 3 illustrates the point. In this figure, I assume, for simplicity, that the implicit plot of $\Phi(w'; w) = 0$ is linear. It should be noted that the equilibrium values of l_i in the Proposition 3 are not necessarily identical to the ones

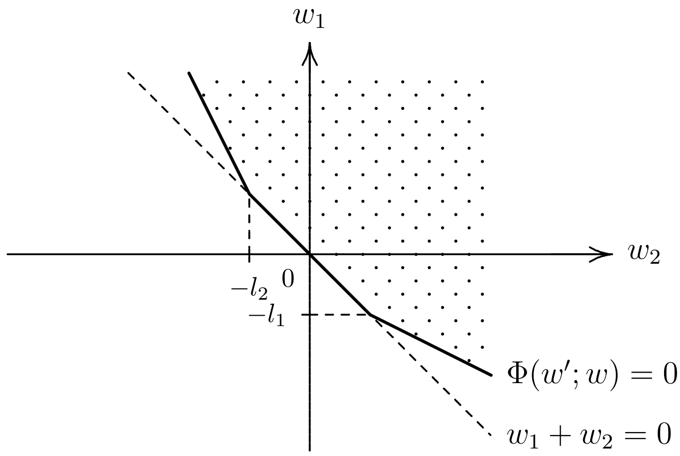

Figure 3: Optimal equilibrium with asset sales.

in Proposition 2. In fact, we would expect them to be greater. Finally, notice that, if the slope of Φ is greater than one, then the set of approved mergers would be even greater. In fact, there might be mergers initially classified as inefficient ($w_1 + w_2 < 0$) which become efficient once asset sales are taken into consideration.

6 Merger waves

One of the most commonly known facts about mergers is that they take place in waves.[5] In terms of my model, a merger wave can be thought of as a temporary increase in ρ, the probability that, in each period, a merger proposal is made. My last result pertains to the daynamics of l_i with respect to a temporary change (e.g., increase) in ρ:

Proposition 4 (merger waves) *Suppose there is an anticipated increase in the frequency of proposed mergers, ρ, from period t' to period t''. Along the cooperative phase of an optimal equilibrium, the frequency of approved mergers is increasing up to t' and declining thereafter. The percent difference in frequency of approved mergers between time t' and time $t'' + 1$ is greater than the percent difference in proposed mergers.*

Figure 4 illustrates Proposition 4. In this figure, the frequency of proposed mergers increases during the period $[t', t'']$. In anticipation of the merger wave,

[5]In this paper, I take merger waves as exogenously given. For a theory of merger waves and a review of the relevant literature, see Toxvaerd (2002).

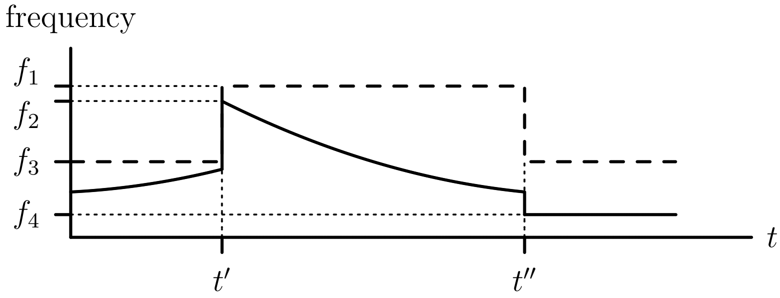

Figure 4: Frequency of proposed mergers (dashed line) and approved mergers (solid line) before, during, and after merger wave.

the proportion of proposed mergers that are approved increases during the period leading up to t'. During the wave, the proportion of proposed mergers that are approved declines. Finally, at time t'' the frequency of approved mergers drops to its lowest value. Notice that the proportion of proposed mergers that are approved is also lowest after time t''.

In words, Proposition 4 implies that the optimal equilibrium amplifies the exogenous variations of a wave of proposed mergers. In Figure 4, there is an increase in 100% in the frequency of proposed mergers between top and bottom of the cycle. However, the difference in terms of approved mergers is much greater. Specifically, $f_2/f_4 > f_1/f_3$.

In words, the result states that the proportion of approved mergers increases during (and before) an economic boom (which is usually associated to a merger wave). The intuition for this result is that before and during a boom the future expected equilibrium payoff is higher, thus providing greater slack in the no-deviation constraint.

This is only apparently in contradiction with the intuition from Rotemberg and Saloner's (1986) theory of repeated games with fluctuating demand. In their analysis, periods of high demand are typically associated with less efficient collusion. The naive extension would be to expect less efficient compromise when the level of activity is higher. However, the structure of my model is quite different from Rotemberg and Saloner. In my model, a higher activity level corresponds to more frequent interaction, whereas in their model a higher activity level corresponds to greater payoffs today with respect to future payoffs.

