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International merger policy coordination

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Abstract

I treat international merger policy coordination as a repeated veto game. I derive optimal equilibria and consider comparative statics with respect to a number of exogenous parameters.

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1. Introduction

One of the most remarkable trends in merger policy is the increased importance of international aspects. Many important recent mergers have been reviewed both by US antitrust authorities (DoJ, FTC) and European authorities (EC), even when the merger only involved firms from one side of the Atlantic. This situation creates new challenges for the merging parties, who now need to avoid two vetoes instead of one. But it also leads to new problems for the antitrust authorities themselves, who must somehow coordinate their policies.

One of the most important challenges for antitrust authorities is that the impact of any given merger is not uniform across countries. For example, the merger between GE and Honeywell is likely to create a number of cost efficiencies. Insofar as the merging firms are based in the US, it is likely that such cost efficiencies are given greater weight by the US antitrust authority than the European one. Since the consumation of the merger requires the approval by *both* antitrust authorities, this leads to the problem that efficient mergers may not be approved: suppose, for example, that the welfare impact in the US is highly positive, whereas in Europe it is negative but not very negative.

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As a solution to this problem, former Assistant Attorney General Joel Klein proposed the creation of a world-wide merger authority.[1] This solution, however, 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 to 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.[3] Given a merger proposal, antitrust authorities in each country must decide whether or not to approve the merger.[4]

I model this situation as a repeated game between two countries. In each 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 if approved by *both* merger authorities.

Consider the stage game where a merger is proposed and the values of w_i are observed. The natural equilibrium of this game is for the merger to go through if and only if $w_i \geq 0$ for both *i*.[5] The problem with this equilibrium is that many efficient mergers are vetoed. Fig. 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

[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] In addition to differences in location, the impact of the merger may differ, because different countries place different weights on profits and consumer surplus. Barros and Cabral (1994), Neven and Röller (2001), and others developed models that suggest possible sources of divergence across antitrust authorities. I take a reduced-form approach that is consistent with all of these models.

[4] In this paper, I only consider the decision of whether or not to approve a merger. An interesting extension would be to allow for concessions in the form of asset sales, etc. that would transfer utility from firms to the antitrust authority.

[5] In what follows, I will refer to this equilibrium as the stage-game Nash equilibrium. Note that this is *not* the only Nash equilibrium. Another Nash equilibrium is for both authorities to veto the merger even when $w_i > 0$. In fact, there exists a continuum of equilibria, consisting of different combinations of the two-veto and no-veto subgame equilibria for different values of w_i. Note however that only the initial equilibrium is (trembling-hand) perfect.

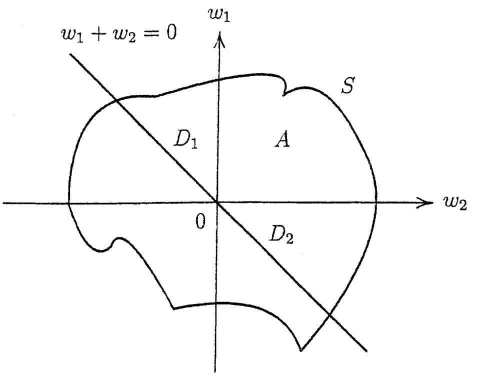

Fig. 1. Agreement and disagreement over merger decisions.

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 takes place: country 1's welfare increases but country 2's decreases (by a lower amount). In the static equilibrium, 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 assumption that the values of w_i are independently distributed across periods and both players have a common interest rate r. Define $\delta \equiv \rho/(1+r)$, the effective discount factor. 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 what follows, I derive optimal equilibria of the repeated game and consider some comparative statics with respect to these equilibria.

Specifically, I consider the following class of grim-strategy equilibria: along the "cooperative" phase, player i vetoes a merger if and only if $w_i < -x_i$ and $w_1 + w_2 < 0$. If, in any past period, any of the players vetoes a merger such that $w_i > -x_i$ and $w_1 + w_2 > 0$ then play reverts to the repetition of the stage-game equilibrium described above.[6] It can be shown (Cabral, 2002) that, among the set of grim-strategy equilibria with reversion to Nash, the above threshold equilibria are the most efficient. Intuitively, the idea is for countries to "compromise" and approve efficient mergers even though they decrease the country's welfare. Naturally, there is only so much that can be asked of a country, which leads to the "concession limit" x_i. Notice that the equilibrium is more efficient the greater the values of x_i. In the next sections, I derive the efficient equilibria (x_i) and consider comparative statics with respect to a series of exogenous parameters.

