Allowable Defensive Tactics and Optimal Search: A Simulation Approach

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1. Introduction

The extent to which a corporation's performance should be exposed to capital market review through shareholder action has been the central corporate governance debate for the last 35 years At stake is the relative power of shareholders and the board of directors: when, over the board's objection, does the law permit shareholders to accept the proposal of an outside actor to purchase the company, change the company's operating or financial strategy, or change management? The character of the outside agents and the mechanisms through which they act have evolved in response both to changes in the capital market and changes in the problems confronting companies. Boards have responded to the increased external exposure that the combination of new mechanisms and problems permit by deploying defensive tactics that transfer to boards the power to accept or reject outside proposals. In this article, we return to issues that the earlier debate never settled, in no small measure because the courts gave boards very broad powers to adopt effective defensive tactics. We use a matching model and simulated searches to address the two key questions: the socially optimal level of defensive tactics in the complex corporate control market; and the privately optimal level of defensive tactics for target shareholders in that market.[1]

1.1 The Dynamics of External Capital Market Exposure

Junk bond financing was the initial mechanism that permitted the market to exert strong pressure on companies. Capital market participants used junk bonds to finance a spate of hostile takeovers in the 1980s. Shleifer & Vishny (1990). These takeovers dismantled many unsuccessful 1970s era conglomerates, but they also gave rise to a responsive defensive

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We are extremely grateful to Sarah Braasch for creating the Matlab code that made it possible to simulate a model of the market for corporate control, and for running the simulations.
[1] The terms of the earlier debate are set out in Easterbrook & Fischel (1981), Gilson (1981 & 1982); Bebchuk (1982 & __; Schwartz (1986) & 1989).

arsenal, including the poison pill. A hostile bid could not be accomplished with a pill in place, and only the board of directors could withdraw the pill. The pill plus the staggered board required a potential acquirer to win two elections in order to replace a majority of the directors and go forward with the hostile bid More recently, the intermediation of equity and the resulting concentration of equity holdings in institutional investors, importantly including public mutual funds, allowed a new category of governance participants – styled "activist investors" – to propose changes in a company's operating or financial strategies or the company's sale. (Gilson & Gordon 2013) Activists confront companies that resist with a threat of a proxy fight, made credible by institutional investors' large equity holdings and their having participated in forcing many potential targets to eliminate their staggered boards.[2] Because the activists' strategy catalyzed the increased equity held by institutional investor, such activist campaigns became possible at companies whose size would have been a complete defense to 1980s-style leveraged takeovers.

Predictably, companies' expanded exposure to activist campaigns induced defensive responses directed at elections rather than forced sales.[3] The governance debate thus reflects a dynamic interaction of capital markets, external governance actors, boards, management and, importantly, courts. The Delaware courts' broad approval of poison pills, even when coupled with staggered boards,[4] helped push governance activity in the direction of activism. Yet as market conditions and opportunities continue to change, hostile takeovers may be making a comeback despite the continued difficulty of buying a company when its board prefers not to sell.[5] More concentrated target stock ownership by institutional investors reduces the costs of running proxy fights, and the reduced incidence of staggered boards speeds a hostile bidder's effort to force the bid's consideration by shareholders.

Despite these dynamic changes in the actors, mechanisms and targets of external capital market activity, the basic normative question underlying the corporate governance debate has

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[2] [cite and give numbers.]

[3] See Gilson and Schwartz (2001). See Third Point v. Ruprecht for the use of a pill designed to address an activist campaign. For a recent description of hedge fund activism, see Coffee and Palia (2015).

[4] Cite and quote Chandler in Air Products.

[5] See "Hostile Bid Feeds Frenzy For Deals", WSJ August 5, 2015, p.1.

remained much the same: what is the appropriate division of authority between shareholders and boards for resolving external claims that the company should be sold or its strategy changed? This question is posed most directly by hostile takeovers, which are our subject. Control over the crucial decision whether to sell the company resides with target shareholders if they are free to accept or reject hostile bids. In contrast, decision making power over whether shareholders will have this opportunity resides with the board when the company has effective defenses, such as a staggered board and a poison pill.[6]

1.2 **Standard Justifications for Defensive Tactics**

The standard justification for giving the board discretion to prevent shareholders from accepting a hostile offer has two tracks. First, effective defensive tactics permit the board to bargain more successfully over the division of rents between the bidder and the target shareholders. The second track is a more extreme form of the first. Suppose the board honestly believes that the target will be worth more in the future (discounting for time and risk), but the board is unable credibly to disclose either to the bidder or to the market the basis for this belief. The board, Delaware courts believe, should then prevent shareholders from acting on the offer, in one case to increase the price to reflect the target's actual value and in the second to block a sale until the board can credibly convey its view of the target's real prospects.[7]

Both of these justifications assume that a target's board is a faithful fiduciary. A particular board, however, may be acting disloyally; its goal in adopting defensive tactics is to block takeovers in order to keep current directors and management in place rather than to benefit

[6] The combination of a poison pill and staggered board materially reduces the probability that a particular firm will be acquired. E.g. , Giang (2015); Sokolyk (2011); Bates, et al (2008). Studies such as these do not analyze market behavior as a function of defensive tactics.

[7] According to Delaware courts, a takeover bid "substantively coerces" target shareholders when it offers them the opportunity to accept a bid that may be below the "true" value of the company. Because a bid cannot succeed unless it exceeds the pre-bid price, and because the pre-bid price does not reflect the target's true value, the acquirer is either bidding irrationally or is aware of the true value. The courts do not ask whether bidders are routinely irrational or otherwise explain how bidders know a target's true value when the target board cannot credibly convey its private value enhancing information. We do not pursue these questions here. See Gilson & Kraakman (1989).

shareholders.[8] Because the board's "real" motivation may be difficult to observe and impossible to verify, courts ultimately have reduced their inquiry into motive to a rule-like assessment of whether a defensive tactic is either "draconian" or "preclusive" of a hostile bid.[9] And while a poison pill would preclude a hostile offer, the Delaware Supreme Court held that the pill is not preclusive if defensive tactics "would only inhibit" a proxy fight to remove target directors, whose successors then could eliminate the pill. More precisely, the Supreme Court stated that a defensive tactic is preclusive only if it makes a successful proxy fight "mathematically impossible or realistically unattainable."[10]

1.3 **The Open Questions**

The resurgence in hostile offers, as well as defensive efforts to block activist proxy fights, reopens the earlier debate, which was not so much settled as abandoned in the face of the broad discretion courts gave boards of directors: Are defensive tactics a good thing? The same two central issues remain. First, what level of defensive tactics maximizes target shareholder welfare? Second, what level of defensive tactics maximizes social welfare? In this paper, defensive tactics maximize shareholder welfare when they maximize the shareholders' expected return from a possible sale of the company. Defensive tactics maximize social welfare when they maximize the number of ex ante efficient acquisitions the capital market makes. [11]

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[8] The same alternative can be framed in behavioral terms rather than in terms of disloyalty. Defenders of the board's power to block an offer also argue that the market is myopic – that it discounts the future excessively. Conversely, defenders of the shareholders' right to decide argue that the board and management are "hyperopic": they fail to discount their future plans sufficiently. Either position is consistent with some combination of behavioral biases. See Gilson (2001).

[9] Unitrin v. American General Corp., 651 A.2d 1361 (Del. S.Ct. 1995).

[10] Unitrin v. American General Corp., supra note 7, at 1388-89.

[11] Two other social welfare measures appear in the literature. First, the credible threat of a takeover may cause target managers to maximize target returns either by performing better or consuming fewer private benefits. This possibility has theoretical support but has been difficult to test empirically. A recent paper conducts a rigorous test, however, and reports: "…we find strong evidence that the enactment of M&A Laws [which reduce barriers to takeovers] increases the sensitivity of CEO turnover to poor performance…. we provide evidence that an external market for corporate control, when available, can be an effective substitute for internal-governance mechanisms." Lel and Miller (2015) at 1590. Because increasing the ex ante probability of acquisitions increases the pressure on managers to maximize, the welfare measure in text is consistent with the incentive increasing measure. Second, a global social welfare measure for corporate governance is the net gain to all those doing business with the company, thereby requiring a netting of gains and losses among, for example, customers, suppliers, employees and shareholders. (Bolton, Becht, & Roell 2003) We do not address this second measure here.

We begin by observing that defensive tactics disadvantage potential acquirers because they eliminate a maximizing strategy: to buy a target with a hostile bid or to improve the target's performance after having taken a position in the target's stock. Before defensive tactics were in place, a firm that discovered an attractive target could attempt, depending on the opportunity a particular target presented, (i) to take an equity position in the target and suggest that the target alter its business strategy; (ii) to request board seats; (iii) if strategies (i) and (ii) do not avail, to run a proxy contest; (iv) to offer to buy the target in a friendly acquisition; and (v) to make a hostile bid. Today, defensive tactics constrain the hostile strategy, which reduces the utility of the firms that would have used it. Because a firm's gains are non-decreasing in the size of the firm's strategy set, defensive tactics thus reduce acquiring firms' expected welfare.[12] This analysis raises the question whether what is unquestionably bad for acquirers – strong defensive tactics -- is also bad for society and for target shareholders.