7 Concluding remarks

I have proposed a repeated-game approach to the problem of international merger policy coordination. Although my analysis is somewhat stylized, it suggests a number of interesting results. For example, Proposition 2 suggests that my "mutual concession" equilibrium, as the name suggests, is a two-way street: in order for a country to increase its concession level, it is necessary for the other country to increase its concession level as well.

The foundation of the analysis in this paper is the idea that repeated interaction allows for the self-enforcement of rules that otherwise would not be implementable. This is not a novel idea. Much of the recent trade policy literature is based on the same premise.[6] In fact, one promising avenue for further research is to study the possible link between merger policy and trade policy: it is known from game theory that repeated interaction on several strategic variables yields more efficient equilibria than interaction over one variable only.[7] A number of authors, including Neven and Seabright (1997), Bond (1997), Motta and Onida (1997), Rysman (2000), François and Horn (2000), Richardson (1999), and Horn and Levinsohn (2001) look explicitly at the relation between trade policy and competition policy, including merger policy. However, none of these papers tackles the issue of repeated interaction as indicated above.

[6] See, for example, Bagwell and Staiger (1990).

[7] See, for example, Telser (1980), Bernhein and Whinston (1990). For an important caveat, see Cabral (2001).

Appendix: proofs

Proof of Proposition 1: See Cabral (2002). ■

Proof of Proposition 2: Let $E_i \equiv \frac{\delta}{1-\delta} \int_S w_i \, f(w;\alpha) \, dw$. The optimal equilibrium maximizes $E_1 + E_2$ subject to $E_i \geq l_i$. At the optimum, we have $E_i = l_i$. Differentiating with respect to α, we get

$$\begin{bmatrix} -1 + \frac{\partial E_1}{\partial l_1} & \frac{\partial E_1}{\partial l_2} \\ \frac{\partial E_2}{\partial l_1} & -1 + \frac{\partial E_2}{\partial l_2} \end{bmatrix} \begin{bmatrix} d\,l_1 \\ d\,l_2 \end{bmatrix} = \begin{bmatrix} -\frac{\partial E_1}{\partial \alpha} \\ -\frac{\partial E_2}{\partial \alpha} \end{bmatrix} d\,\alpha$$

Solving with respect to l_i, we get

$$\frac{d\,l_i}{d\,\alpha} = \left(1 - \frac{\partial E_j}{\partial l_i}\right) \frac{\partial E_i}{\partial \alpha} \, \Delta^{-1} > 0$$

where

$$\Delta \equiv \left(1 - \frac{\partial E_1}{\partial l_i}\right)\left(1 - \frac{\partial E_2}{\partial l_i}\right) - \frac{\partial E_1}{\partial l_2} \frac{\partial E_2}{\partial l_1} > 0.$$

This completes the proof. ■

Proof of Proposition 3: Clearly, the points in the shaded region of Figure 2 should be in the approved-merger region with remedies. (The possibility of remedies cannot make things worse off.) Consider a point A that belongs to the shaded region in Figure 3 but not to the shaded region of Figure 2. Consider a symmetric equilibrium and suppose the merger w_A is not approved in equilibrium. Consider an alternative equilibrium such that both A and its symmetric counterpart, A' are approved. By construction, there exist points B, B' such that (i) $\Phi(B, A) = 0, \Phi(B', A') = 0$; (ii) $w_1^B \geq 0,\ w_1^{B'} \geq 0$; (iii) $w_2^B \geq 0,\ w_2^{B'} \geq 0$; (iv) $w_1^B + w_2^B \geq 0,\ w_1^{B'} + w_2^{B'} \geq 0$. It follows that the new proposed solution (a) is a subgame perfect equilibrium, (b) yields a higher payoff. ■

Proof of Proposition 4: The probability that a merger is approved in a given period is a function of (a) the frequency with which merger proposals arise (ρ) and (b) each country's concession level l_i. The level of l_i, in turn, is a function of the future discounted payoff: the greater the future discounted payoff, the greater the value of l_i. Starting at period t'' and working backwards, we see that, for $t > t''$, the future discounted payoff is lowest. As we move backwards from t'', the fraction of approved mergers increases. At t'', this results from a higher ρ. At $t'' - 1$, this results both from at higher ρ and a higher expected future payoff at t''. And so forth. Finally, for $t < t'$, future expected payoff declines as we move backward in time, both because we have a lower ρ and because the period of higher payoff ($[t', t'']$) moves farther into the future. ■

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