Specifically, I will perform a series of numerical simulations for the case when w_i is uniformly distributed in $[l_i, h_i]$ and w_1, w_2 are independent:

$$F(w_1, w_2) = \left(\frac{w_1 - l_1}{h_1 - l_1}\right)\left(\frac{w_2 - l_2}{h_2 - l_2}\right) \tag{1}$$

[6] In Section 6, I also consider the possibility of equilibria with more severe punishments for deviations from prescribed strategies.

Under the above-mentioned grim-strategy equilibrium, country i's expected future payoff along the equilibrium path is given by

$$\frac{1}{1-\delta}\int_S w_i \,\mathrm{d}F(w_1, w_2),$$

where the set S is defined by $w_1 \geq -x_1, w_2 \geq -x_2, w_1 + w_2 \geq 0$. In the particular case when F is given by (1), we have

$$\frac{1}{1-\delta}\mu\left(\int_{-x_i}^{x_j}(h_j + w_i)\,\mathrm{d}w_i + \int_{x_2}^{h_i}(h_j + x_j)\,\mathrm{d}w_i\right),$$

where

$$\mu \equiv \frac{1}{h_1 - l_1}\frac{1}{h_2 - l_2}.$$

I consider three possible exogenous changes. First, I consider changes in the discount factor δ. Next I consider a diagonal shift in the distribution of welfare gains, away from a symmetric distribution:

$$h_1 = 1 + \alpha, \qquad l_1 = -1 + \alpha$$
$$h_2 = 1 - \alpha, \qquad l_2 = -1 - \alpha$$

Finally, I will consider a uniform increase in country 1's welfare gains, again starting from a symmetric situation:

$$h_1 = 1 + \beta, \qquad l_1 = -1 + \beta$$
$$h_2 = 1, \qquad l_2 = -1$$

The goal of these comparative statics is to determine the impact of changes in δ, α, β on the values of x_i, the "maximum concession levels", as well as on the efficiency of the equilibrium. I define equilibrium efficiency as the ratio between joint welfare and maximum joint welfare:

$$E = \frac{\int_S (w_1 + w_2)\,\mathrm{d}F(w_1, w_2)}{\int_{\bar{S}} (w_1 + w_2)\,\mathrm{d}F(w_1, w_2)},$$

where the set $\bar{S}$ is defined by $w_1 + w_2 \geq 0$ and, as before, the set S is defined by $w_1 \geq -x_1, w_2 \geq -x_2, w_1 + w_2 \geq 0$.

3. Frequency of merger proposals

Let us first consider the effects of varying the discount factor. Table 1 presents the values of $x_i = x$, expected per-period payoff $e_i = e$ and efficiency E as a function of δ. Not surprisingly, the value of x_i is increasing in δ. Accordingly, the equilibrium is more efficient the greater the value of δ is. For values of δ greater than $\bar{\delta} = 24/25 = 0.96$, the efficient

Table 1
Effects of discount factor under Nash punishments $(h_i = 1, l_i = -1)$

δ	x	e	E
0.(8)−	0	0.125	0.750
0.89	0.011	0.126	0.758
0.90	0.116	0.138	0.827
0.91	0.226	0.147	0.884
0.92	0.344	0.155	0.929
0.93	0.472	0.161	0.963
0.94	0.616	0.164	0.986
0.95	0.784	0.166	0.997
0.96+	1.00	0.166	1.00

solution is attained.[7] For values of δ lower than $8/9 \approx 0.888$, no efficiency gain is possible with respect to the static Nash equilibrium.[8]

Recall that the discount factor reflects both the interest rate and the frequency with which mergers are proposed. Thus in a period when mergers are more frequent, we would expect the optimal merger policy to be more efficient, i.e. we would expect more efficient mergers to be approved. Given the assumption that w_i are independent across periods, this also implies that more mergers are approved (unconditional on the values of w_i).