Turning to social welfare, defensive tactics opponents assume that, if there were no defensive tactics, the corporate control market would be competitive. In competitive markets, price equals cost. Because a target's shareholders implicitly refuse to sell at the market price, the price at which they will tender must count in a welfare analysis; that is, the "cost" that price should equal is the target's stand-alone value plus the premium necessary to induce target shareholders to tender. However, a target's board would only adopt defensive tactics if they generated bids above cost; that is, above the target shareholders' reservation price.[13] In the view of the opponents, then, defensive tactics are inefficient because they induce supra-competitive prices.[14]

The concern that actions by loyal boards of directors to realize supra-competitive prices may also reduce the overall number of bids never commanded the attention of the Delaware courts. The fiduciary duty of directors runs to the company and its shareholders, not to

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[12] A poison pill, by limiting the percentage of a target's stock that can be purchased without its board's consent, also constrains the potential for a successful proxy fight.

[13] Our simulations are consistent with this statement; in them, target shareholder payoffs are materially higher when the board can deploy defensive tactics to bargain on the shareholders' behalf.

[14] A modern version of this argument is Jordon and Hatfield (2012 at 690-91). We do not address the special circumstance of bid structures that may coerce target shareholders to tender into an offer that, absent the coercive structure, would be below target shareholders' reservation price.

shareholders generally. The courts' focus on target shareholders thus elided, rather than responded to, the social welfare objection. Indeed, should a board agree to consider acquisition offers, Delaware law requires that the board maximize the price.[15]

However, the social welfare objection to defensive tactics ignored by the Delaware courts – that they would reduce the overall number of hostile bids – has a difficulty of its own: reducing target acquisition price to the target shareholders' reservation price may itself be inefficient. Earlier economic analyses assumed that the corporate control market was similar to ordinary markets: there were passive sellers – the potential targets – and active shoppers – the potential acquirers. Because shoppers police the market, reducing the return to shopping would yield noncompetitive equilibria. Defensive tactics reduce the return to shopping because they raise the target's price. Hence, the conclusion that defensive tactics should be banned apparently also holds in an equilibrium analysis.[16] But the premise of the efficiency argument for prohibiting defensive tactics is questionable because the corporate control market is atypical. To be sure, there are acquirers that search for targets and there are targets that do not search, but there also are "noise firms" that are not in play[17] *and* targets that search for acquirers. The corporate control market thus is partly a traditional active buyer/ passive seller market and partly a noisy matching market with perfectly transferable utility.[18]

Standard matching models fit the corporate control market poorly because, as just said, some potential sellers – the targets -- do not search; indeed, a subset of the "sellers" are passive because they do not want buyers to find them, and may become active resistors if

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[15] *Revlon, Inc. v. MacAndres & Forbes Holdings*, 506 A.2d 173 (Del. S. Ct. 1986). Similarly, a board may not be passive if it believes shareholders will tender into an underpriced offer. Unocal Corp. v. Mesa Petroleum, 493 A. 2d 946, ___ (1985).

[16] Galenianos and Kircher (2012) provide a general review of search models in which one side searches and the other side sets prices. Schwartz (1986) applies this genre of model to the corporate control market.

[17] A noise firm is a bad match in a particular period for any of the acquirers who search in that period. Noise firms dilute the effectiveness of acquirer search. To see why, let a potential acquirer plan to analyze three potential targets. Finding out that one of the searched firms is not in play at all wastes the costs of analyzing it: the searching firm in effect is reduced to sampling two "live" prospects.

[18] Utility is perfectly transferable when, as here, it can be measured in money. For example, acquirers transfer money to the targets they buy.

found.[19] Also, in matching models how the agents split the match surplus is either exogenous or determined by bargaining after searching agents find each other. In contrast, in the corporate control market, the split of expected surplus from an acquisition is importantly influenced by the level of defensive tactics (and their effectiveness) that acquirers assume potential targets will deploy should an offer be made. For example, because a target can adopt a poison pill at any time, and is likely to adopt one if an acquirer approaches it, acquirers choose search strategies on the assumption that pills are in place. Coates.

That potential acquirers anticipate defensive tactics is significant because these tactics affect how the surplus from an acquisition – the amount by which the post-transaction value of the target is expected to exceed the target shareholders' reservation price – is split ex post. An agent's expectation of the split, in turn, influences the agent's intensity of search. Just as defensive tactics reduce acquirer search for targets by reducing acquirer returns, banning defensive tactics may reduce target search for acquirers by reducing target returns. A possible target may not search intensively for a potential buyer if the buyer could purchase it at the target shareholders' reservation price, which the buyer could get by making a hostile offer directly to the shareholders. Because defensive tactics influence the searching activity of both sides of the market, there is a question whether acquirer and target search are substitutes -- acquirers search less when targets search more – or complements – acquirers search more when targets search more. The unsettled nature of this question is another reason why the socially optimal level of defensive tactics remains an open question.

The target shareholder welfare question also is open. A loyal target board should want to maximize bid size conditional on there being bids but also want to maximize bid probabilities, which defensive tactics affect. Because these goals conflict, the "loyal board problem" is to maximize the tradeoff between bid price and bid frequency – that is, to maximize expected acquisition gains. As yet, the solution to this tradeoff has not been characterized analytically.

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[19] A standard matching model has all of the agents on each side – sellers and buyers or prospective marriage partners – searching to buy or combine with the other side.

Empirical research on defensive tactics has been extensive, but it has not established which level of defensive tactics maximizes social or private welfare. Regarding the social welfare measure, the econometrician can observe concluded and failed bids for targets under an existing legal regime. She cannot observe the total number of possible good matches there were in that regime, however. Hence, she cannot estimate how well, in terms of making matches, a current regime is doing, nor can she plausibly predict whether there would be more or fewer good matches under an alternative legal regime. These empirical and theoretical gaps make comparative institutional analysis difficult. The social welfare question has been hampered by the qualitative aspects of defensive tactics. A poison pill, for example, permits a target board to reject bids and to constrain a proxy fight initiated to remove a pill. Whether this power is relatively more important than a staggered board, or whether less important than a combination of the two, in maximizing the target shareholder tradeoff between bid size and bid frequency is difficult to measure without a common metric for comparing various defensive tactics and their combination.[20]

1.4. **Methodology and Results**

In this paper, we simulate a search equilibrium model of the market for corporate control to analyze what are the socially and privately optimal of defensive tactics levels. In general, two efficiency measures are applied to matching markets. First, do agents' matches maximize surplus? Second, is the market "match efficient"? To understand what is meant by match efficiency, let m represent the number of ex ante efficient matches that exists in a market at time t. Agents in the market can make $n \leq m$ matches. Letting σ denote the ratio n/m, the market is perfectly match efficient if $\sigma = 1$; actual sigmas reveal the efficiency shortfall because they reflect the matches that agents make compared to the good matches it was possible for agents to make.

[20] Straska and Waller (2014) extensively review the literature concerning the effect on shareholder wealth of antitakeover provisions. According to these authors, the literature reaches no firm conclusions. Thus, they suggest, as a question for future research (at 953): "Does an optimal value-maximizing number of antitakeover provisions exist?"

We focus here on the match efficiency question. Regarding motivation, we assume that semi-strong efficiency holds: the market price approximates a target's stand-alone value. It follows that every acquisition is ex ante efficient: the bidder believes that it will realize surplus at the bid price and the target's shareholders, or its board, will reject bids that do not exceed the target shareholders' reservation price, which we saw in the previous section exceeds its stand-alone value. If every actual match is ex ante efficient, the relevant question is whether the market is match efficient. [21]

Relating this discussion to the prior analysis, search intensity is an increasing function of the expected return to searching. Here, an agent's expected return is a function of how the surplus from an acquisition is split. [22] Because defensive tactics affect the split, the analyst's goal (taking search costs into account) is to solve for sigma under various defensive tactics regimes. Thus, there should be more acquirer search but less target search when the split favors acquirers – the acquirer friendly regime – and less acquirer search but more target search when the split favors targets – the target friendly regime. As an illustration, let there be 20 possible efficient matches in total, and suppose that agents make ten matches under the acquirer friendly regime and 12 matches under the target friendly regime. Then the target friendly regime is more match efficient than the acquirer friendly regime (a σ of .6 is greater than a σ of .5). The stronger the defensive tactics allowed, the more target friendly is a legal regime, so if actual matches are as in the illustration the corporate control market may be more match efficient with defensive tactics than without them.

[21] Many matching models analyze marriage (or its equivalent) or a job. In the corporate control market, a target may be sold to an acquirer. Hence, the text's assumption that matches are correct holds only that well informed agents make ex ante efficient trades. A market then is match inefficient when agents make fewer trades than are available to them. Turning directly to the corporate control market, a recent review of private and public company acquisitions reported: "We find that acquisitions are efficiency improving, both on and off the [merger] wave." Makismovic, et al (2013 at 2179). Duchin and Schmidt (2013) partly confirm these results because they find less favorable results for on wave mergers. Because searching for and buying companies are costly, the corporate control market is unlikely to be perfectly match efficient. The issue is how close various legal regimes permit agents to come. Match efficiency is related to investment efficiency because agents may invest in anticipation of making matches. We do not investigate investment efficiency. For a complex and thorough treatment, see Noldeke and Samuelson (2015).

[22] A recent paper estimated that target resistance explains 74% of the premium in single bidder contests, with which we are primarily concerned. See Dimopoulos and Sacchetto (2014). Hence, it is plausible to suppose that potential acquirers consider the effect of defensive tactics on their likely share of acquisition surplus when choosing search strategies.

Determining match efficiency in real markets is impossible because, as said, the analyst cannot observe the number of efficient matches that could have been but were not made. There are two ways to address the unobservability problem. The first is to solve a model of the corporate control market analytically and then see whether agents' observed behavior is consistent with optimal behavior in the model. This approach still would not let the analyst get a fix on one of the key parameters of interest, however -- the number of possible good matches. More important, such a model has not been solved, and seems difficult to do.

We thus proceed in the second way: we write a model of the corporate control market and "solve it" with the use of simulations. The simulations are described in detail in Part 2; we introduce our methodology here. First, we create sets of acquirers and targets and characterize them. Targets either are companies whose stand-alone value can be improved by acquirer imposed (whether by hostile takeover or through activist activity) changes in strategy or management (financial acquirer opportunities), or targets whose value is increased by combining their activities with those of the acquirer (synergistic acquirer opportunities). Acquirers are of parallel types: an acquirer either has the managerial capacity to improve a target's strategy or performance (for example, a private equity firm), or has a business that when combined with that of the target will increase the value of both (a synergy acquirer).

We next specify how acquirers and targets search for good matches. Search costs are estimated as an increasing fraction of the surplus that acquisitions generate. Because we let every target in the model be a good match for the appropriate acquirer, we know the total number of ex ante efficient matches that the simulated market can sustain. We then vary the surplus splits from matches, to make potential transactions more or less acquirer friendly: that is, we characterize, more or less, the split a no-defensive tactics regime generates and the split a more defensive tactics friendly regime generates.[23] To understand the bottom line, suppose that under one posited legal regime, say, acquirers take three draws (search three possible acquisition targets) and under another legal regime acquirers take only two draws. Because the

[23] We sometimes refer to the no-defensive-tactics regime as the "prior regime" or the "pre-1985 regime" and the strong-defensive-tactics regime as the "current regime". These descriptions are rough proxies for the complex legal and economic realities as they once existed and now exist. In the model, we identify each regime precisely by the surplus split it is assumed to engender.

number of matches the market makes is an increasing function of the agents' search intensities, the three-draw regime is the more match efficient. More acquisitions occur under the legal regime that induces agents to take three draws rather than two.

To be sure, simulation results are only suggestive, but if the parameters are plausible and the results are intuitive, some progress has been made. Simulating our model suggests that the current legal regime, under which defensive tactics permit a target to acquire a large share of an expected acquisition surplus, is less match efficient than a legal regime less friendly to defensive tactics, under which defensive tactics would permit the target acquire a much smaller share. As we will show, the surplus split that a defensive tactics-friendly regime implies produces approximately 57% of the total matches that could be made while a less defensive tactics friendly regime produces approximately 65% of the possible matches. "In 2007, the aggregate deal value for acquisitions of U.S. targets (from Securities Data Company) (SDC) was $1.37 trillion." [24] That the current legal regime may reduce the number of acquisitions by approximately 8% per period thus is economically significant. A simple intuition, set out more fully below, explains this result. *All* of the acquirers search in the corporate control market but only a subset of targets search. Therefore, though acquirer and target search turn out to complement each other, the market for matches is more sensitive to legal rules that shift surplus away from acquirers than it is to rules that shift surplus toward searching targets. That there are fewer total searches as the legal regime becomes more defensive tactics- friendly implies that there will be net fewer matches.

Turning to shareholder welfare, the analyst's difficulty, as noted above, has been the lack of a common metric by which to assess various defensive tactics. We suggest here that a common metric does exist: *time*. An acquirer's payoff – its surplus share – declines as the time increases from finding a possible target to buying it. The acquirer may have to tie up resources for a longer period, focus executive time on a deal for a longer period, pass up other business opportunities, negotiate more intensively with the target and, perhaps most important, have to confront a competitor for the acquisition opportunity. A poison pill can delay an acquisition for

[24] Garfinkel and Hankins (2011 at 515).

a year because it can take up to a year to win a proxy contest; a poison pill with a staggered board can delay an acquisition for two plus years because the acquirer must win two proxy contests, which in practice may block the offer.[25] The acquirer's expected gain thus is lower when a pill is combined with a staggered board.

Because time and the resulting payoffs are continuous variables, it is possible to write a simple equation for a target's expected revenue from an acquisition as a function of the target's defensive tactics level. We argue that this expression is strictly concave: that is, for each target there is a defensive tactics level that maximizes its expected return. This claim is consistent with our simulations. The simulations also show that target shareholders do better under the current permissive legal regime than they did under the prior regime. On the other hand, the most powerful defensive tactics in use today may approach corners; if so, these tactics would be privately as well as socially inefficient.

The first part of this paper, which considers market efficiency, and the second part, which considers target welfare, relate in the following way. Takeover premiums in a defensive tactics-friendly regime (roughly) imply a surplus split that favored acquirers two to one. The most recent data suggests that defensive tactics imply a split that favors targets approximately two to one. Moving from the a defensive tactics-friendly to a defensive tactics-unfriendly regime without more, we show, *improves* target shareholder welfare but *reduces* social welfare. Because there is no reason to favor target shareholders at society's expense, permitting companies freely to choose defensive tactics levels is questionable.

We do not interpret these results as a clarion call for regulatory action. Our simulations and our target shareholder welfare analysis are intended to restart the debate over defensive tactics rather than end it, although we note that both commentators and respected courts have questioned giving boards very broad freedom to deploy defensive tactics. Rather, we want to situate defensive tactics in the larger debate about the desirability of shareholder control. Our preliminary results suggest that defensive tactics, considered in isolation, are unequivocally bad for acquirers; good for target shareholders at some levels, but not at higher levels; and can

[25] See *Airgas*, in which the court remarked that no one has seen a two-election effort.

materially reduce efficiency in the market for corporate control. The ability of activist investors today to influence corporate policy may ameliorate some of these bad effects because the concentration of equity through intermediation makes effective defensive tactics against activists more difficult, at least for now. Potential targets still have weapons to use against activists, however, and may develop more with time.[26] Thus, we suggest that the defensive tactics issue should again occupy a prominent place in the corporate governance debate. Finally, and regarding regulation, there are hints that as the level of institutional ownership has increased, Delaware courts may give boards less room to protect shareholders from making mistakes than under the current substantive coercion regime, (Gilson & Gordon 2015; Jacobs). This legal position, in turn, would be consistent with an interior solution to the level of allowable defensive tactics. Interestingly, this solution tracks a position that the Delaware Chancery Court advanced in the mid-1980s only to be rejected by the Delaware Supreme Court in the mid-1990s, a pattern that we consider in Part IV.

Part 2 below analyzes match efficiency in the market for corporate control; Part 3 analyzes shareholder welfare, highlights the conflict between private and social efficiency and addresses normative objections to our analysis. Part 3 then closes with an analysis of the earlier Delaware legal regime that governed a company's defensive tactics and compares that regime to the current regime. Our analysis here suggests that the Delaware courts had it right the first time. Part 4 concludes. The Appendix describes the coding and search algorithms.

2. The Market for Corporate Control

2.1. The Parameters and the Model

The market has 47 agents: 26 acquirers, 18 targets and 3 noise firms. A target is defined to be a live prospect: a firm that the right type of acquirer will buy if the acquirer finds it. Hence, the total number of good – that is, ex ante efficient -- matches is 18. A noise firm is not a live prospect.[27] The problem would be trivial if there were as many or more targets as there are searching acquirers; hence, we assume that targets are relatively scarce. Wasted

[26] See Third Point v. Ruprecht.
[27] Noise firms are defined more precisely in note 17 above.

searches also are common, which implies the existence of noise firms. The number of acquirers, targets and noise firms in actual markets is unknown. The important consideration, however, is the ratio of these agents to each other. In particular, search becomes less effective as the ratio of targets to searchers falls or as the ratio of noise firms to searchers increases. If defensive tactics reduce the effectiveness of search, the effect should be more pronounced as search becomes less effective. Therefore, in order not to bias the results against defensive tactics we let the ratio of targets to searchers –.67 – be relatively high and the ratio of noise firms to searchers -- .11 – be relatively low. Regarding the particular numbers we use, the simulation results were almost random when four acquirers searched for two targets. Thus, we increased the numbers until we saw consistent patterns.

In the model, all of the acquirers search for targets. Importantly, there are few searching targets relative to acquirers. Initially, targets plagued by serious agency costs -- mismanaged targets -- will not search for acquirers because the boards and managements of these targets prefer not to be found. Targets that would be good synergy matches either can search for acquirers or be passive. We assume that a large proportion of synergy targets does not search but will consider sale if found, for two reasons. First, search for synergy partners is a different skill set than running a business (Gilson 1982); many firms in the normal course specialize in running their businesses, but will consider a good offer should one appear. Second, a synergy seeking firm can either want to buy another firm or sell itself to another firm. Success in a synergy motivated acquisition requires both search and implementation skills. We classify synergy seekers that want to buy – those who believe they have implementation skills – as acquirers. Consistent with this framing, the impressionistic evidence is that non-distressed firms seldom actively seek to sell themselves. Finally, targets cannot implement acquisition *programs* because a target can only sell itself once, but some acquirers make repeated acquisitions.[28] Search and implementation skills presumably increase with experience. Summing up, we assume that a relatively small subset of the targets is searching for acquirers.