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.

4. Asymmetric distribution of mergers

I now consider the possibility that the incidence of merger gains is asymmetric across countries. Suppose that most mergers are between firms in country *i*. One would then expect country *i* to receive a greater welfare gain than country *j*. I model this by assuming that the distribution of w_i gets shifted in favor of country 1:

$$h_1 = 1 + \alpha, \qquad l_1 = -1 + \alpha$$
$$h_2 = 1 - \alpha, \qquad l_2 = -1 - \alpha$$

[7] This value of δ is obtained by solving the no-deviation constraint as an equality for $x = 1$.

[8] This value of δ is obtained by taking the derivative of the left-hand side of the no-deviation constraint with respect to x, finding the value at $x = 0$ and finding the value of δ that makes this expression equal to 0. For lower values of δ, the left-hand side is decreasing with respect to x and the no-deviation constraint is nowhere satisfied except for $x = 0$.

Table 2
Effects of asymmetry (α) under Nash punishments ($h_1 = 1+\alpha, l_1 = -1+\alpha, h_2 = 1-\alpha, l_2 = -1-\alpha, \delta = 0.9$)

α	x_1	x_2	e_1	e_2	E
0	0.116	0.116	0.138	0.138	0.827
0.05	0.119	0.107	0.144	0.130	0.824
0.10	0.116	0.095	0.149	0.122	0.813
0.15	0.107	0.079	0.152	0.113	0.795
0.20	0.091	0.060	0.154	0.103	0.770
0.25	0.066	0.039	0.154	0.092	0.738
0.30	0.030	0.016	0.151	0.081	0.698
0.35	0	0	0.148	0.071	0.658

Table 2 shows the impact of changes in α in the equilibrium concession levels, expected payoffs, and efficiency level.[9] There are several interesting features in this table. First, a small increase in α leads to an increase in x_1. The idea is that there are now more mergers that benefit country 1 but not country 2. For a given level of x_2, this implies that country 1 has more to lose from breaking the compromise of mutual concessions. Country 1 is therefore willing to incur greater losses. It is also the case that these losses are now less frequent.

Regarding country 2, the opposite happens: the greater the value of α, the lower the average expected payoff along the equilibrium path. Although the Nash payoff is also decreasing, the former effect dominates. It follows that, in order to maintain the equilibrium conditions, less can be asked of country 2: x_2 is therefore decreasing in α.

The decrease in x_2 has a feedback effect on the maximum level of x_1. If country 2 is not willing to concede as much, then neither is country 1. Although payoffs are changing in favor of country 1, the difference between equilibrium expected payoff and Nash payoff is changing in a way that the maximum x_1 decreases as well. For values of α greater or equal to 0.35 no efficiency gain is attainable with respect to the static solution.

5. Unilateral increase in welfare gains

Suppose now that welfare gains in country 1 are uniformly increased by β:

$$h_1 = 1+\beta, \qquad l_1 = -1+\beta$$

$$h_2 = 1, \qquad l_2 = -1$$

The reason for an increase in β may be, for example, that country 1 places greater value on efficiency gains than country 2 (see Neven and Röller, 2002). Table 3 suggests that several effects are at work. For a given value of x_2, country 1 expects a greater payoff along the equilibrium path. Country 1 is therefore willing to concede up to a higher level. Increased concessions are "contagious": even though country 2 does not experience any direct increase in payoffs, an increase in x_1 implies an increase in country 2's expected

[9] I assume that $\delta = 0.9$. Similar results are obtained for different levels of δ.