[28] See Golubov, et al (2015); Aktas, et al (2013).

There are two search strategies in the literature: sequential search, in which the agent continues to search until the marginal cost of another search equals the expected marginal gain; and fixed sample size search, in which the agent chooses a sample size over which to search *before beginning*, and buys at the best price she sees if it is below her limit price. We use a modified version of the fixed sample size strategy for two reasons. First, it is relatively convenient and the little available data about actual markets suggest that this strategy either produces better results than the sequential strategy[29] or is indistinguishable from the sequential strategy in terms of fit.[30] Second, more recent data for consumer markets rejects the sequential search strategy because that strategy implies that the agent buys at the last firm she sees (unless she has searched every firm), but actual agents return to earlier draws if they revealed lower prices.[31]

In our model, an agent can take up to five draws, where to take a draw is to analyze a firm to see whether a profitable match exists. The actual number of draws (up to five) that agents take is a function of search costs and prospective gains. Searchers know the distribution of targets and noise firms and have expectations over the payoffs from matches,[32] but searchers do not know the identity of particular firms. We assume that it costs about 3% of the match surplus to make one search, which is consistent with the data about the ratio of transaction costs to acquisition gains. Our cost assumption also permits us to specify match gains. In the model, costs are convex, so searching over a sample size of two firms costs a searcher more than would just doubling the cost of searching over a sample size of one firm.[33]

The empirical observer cannot conveniently observe actual surplus splits. As a general matter, we assume that the split favors targets in the current defensive tactics regime because these tactics are adopted either to stop acquisitions or to raise their prices. Regarding

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[29] Hong and Shum (2006).
[30] Chen, Hong and Shum (2007).
[31] De Los Santos, et al (2012).
[32] This is why the acquirers search.
[33] We make the standard assumption that agents can finance positive net present value projects; in the model, searching for targets is such a project. We restrict an acquirer's search strategy to buying one firm or not buying it. As the Introduction suggests, and Part 3 remarks, an activist has a number of available strategies to affect potential target behavior. We focus on purchases here because our immediate goal is to characterize the market for acquisitions.

magnitudes, we derive our (rough) estimates in the following way. Let p be the (correct) pre-bid market price of the target; p thus is the target's stand-alone value. The acquirer's value for the target is v and the winning bid is b. We let $b = (1 + \alpha)p$, where $0 < \alpha < 1$ is the premium necessary to induce a sale, and $v = (1 + \beta)p$, where $0 < \alpha < \beta$, reflects the value the acquirer has for the target, as a function of the target's pre-bid price. A bidder's return is v – b, or $(1 + \beta)p - (1 + \alpha)p = p(\beta - \alpha)$. The match surplus is the bidder's value less the pre-bid price: $p(1 + \beta) - p = p\beta$. The acquirer's share of the surplus thus is $\frac{p(\beta - \alpha)}{p\beta} = \frac{\beta - \alpha}{\beta}$. A recent paper[34] studied 5,136 takeover contests between 1998 and 2006 (during which time the defensive tactics-friendly legal regime governed) and found an average premium above the pre-bid price of 50% (the α) and estimated an average acquirer value above the pre-bid price of .81 (the β). Therefore, the acquirer's surplus share was .333. Our simulations use a surplus split of 1/3 for acquirers and 2/3 for targets in the current regime. We lack valuation data for the defensive tactics-unfriendly regime. Premiums then were around 25 to 30% above the pre-bid price. If bidder valuations were then as they are now, bidders would have received 63% of the surplus under a 30% premium and 69% of the surplus under a 25% premium. Our simulations use a regime-unfriendly defensive tactics split of 2/3 for acquirers and 1/3 for targets. An acquirer buys a target if it finds one, and buys at most one target during the search period. [35]

We proceed as follows.[36] First, we calculate the expected utility of a searcher at the beginning of a period under 1, 2 … 5 draws using the assumed search strategy, our cost parameters, an assumed total value of a match (as a multiple of assumed acquisition costs); and an assumed split. An agent's expected utility is reported as the average of a thousand simulations for each one of the five possible draws. If, say, an acquirer's expected utility is maximized at two searches when the split favors targets, we assume that each acquirer finds and considers two potential target firms.[37] We calculate similarly the number of draws a

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[34] Dimopoulos and Sacchetto (2014).

[35] Our assumption that every found target is bought is consistent with the data. A thorough study showed that 74% of initial bids result in completed transactions and 78% of auctions result in completed transactions. See Bates, et all (2008).

[36] The Appendix sets out with precision how the model unfolds.

[37] We report expected utility as whole numbers and fractions: e.g. 2.35. We interpret this to mean that the agent will make two searches for sure and make a third search with probability .35.

searching target makes. In the standard fixed sample size model, a searcher exhausts her sample and then makes the most favorable purchase. We assume for convenience that the searcher plans to exhaust her sample, but will truncate search to buy the first target it sees.[38]

The number of matches in a market is determined by the number of acquirer searches because all of the acquirers search, but a target can only match with an acquirer. It may appear optimal for targets to search more than acquirers search, but this is indicative and inclusive of the targets' wishes that acquirers would search more for them. Target search is important, however, because it complements acquirer search. In our simulations, acquirer expected utility per draw is increasing in the amount of target search. This is because increasing target search increases the probability that acquirers – who may be found by a searching target–make matches.

Turning to market efficiency, we calculate the probability that a particular target will match, given the number of searches an acquirer who wants to buy a target of that type will make. For example, if acquirers who want to buy mismanaged targets search over three firms, our simulations uncover the probability that a mismanaged target will be purchased when the sample size is three. These are the sigmas for that target type. We then multiply the total number of mismanaged targets in the market by this probability to get the number of mismanaged target matches. We repeat this exercise for synergy targets: the sum of the mismanaged and synergy matches together is the total number of matches. Dividing the number of made matches by 18 (the number of ex ante efficient matches that could be made) yields the market sigma, the measure of market efficiency. Our tables often specify a whole number plus a fraction: i.e., there are 10.3 matches. Because we do thousands of simulations,

[38] We note two implications of the model. First, the search modification is innocuous because when there are many targets relative to acquirers, an individual target cannot affect the sample sizes the acquirers set by the defensive tactics level the particular target chooses. This is because, at the outset, acquirers optimize against the market average. Rather, defensive tactics levels affect the price at which a "found target" is purchased. Our assumption that every found target is purchased biases our results in favor of the defensive tactics regime. In effect, we assume that every target is ultimately priced at or below a searching acquirer's limit price. If we relax this assumption to let found targets be bought only with positive probability, search would be less productive for acquirers and they would search less. In effect, relaxing our assumption that every found target is purchased would be equivalent to increasing the number of noise firms relative to acquirers.

we interpret such a result as holding that 10 matches will be made under the parameters and there is a 30% chance of making an 11th.

2.2 Results

We begin with a base case as a benchmark: in it, all the acquirers are the same and all the targets are the same. We later partition acquirers into financial and synergy buyers and so forth. In the base case, our results are in Table 1.[39]

[39] In Table One, an A agent is an acquirer, a TP agent is a passive target and a TA agent is a searching target.

Table One

Base Case
Larger Set of Agents with 3% Costs (47 Agents – 26 A's, 3 P's, 18 T's)
3% Costs

A and T Split Surplus Asymmetrically
(1/3rd A, 2/3rds T)
18 T's (3 TA's, 15 TP's)
26 A's
3 P's

Sample Size	1	2	3	4	5
Prob TP (15)	0.4268	0.6131	0.7155	0.7758	0.8157
Prob TA (3)	0.692	0.8737	0.9233	0.9523	0.9627
Prob TM (0)	0	0	0	0	0
Sigma	0.471	0.656533	0.750133	0.805217	0.8402
Sigma TP	0.4268	0.6131	0.7155	0.7758	0.8157
Sigma TA & TM	0.692	0.8737	0.9233	0.9523	0.9627
Sigma TA	0.692	0.8737	0.9233	0.9523	0.9627
Sigma TM	0	0	0	0	0
Sigma A	0.3261	0.4545	0.5193	0.5575	0.5817
Sigma AH	0	0	0	0	0
Total Matches Made	8.478	11.8176	13.5024	14.4939	15.1236
Total A Payoff	67.94	84.8472	83.1744	72.5803	54.3598
Total AH Payoff	0	0	0	0	0
Total TP Payoff	140.844	202.312	236.104	256.014	269.192
Total TA Payoff	43.392	54.4927	57.227	58.6553	58.7124
Total TM Payoff	0	0	0	0	0
Total Payoff (Welfare)	252.176	341.6519	376.5054	387.2496	382.2642
Payoff per Match Made	29.7447511	28.9104302	27.8843317	26.718109	25.2760057
A Agent Expected Utility	2.6131	3.2634	3.199	2.7915	2.0908
AH Agent Expected Utility	0	0	0	0	0
TP Agent Expected Utility	9.3896	13.4875	15.7403	17.0676	17.9461
TA Agent Expected Utility	14.464	18.1642	19.0757	19.5518	19.5708
TM Agent Expected Utility	0	0	0	0	0
Expected Welfare	14.0097778	18.9806611	20.9169667	21.5138667	21.2369

A and T Split Surplus Asymmetrically
(2/3rds A, 1/3rd T)
18 T's (2 TA's, 16 TP's)
26 A's
3 P's

Sample Size	1	2	3	4	5
Prob TP (16)	0.4298	0.6258	0.715	0.7768	0.8108
Prob TA (2)	0.7055	0.863	0.927	0.9455	0.9695
Prob TM (0)	0	0	0	0	0
Sigma	0.460433	0.652156	0.738556	0.795544	0.828433
Sigma TP	0.4298	0.6258	0.715	0.7768	0.8108
Sigma TA & TM	0.7055	0.863	0.927	0.9455	0.9695
Sigma TA	0.7055	0.863	0.927	0.9455	0.9695
Sigma TM	0	0	0	0	0
Sigma A	0.3187	0.4515	0.5113	0.5508	0.5735
Sigma AH	0	0	0	0	0
Total Matches Made	8.2878	11.7388	13.294	14.3198	14.9118
Total A Payoff	156.798	212.5868	226.6636	227.0673	214.8706
Total AH Payoff	0	0	0	0	0
Total TP Payoff	75.636	110.143	125.84	136.719	142.703
Total TA Payoff	14.004	16.9075	17.896	18.0295	18.3332
Total TM Payoff	0	0	0	0	0
Total Payoff (Welfare)	246.438	339.6373	370.3996	381.8158	375.9068
Payoff per Match Made	29.7350322	28.9328807	27.8621634	26.6634869	25.2086804
A Agent Expected Utility	6.0307	8.1764	8.7178	8.7334	8.2643
AH Agent Expected Utility	0	0	0	0	0
TP Agent Expected Utility	4.7272	6.8839	7.865	8.5449	8.9189
TA Agent Expected Utility	7.002	8.4537	8.948	9.0148	9.1666
TM Agent Expected Utility	0	0	0	0	0
Expected Welfare	13.691	18.8687389	20.5777556	21.2119889	20.8837111

When the defensive tactics-unfriendly legal regime governs and so the surplus split favors targets, acquirers make two searches and the three searching targets make five searches. There are 11.82 matches and the sigma is .6565: the market makes a little more than 65% of the matches that could be made. In the defensive tactics-friendly legal regime, where the split favored acquirers, the acquirers search four firms and the two searching targets continue to search five firms.[40] There are 14.32 matches and σ = .7955. In this regime, the market makes almost 80% of the possible matches. The defensive tactics-friendly regime thus produces a match inefficiency of 14% – the fraction of matches that could have been made but were not.

The base case is unrealistic, however, because it assumes that all acquirers are alike and all targets are alike. A more realistic assumption is that there are two types of acquirers: financial buyers and strategic buyers. A financial buyer, often a hedge fund or several of them, seeks to purchase a mismanaged target, improve the target's performance and then sell the target. A strategic buyer seeks a synergy match that improves the performance of both parties to the transaction.[41] Thus, there are three types of targets: mismanaged firms, which do not search, passive potential synergy targets and active potential synergy targets that themselves search for a partner.

Our analysis implies that the more realistic version of the corporate control market should differ from the base case in two ways. First, the market should be more match inefficient than the base case market because agent heterogeneity dilutes the effectiveness of search. A searching financial buyer will waste search costs when it finds a synergy target because the buyer cannot combine with that target; and a strategic buyer will waste search costs when it finds a mismanaged target because this buyer lacks the skills to improve stand-alone target performance. Similarly, active potential synergy targets will pass over a financial buyer because synergy is not possible.[42] Second, the relative match inefficiency between the

[40] We assume that fewer targets search in the pre-defensive tactics world because the surplus split is less favorable to targets. Adding another searching target would not affect the results materially.
[41] See Gorbenko and Malenko (2014).
[42] Schwartz and Wilde (1982) first show that search becomes less effective as market agents become more heterogeneous.

defensive tactics friendly and unfriendly regimes should shrink. When there is less effective acquirer search over all, shifting surplus away from acquirers should have a smaller efficiency effect. Our results for this more realistic case, with the two possible splits, are set out in Table 2.[43]

[43] In Table Two, an AH agent is a financial buyer who is searching for mismanaged firms; an AS agent is a strategic buyer who is searching for a synergy match; a TP agent is a passive synergy target; a TA agent is a searching synergy target; and a TM agent is a passive mismanaged target.

Table 2

Larger Set of Agents with 3% Costs (47 Agents – 26 A's (16 AH's; 10 AS's), 3 P's, 18 T's (3 TA's; 12 TP's; 3 TM's)
3% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(1/3rd A, 2/3rds T)
AS and TM Split Surplus Asymmetrically
10 AS's and 16 AH's
18 T's
12 TP's, 3 TA's, and 3 TM's
3 P's

Sample Size	1	2	3	4	5
Prob TP (12)	0.2969	0.4667	0.5773	0.6494	0.6974
Prob TA (3)	0.3593	0.5597	0.6913	0.775	0.843
Prob TM (3)	0.1927	0.317	0.4113	0.5177	0.5637
Sigma	0.289933	0.45725	0.568633	0.648383	0.699383
Sigma TP	0.2969	0.4667	0.5773	0.6494	0.6974
Sigma TA & TM	0.276	0.43835	0.5513	0.64635	0.70335
Sigma TA	0.3593	0.5597	0.6913	0.775	0.843
Sigma TM	0.1927	0.317	0.4113	0.5177	0.5637
Sigma AS	0.1656	0.263	0.3308	0.3878	0.422
Sigma AH	0.2227	0.3501	0.433	0.4871	0.5231
Sigma A	0.200738	0.3166	0.393692	0.448908	0.484215
A Matches Made	5.2192	8.2316	10.236	11.6716	12.5896
Total Matches Made	5.2188	8.2305	10.2354	11.6709	12.5889
Total AS Payoff	8.523	10.3848	8.6158	4.777	-2.5724
Total AH Payoff	23.193	31.81	33.0145	27.9275	17.9603
Total TP Payoff	78.386	123.222	152.416	171.446	184.118
Total TA Payoff	21.022	32.3061	39.513	43.4876	46.7968
Total TM Payoff	12.716	20.922	27.148	34.166	37.202
Total T Payoff	112.124	176.4501	219.077	249.0996	268.1168
Total Payoff (Welfare)	143.84	218.6449	260.7073	281.8041	283.5047
Payoff per Match Made	27.5618916	26.5652026	25.4711394	24.1458756	22.5202123
A Agent Expected Utility	1.21984615	1.62287692	1.60116538	1.25786538	0.59184231
AS Agent Expected Utility	0.8523	1.0385	0.8616	0.4777	-0.2572
AH Agent Expected Utility	1.4496	1.9881	2.0634	1.7455	1.1225
TP Agent Expected Utility	6.5322	10.2685	12.7013	14.2872	15.3432
TA Agent Expected Utility	7.0073	10.7687	13.171	14.4959	15.5989
TM Agent Expected Utility	4.2387	6.974	9.0493	11.3887	12.4007
Expected Welfare	7.99111111	12.1469389	14.4837389	15.6557833	15.7502611

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(2/3rds A, 1/3rd T)
AS and TM Split Surplus Asymmetrically
10 AS's and 16 AH's
18 T's
12 TP's, 3 TA's, and 3 TM's
3 P's

Sample Size	1	2	3	4	5
Prob TP (12)	0.2964	0.4635	0.571	0.6523	0.7002
Prob TA (3)	0.369	0.575	0.706	0.7873	0.8423
Prob TM (3)	0.1733	0.3193	0.421	0.5063	0.5733
Sigma	0.287983	0.45805	0.5685	0.650467	0.702733
Sigma TP	0.2964	0.4635	0.571	0.6523	0.7002
Sigma TA & TM	0.27115	0.44715	0.5635	0.6468	0.7078
Sigma TA	0.369	0.575	0.706	0.7873	0.8423
Sigma TM	0.1733	0.3193	0.421	0.5063	0.5733
Sigma AS	0.1627	0.2683	0.3381	0.3881	0.4247
Sigma AH	0.2223	0.3476	0.4283	0.4893	0.5251
Sigma A	0.199377	0.3171	0.393608	0.450377	0.486485
Total A Matches Made	5.1838	8.2446	10.2338	11.7098	12.6486
Total Matches Made	5.1837	8.2449	10.233	11.7084	12.6492
Total AS Payoff	26.102	40.4427	46.7459	47.7529	44.5259
Total AH Payoff	62.254	92.6351	107.4684	114.4791	110.5742
Total TP Payoff	39.127	61.182	75.372	86.108	92.422
Total TA Payoff	9.467	14.4657	17.2565	18.5219	18.7425
Total TM Payoff	5.72	10.538	13.893	16.709	18.92
Total T Payoff	54.314	86.1857	106.5215	121.3389	130.0845
Total Payoff (Welfare)	142.67	219.2635	260.7358	283.5709	285.1846
Payoff per Match Made	27.5228119	26.5938338	25.4798984	24.2194407	22.545663
A Agent Expected Utility	3.39830769	5.11837692	5.93131923	6.23969231	5.96538846
AS Agent Expected Utility	2.6102	4.0443	4.6746	4.7753	4.4526
AH Agent Expected Utility	3.8909	5.7897	6.7168	7.1549	6.9109
TP Agent Expected Utility	3.2606	5.0985	6.281	7.1757	7.7018
TA Agent Expected Utility	3.1557	4.8219	5.7522	6.174	6.2475
TM Agent Expected Utility	1.9067	3.5127	4.631	5.5697	6.3067
Expected Welfare	7.92611111	12.1813056	14.4853222	15.7539389	15.8435889

In the defensive tactics-friendly regime, financial buyers make three searches and strategic buyers make two searches. The synergy seeking targets make five searches. There are 10.2354 matches and σ = .5686: the market makes about 57% of the total possible matches. In the defensive tactics-unfriendly regime – that is, one in which the split favored acquirers – both the financial buyers and the strategic buyers make four searches, and the synergy seeking targets make four or five searches. There are 11.71 matches made and σ = .6505: the market makes about 65% of the possible matches. As expected, there are significantly fewer matches under either legal regime in the more realistic case, with two acquirer types and three target types. Further, and as expected, defensive tactics now produce 8% fewer matches than could be made rather than the 14% in the base case. [44] Eight percent, however, is an economically significant efficiency loss given the market size.