Table 3
Effects of a uniform increase in country 1's payoffs (β) under Nash punishments ($h_1 = 1 + \beta, l_1 = -1 + \beta, h_2 = 1, l_2 = -1, \delta = 0.9$)

β	x_1	x_2	e_1	e_2	E
0	0.116	0.116	0.138	0.138	0.827
0.10	0.143	0.121	0.167	0.153	0.831
0.20	0.172	0.125	0.199	0.169	0.831
0.30	0.202	0.127	0.234	0.185	0.829
0.40	0.231	0.128	0.271	0.201	0.826
0.50	0.259	0.127	0.310	0.216	0.822
0.60	0.287	0.126	0.352	0.232	0.817
0.70	0.300	0.123	0.396	0.246	0.811
0.80	0.200	0.106	0.444	0.247	0.792
0.90	0.100	0.076	0.485	0.249	0.767
1.00	0	0	0.500	0.250	0.720

payoff along the equilibrium path, which in turn implies an increase in country 2's concession level.

However, as β continues to increase, a second effect takes place. The static Nash equilibrium payoff for country 2 increases. Intuitively, if country 1's gain from the merger is very high, then no efficient merger will be vetoed by country 1. It follows that country 2 has little to gain from an equilibrium of mutual concessions. Accordingly, the value of x_2 is decreasing in β. Finally, because of the "contagion" effect previously mentioned, the value of x_1 is also decreasing. In the extreme case when $\beta = 1$, no improvement over the static Nash equilibrium is attainable.

6. Extreme punishments

In Table 1, I considered the effects of changing the discount factor under the assumption of reversion to static Nash equilibrium. Reversion to Nash is not, however, the best that can be achieved. The minimax payoff level in the repeated game is zero for both players. In this section, I consider efficient grim-strategy equilibria under extreme punishments.[10] Table 4 presents the optimal values for in case of extreme punishments. The contrast with the case of Nash punishments (cf. Table 1) is stark. Recall that, under Nash punishments, no efficiency improvement is possible for $\delta < 8/9$. Under extreme punishments, full efficiency is possible for $\delta > 6/7$, in particular if $\delta = 8/9$. Under extreme punishments, some amount of efficiency gain is possible for all positive values of δ.

Fig. 2 plots the efficiency coefficient E as a function of δ, both for the case of Nash punishments and the case of extreme punishments. Notice that the effect of δ on E is S-shaped. This results from two effects. First, the value of $\delta/(1 - \delta)$, from which the discounted expected payoff is derived, increases very slowly for low values of δ. For low values of δ, a small increase in δ does not make players very forward looking.[11] Second, for

[10] In Cabral (2002), I show these equilibria are globally optimal.
[11] Specifically, the derivative of $\delta/(1 - \delta)$ is given by $1/(1 - \delta)^2$, which is increasing in δ.

Table 4
Effects of discount factor under extreme punishments ($h_i = 1, l_i = -1$)

δ	x	e	E
0	0	0.125	0.750
0.10	0.014	0.127	0.760
0.20	0.032	0.129	0.773
0.30	0.056	0.132	0.790
0.40	0.090	0.135	0.812
0.50	0.140	0.140	0.841
0.60	0.220	0.147	0.882
0.70	0.364	0.156	0.936
0.80	0.660	0.165	0.990
0.90	1.00	0.166	1.00

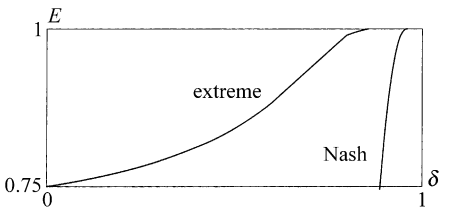

Fig. 2. Effects of discount factor under Nash and extreme punishments.

high values of δ (and high values of x_i), an increase in x_i has little impact on efficiency. This is because the likelihood of an efficient merger such that $w_i < x_i$ is very small (of course, this depends on the particular distribution assumption I am making).

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. In particular, one feature that is salient from my comparative statics experiments is that a "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. This has two implications. First, if for some exogenous reason a country becomes more lenient towards mergers, then it is likely that the other country will become more lenient as well. Second, the efficiency of merger policy coordination is reduced if the incidence of mergers is asymmetric across countries.

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.[12] In fact, one promising avenue for further research is to study the possible link between

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

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.[13] A number of authors, including Neven and Seabright (1997), Bond (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 (see also Dixit, 1987; Jensen and Thursby, 1984; Motta and Onida, 1997). However, none of these tackles the issue of repeated interaction as indicated above.

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

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