To summarize, practitioners and some academics argue that defensive tactics deter an immaterial number of bids because there are so many acquisitions each year. To the contrary, our simulations suggest that the corporate control market is significantly less match efficient under the defensive tactics-friendly regime than under a regime less favorable to defensive tactics. Because there are more acquirers than searching targets, the total number of market searches, and thus the total number of matches made, falls when the legal regime shifts surplus toward targets and *away from* acquirers. There are over a trillion dollars of acquisitions made in the corporate control market each year. Under a defensive-tactics-unfriendly legal regime, the market could make 8% more value adding acquisitions in each of these years. Thus, to the extent that our simulations resemble the real world, defensive tactics cause a large reduction in social welfare.[45] As said above, this result should not be overstated: we have done one set of

[44] We view these results as a robustness check for the simulation method. Because agents are more heterogenous in the realistic market than in the base case market, the realistic market should be more match inefficient than the base case market but the relative inefficiency between the defensive tactics regime and the earlier regime also should shrink. Our simulations yield these results.

[45] Using the figure quoted earlier of a $1.37 trillion annual acquisition market, almost $110 billion more in acquisitions would be made annually under the pre-defensive tactics regime. This result overstates realized welfare losses, however, because some acquisitions fail: not every purchased target can be improved or yield positive synergy gains. On the other hand, we make two assumptions that bias results in favor of defensive tactics. First, the ratio of targets to acquirers is relatively high and the ratio of noise firms to acquirers is relatively low. Second, acquirers purchase every found target. See note 40, supra. Relaxing these assumptions would cause the

simulations under one set of parameters. Nevertheless, the parameters are plausible and the results accord with intuition. Thus, we argue that consideration of the welfare effects of defensive tactics should be moved up on the scholarly and regulatory agenda.

3. Shareholder Welfare

3.1 Analyzing Defensive Tactics

Defensive tactics are authorized and then deployed on the initiative of the board of directors.[46] In turn, courts set the level of allowable defensive tactics in the course of resolving litigation brought by shareholders challenging the board's deployment of defensive tactics. The plaintiff shareholders' typical complaint is either that the target was sold for too little or that, in consequence of defensive tactics, the target was not sold at all. A board's core fiduciary duty is to maximize long-term value for target shareholders.[47] The question for courts, then, is what level of defensive tactics satisfies this obligation: when the claim is that the target was sold for too little, should the board have resisted more strenuously; when the claim is that an offer was prevented, should the board have resisted less strenuously.

How much resistance is beneficial to the shareholders is difficult to answer rigorously because, up to now, there has been no convenient way to assess with precision the effectiveness of different tactics and so their welfare effects. For example, it is difficult to know whether a supermajority voting requirement is better or worse for target shareholders than a poison pill. In each case, the particular context matters – for example, a two-third's vote requirement to take an action desired by the shareholders to facilitate a bid going forward may be ineffective if the shares are widely held, but very effective if management and the board together own 34 percent of the target's stock. The Delaware courts – the courts that define

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actual match inefficiency to exceed 8%. The safe conclusion is that defensive tactics, at least in our model, are materially socially inefficient.

[46] Some defensive tactics, like poison pills, can be authorized and deployed by the board alone. Others, like barriers to a post-acquisition freezeout of target shareholders require a charter amendment and therefore shareholder approval after board initiation.

[47] The board's duty is usually stated as owed to the corporation and its shareholders. Because the circumstances in which the long-term value to the shareholders of an action and the value of that action to the corporation diverge are difficult to describe, we use the shareholder-only framing of fiduciary duty to avoid the additional phrase.

takeover law in the U.S. – have come to give target boards great leeway in setting the level of defensive tactics; as said above, a defensive tactic is permissible unless it almost precludes an acquisition, whether directly or through an initial proxy contest to replace the target boards. [48] Thus, current judicial takeover law poses two problems. First, it does not address the social welfare question. Second, it does not address the shareholder welfare question rigorously. We initially take up the second question in this section, first with a discursive and then with a technical discussion.[49] We next relate the results to the social welfare question.

Part 2 suggests that a loyal board's task is to choose the level of defensive tactics that maximizes the target shareholders' portion of the surplus an acquisition can create. Defensive tactics increase the target board's bargaining power in a negotiation with a potential acquirer for two reasons. First, in a bargain the more patient party is advantaged because it can wait for better offers.[50] The better are defensive tactics at permitting the target board to refuse offers and wait, the more power the target has relative to the acquirer. A financial acquirer cannot just keep negotiating because alternative investments may disappear with time and its resources are tied up in the proposed deal; if there is a window in which a "fix" of the target will have its greatest impact, then delay may deter the offer. Also, the potential of a competing bid arising, a particular threat to a financial acquirer for whom the target has less private value than to a synergy acquirer, increases with time.

Less obviously, the party with the best disagreement point has more power in a negotiation. A synergy acquirer may have to reveal information about itself it does not want the market or the target to have if there is no deal in order to demonstrate the potential for synergy. This is especially the case in a stock for stock deal because the target cannot evaluate a bid in the form of stock without considering the bidder's circumstances and the expected gain from the transaction. If the parties do not agree, secrecy may be compromised. The easier it is

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[48] And in some circumstances as a practical matter the tactics do preclude an offer. For example, a court allowed a package of defensive tactics that would require a bidder to win two proxy contests over two years to prevail even though the record reflects that no bidder had ever continued its offer for two successive proxy fights. See Air gas.

[49] We do not distinguish between synergy and agency cost acquisitions here because we ask the general question what level of defensive tactics will maximize a generic target's expected return from an acquisition.

[50] We assume Nash bargaining for convenience. The target and an acquirer roughly know the amount at stake.

for a target to reject a bid, the more information the acquirer may have to disclose, or the higher the bid it will have to make, or both. Consistent with this two-part explanation of the relation between defensive tactics and target bargaining power, as defensive tactics have become stronger, bid premia have risen.[51]

For the same reasons, a potential acquirer's expected gain from a takeover is falling in the level of defensive tactics potential targets adopt. As Part 2 shows, acquirers will reduce their search for potential targets when their expected match gains fall. Thus, when a potential target board is choosing the level of defensive tactics to adopt, it should consider the reduction in the probability of a bid as well as the increase in the bid share going to the target.[52] It follows that a board that is maximizing shareholder value must solve for the optimal level of defensive tactics: the level that efficiently trades off the probability of receiving a bid – weak defenses -- against the price conditional on a bid being made -- strong defenses.

A key to addressing this problem is to focus on the property of defensive tactics to increase target patience relative to acquirer patience. This is because defensive tactics that are not formally preclusive nonetheless present significant opportunities to delay a bid. As we have seen, there is no formal barrier to a bidder waiting two election cycles to complete the task of replacing a majority of the target board so as to have their successors remove the poison pill and allow the bid to go forward. It is just that apparently no bidder has done so. The common metric of defensive tactics thus is time: the ability of the target to extend the period during which an acquirer must keep an offer open or cannot make a formal offer. The longer that period is, the more patient the target board can be and the larger the share of the expected acquisition surplus the target can extract. Time also permits the target to run an auction or to find another bidder; either strategy reduces the probability of acquirer success, and so induces the acquirer to make a higher offer to preclude them.

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[51] Heron and Lie (2015) find that the presence of a poison pill increases takeover prices and that multiple entrants reduce the likelihood that the initial bidder succeeds.

[52] Karpoff, et. al (2015) at 4-5 summarize: "…we find that takeover likelihood is negatively and significantly related to both the G-Index and the E-Index." Lower scores on these indices correlate with higher defensive tactics levels.

Time and probability are continuous variables. Because target bargaining power – its surplus share – is increasing in time, and a target's expected return is a function of its share, a target's expected revenue from an acquisition can be written as a function of continuous variables as well. To do this, define a target's share of the acquisition surplus as λ, where $0 < \lambda \leq 1$; the potential acquirer's share is $(1 - \lambda)$. Let π be the probability of a bid and denote the level of defensive tactics d. The target thus should choose the level of defensive tactics that maximizes its expected gain:

$$\text{Max}_d \ E(R) = \pi(\lambda s) - c(d)$$

The first term is the target's expected return: its share – λ – of the expected acquisition surplus, which is s, times the bid probability π; the second term is the cost of enacting defensive tactics. The bid probability π is a decreasing function of the target's surplus share: π = f(λ). The surplus share λ is an increasing function of the defensive tactic level d: λ = f(d).

The costs of enacting defensive tactics are assumed to be convex: $c(d) = \frac{cd^2}{2}$. We also let $\pi = \frac{b}{\lambda^2}$ where b is a positive constant. Regarding this representation, π must fall as the target's share of the surplus increases. Because the acquirer's search costs are convex – its costs increase at a greater rate as its search becomes more intense – the acquirer is more sensitive to higher target share prices, which wipe out more of the gains from search, than to lower target prices. Hence, the bid probability π likely decreases in λ at an increasing rate.

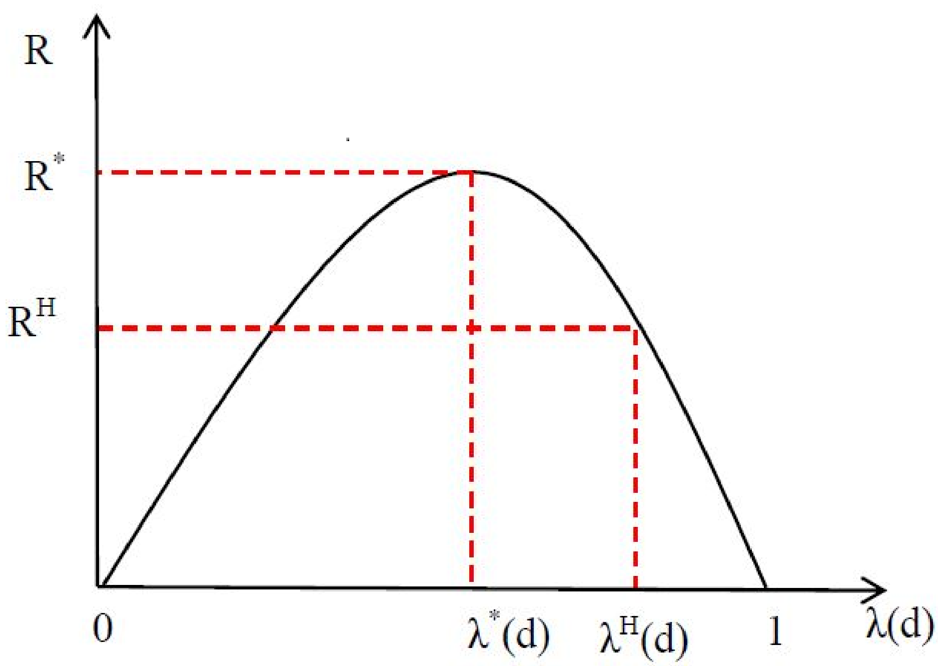
Returning to the target's maximization problem, and using the chain rule, the first derivative of the expected revenue function is

$$s\left[\frac{d\pi}{d\lambda}\frac{d\lambda}{dd}\right] - cd < 0$$

There is no closed form solution to this first order condition without an expression for λ as a function of d, the level of defensive tactics. We know that λ is non-decreasing in d, however, and we argue that the expression λ = f(d) is quadratic. The acquirer's bargaining power falls as time extends, and should fall rapidly when enough time has run to threaten a loss of financing, the entry of other bidders, or the exposure of confidential information. This reasoning suggests that an acquirer's incentive to make a high bid also increases rapidly as the likelihood of a threat to the bid's success goes up. On these assumptions, the first and second derivatives of E(R), the target's revenue function, are negative. This is because $\frac{d\pi}{d\lambda} = -2b\lambda$. We also know that the second derivative of the function is negative because $\frac{d^2\pi}{d\lambda} = -2b$ and the derivative of the last negative term is d. Because both the first and the second derivatives of the revenue function are negative, the function is strictly concave in d. There is a defensive tactics level that yields the target's surplus maximizing share $\lambda^*(d)$.

A picture may be helpful.

Figure Here



Interpreting this Figure, the target's surplus share λ as a function of the defensive tactics level is plotted on the horizontal axis and its expected revenue as a function of the defensive tactics level is plotted on the vertical axis. The target's expected revenue from acquisitions is zero when its surplus share is zero, and its expected revenue also is zero when its surplus share is one because then it will get no bids. We assume the usual conditions for an internal solution. The target's maximizing surplus share $\lambda^*(d)$ thus supports the maximum expected revenue R^*. A target that chooses the defensive tactics level $\lambda^H(d) > \lambda^*(d)$ reduces its expected revenue to $R^H < R^*$.

Courts deciding acquisition cases review a target board's conduct to see if the board has complied with its fiduciary duty because the board is conflicted: it has an incentive to choose defensive tactics that minimize the probability of hostile acquisitions in order to protect the board's and management's private benefits of control.[53] A loyal board would enact defensive tactics that would generate for the target company the share $\lambda^*(d)$ of the surplus from a bid: this share efficiently trades off the probability of getting a bid against the bid price if a bid is made. Because $\lambda^*(d) > 0$, the Delaware courts, applying the fiduciary duty standard, should permit target boards to adopt some defensive tactics. The issue is then whether a target's actual defenses are too great: that is, should those tactics survive the stricter scrutiny applied to defensive tactics than to ordinary business decisions? In practice, as we have seen, the stricter review turns out not to be very strict. Delaware courts say that the level of defensive tactics should be "proportionate to the threat posed" by an acquirer, but collapsing the nested levels of the courts' verbal formulations, the courts approve any tactic that is not "preclusive". In turn, this has allowed a target board to delay a bid for up to two years if the target corporation has a staggered board. This discretion permits target boards to choose defensive tactics levels that imply surplus shares of λ^H or greater.

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[53] We include here non-pecuniary private benefits of control, for example, avoiding the public humiliation of shareholders preferring a premium to the board's continued stewardship.

Our simulations are suggestive regarding the privately optimal target share. Tables three and four analyze the realistic case[54] under two more surplus splits: 1/2//1/2 between acquirers and targets; and 1/6//5/6.

Table 3

Larger Set of Agents with 3% Costs (47 Agents – 26 A's (16 AH's; 10 AS's), 3 P's, 18 T's (3 TA's; 12 TP's; 3 TM's)
3% Costs

AS and TA Split Surplus Evenly
AH and TP Split Surplus Evenly
(1/2 A, 1/2 T)
AS and TM Split Surplus Evenly
10 AS's and 16 AH's
18 T's
12 TP's, 3 TA's, and 3 TM's
3 P's

Sample Size	1	2	3	4	5
Prob TP (12)	0.2989	0.4673	0.5703	0.6519	0.7036
Prob TA (3)	0.3567	0.5447	0.6783	0.782	0.8377
Prob TM (3)	0.1933	0.3123	0.442	0.514	0.5763
Sigma	0.290933333	0.454366667	0.566916667	0.6506	0.704733333
Sigma TP	0.2989	0.4673	0.5703	0.6519	0.7036
Sigma TA & TM	0.275	0.4285	0.56015	0.648	0.707
Sigma TA	0.3567	0.5447	0.6783	0.782	0.8377
Sigma TM	0.1933	0.3123	0.442	0.514	0.5763
Sigma AS	0.165	0.2571	0.3361	0.3888	0.4242
Sigma AH	0.2242	0.3505	0.4278	0.4889	0.5277
Sigma A	0.201430769	0.314576923	0.392530769	0.4504	0.487892308
Total A Matches Made	5.2372	8.179	10.2058	11.7104	12.6852
Total Matches Made	5.2368	8.1786	10.2045	11.7108	12.6852
Total AS Payoff	17.532	23.7692	27.7275	26.6953	20.8741
Total AH Payoff	43.1855	62.8721	69.605	71.5335	65.2927
Total TP Payoff	59.1855	92.532	112.926	129.0795	139.3095
Total TA Payoff	14.991	22.3487	27.3761	31.2628	32.4261
Total TM Payoff	9.57	15.4605	21.879	25.443	28.5285
Total T Payoff	83.7465	130.3412	162.1811	185.7853	200.2641
Total Payoff (Welfare)	144.464	216.9825	259.5136	284.0141	286.4309
Payoff per Match Made	27.58631225	26.53051867	25.43129012	24.25232264	22.57992779
A Agent Expected Utility	2.335288462	3.332357692	3.743557692	3.778030769	3.314107692
AS Agent Expected Utility	1.7532	2.3769	2.7727	2.6695	2.0874
AH Agent Expected Utility	2.6991	3.9295	4.3503	4.4708	4.0808
TP Agent Expected Utility	4.9321	7.711	9.4105	10.7566	11.6091
TA Agent Expected Utility	4.997	7.4496	9.1254	10.4209	10.8087
TM Agent Expected Utility	3.19	5.1535	7.293	8.481	9.5095
Expected Welfare	8.025777778	12.05458333	14.41742222	15.77856111	15.91282778

[54] See Table 2.

Table 4

Larger Set of Agents with 3% Costs (47 Agents – 26 A's (16 AH's; 10 AS's), 3 P's, 18 T's (3 TA's; 12 TP's; 3 TM's)
3% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(1/6th A, 5/6ths T)
AS and TM Split Surplus Asymmetrically
10 AS's and 16 AH's
18 T's
12 TP's, 3 TA's, and 3 TM's
3 P's

Sample Size	1	2	3	4	5
Prob TP (12)	0.2981	0.4655	0.5733	0.6472	0.6954
Prob TA (3)	0.3613	0.5643	0.6887	0.782	0.8307
Prob TM (3)	0.1817	0.33	0.4387	0.5133	0.587
Sigma	0.289233	0.459383	0.5701	0.64735	0.699883
Sigma TP	0.2981	0.4655	0.5733	0.6472	0.6954
Sigma TA & TM	0.2715	0.44715	0.5637	0.64765	0.70885
Sigma TA	0.3613	0.5643	0.6887	0.782	0.8307
Sigma TM	0.1817	0.33	0.4387	0.5133	0.587
Sigma AS	0.1629	0.2683	0.3382	0.3886	0.4253
Sigma AH	0.2236	0.3491	0.43	0.4854	0.5216
Sigma A	0.200254	0.318023	0.394692	0.448169	0.484562
Total A Matches Made	5.2066	8.2686	10.262	11.6524	12.5986
Total Matches Made	5.2062	8.2689	10.2618	11.6523	12.5979
Total AS Payoff	-0.7415	-3.8484	-9.0135	-16.1251	-25.3306
Total AH Payoff	3.6735	0.9601	-5.3697	-15.063	-28.4417
Total TP Payoff	98.3675	153.615	189.2	213.565	229.4875
Total TA Payoff	27.125	41.974	50.5694	56.9664	59.4644
Total TM Payoff	14.9875	27.225	36.19	42.35	48.4275
Total T Payoff	140.48	222.814	275.9594	312.8814	337.3794
Total Payoff (Welfare)	143.412	219.9257	261.5762	281.6933	283.6071
Payoff per Match Made	27.546387	26.5967299	25.4902844	24.1749097	22.512252
A Agent Expected Utility	0.11276923	-0.1110885	-0.5532	-1.1995423	-2.0681654
AS Agent Expected Utility	-0.0742	-0.3848	-0.9014	-1.6125	-2.5331
AH Agent Expected Utility	0.2296	0.06	-0.3356	-0.9414	-1.7776
TP Agent Expected Utility	8.1973	12.8013	15.7667	17.7971	19.124
TA Agent Expected Utility	9.0417	13.9913	16.8565	18.9888	19.8215
TM Agent Expected Utility	4.9958	9.075	12.0633	14.1167	16.1425
Expected Welfare	7.96733333	12.2180944	14.5320111	15.6496278	15.75595

We now have four simulated data points for total target shareholder payoffs as a share of the match surplus: 1/3; 1/2; 2/3; 5/6. The data is consistent with a concave shareholder payoff function.

1/3: 121.34

1/2: 162.18

2/3: 176

5/6: 140.5

Target shareholder payoffs – the numbers after the colons -- increase substantially when the split moves from one third to one half, increase by much less when the split moves from one half to two thirds, and then fall off when the split increases to five sixths.

There is a common view that defensive tactics lower firm value. This view has led to several papers, some summarized in Part 3.2 below, that seek to explain how loyal boards can efficiently choose those tactics. To the contrary, in our simulations defensive tactics raise firm value, over a range, because they efficiently resolve (privately) the tradeoff between the probability of receiving bids for the firm and inducing the bidders to pay high prices. Private efficiency likely exists because, in the simulations, there are only 8% fewer expected matches under a regime that restricts defensive tactics, but the payoff difference between one third and two thirds of expected surplus is large: the payoff difference, that is, dominates the bid reduction effect. From the target shareholders' perspective, the best solution thus is interior.[55] The corporate governance implication of this result is that target boards should have significant, though not complete, discretion to employ defensive tactics.

Nonetheless, the question remains whether courts have allowed boards to go too far. The data we use to infer a two-thirds split in favor of targets ended in 2006. Delaware courts allow the poison pill/staggered board combination to create a delay period of up to two years. Therefore, there is a possibility that some current target shareholder payoffs may be, or may be coming, closer to the five sixths split -- λ^H or to its right in the Figure – than to the two thirds split we use. In this case, the reduction in the bid probability dominates the increase in the bid size, thereby making shareholders worse off. We return to the level of defensive tactics Delaware courts allow in Section 3.2 below.

3.2 **Social Welfare, Shareholder Welfare and Political Economy**

There is a significant conflict between private and social efficiency. Target shareholder welfare, our simulations suggest, is maximized *at defensive tactics levels that exceed the socially optimal level.* This is because potential targets do not fully internalize the social benefits that increasing acquirer search would yield. Hence, in equilibrium each firm chooses a higher defensive tactics level than the collectively rational level. Legal reform that would restrict defensive tactics levels, our simulations suggest, thus could increase social welfare.

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[55] See Table 2. Defensive tactics may insulate target boards from takeovers and also may maximize target shareholder returns. Hence, there is no agency conflict between boards and shareholders up to the maximizing defensive tactics level: $\lambda^*(d)$ in the Figure. Compare Easterbrook & Fischel (1981) and Gilson (1981).

A current objection to this criticism, called the bonding or short time horizon theory, takes two forms.[56] First, the combination of a claim that the stock market over-discounts future returns and the effect of that myopia on managerial incentives is said to increase the social cost of bids by an amount that offsets the reduced search resulting from extensive defensive tactics. [Stein, Kay] Target directors and managers put in time, and make firm specific human capital investments, to create value for the company. In a world with a myopic stock market, target shareholders would accept a hostile offer before some long-term investments whose value is not fully reflected in the target's stock price pay off. Managers and directors often are dismissed after takeovers, and so they face risk that they may not be appropriately rewarded for increasing value. This risk may bias the directors and managers in favor of inefficient short-term investments. On this view, authorizing defensive tactics represents a commitment from the target's shareholders to their management and board that the company either will not be sold prematurely, or that it will bargain for an appropriate price if it is in play. Thus, there actually is an efficiency tradeoff: from a social point of view defensive tactics produce too few matches but also create better investment incentives for corporate directors and managers.[57] Second, customers or suppliers may make relationship specific investments with a potential target. An acquirer, who has no particular loyalty to these customers and suppliers, may exploit the sunk cost aspect of the investments by renegotiating the target's deals with the customers or suppliers. See Summers & Shleifer; Johnson, et al (2015).

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[56] An objection to restricting defensive tactics, reflected in judicial decisions and pro-management commentary, holds that hostile takeovers are unfair to target shareholders because the shareholders, unlike a unified board, cannot coordinate to negotiate for higher prices. This objection is without merit, unless there is a good reason to prefer target shareholders to acquirer shareholders, because restricting defensive tactics shifts surplus to the acquirers. Also, shareholders with nontrivial holdings in a target are in two categories: wealthy individuals and institutions, such as pension funds. Both investor types are widely diversified. Hence, over the run of cases, takeovers may be a wash for shareholders: they gain when their companies buy and lose when their companies sell.

[57] Gilson (1982) first suggested that defensive tactics which require shareholder approval, such as staggered boards, may represent an efficient commitment from shareholders to managers and boards not to dismiss these agents prematurely, but tactics that do not require board approval may inefficiently reduce shareholder value. Cremers, et al, (2015) contains data that support this view. The distinction between the two types of defensive tactics is an interesting area for research.

These short-term objections are more inchoate than incorrect. To say that there is a tradeoff is not to say how it should be resolved. As yet, neither theory nor evidence show which efficiency claim is the stronger: does the impact of myopia exceed that of reduced search? Also, the claim that hostile acquisitions in a myopic capital market expropriate target manager and board human capital investments, and so inefficiently incentivize too short investment horizons, needs development. To see why, assume that target executives are given a golden parachute and a compensation package with a significant variable component. In the event of a successful hostile bid, the executive would receive a large payment from her golden parachute and, if the historical average holds, a significant portion of the nontrivial fraction of the deal's surplus that targets received under the restricted defensive tactics regime.[58] The open issue is the elasticity of the executive's investment behavior to her expected end game payoff. Would the prospect of the increased payoff on a takeover resulting from more restricted defensive tactics offset the executive's incentive to shorten the firm's investment horizon? Next, the shareholder signal of commitment that is said to accompany adopting defensive tactics prior to a hostile bid is credible only if the shareholders are required to approve their adoption. This is not the case with the adoption of a poison pill, and with respect to the combination of a poison pill and a staggered board, if the firm has a staggered board structure dating to the pre-hostile takeover era. Also, the decision whether to approve a pre-bid defensive tactic and to approve a decision to tender at the price offered in a hostile takeover are largely made by institutional investors, who today hold about 70% of public company stock. These investors have the incentive and apparently the ability to recognize the difference between a confiscatory and a compensatory acquirer bid. Finally, we note that the empirical claim that the stock market is myopic, on which this argument is based is hotly contested.[59]

The short-term theory, as applied to customers or suppliers, also raises theoretical questions. For example, a supplier can protect itself with a long-term contract because such contracts bind acquirers. Some negotiated labor agreements bind acquirers as well. A

[58] Fich, et al (2013) show that golden parachutes materially increase deal completion probabilities, create large gains for target CEOs and may also benefit target shareholders.
[59] cite

contract seems more secure than a personal relationship. To be sure, some contracts between companies and their customers and suppliers are implicit. There is no reason to assume, however, that a reputation that allows such relational contracting would be less valuable to an acquirer than to the target. If the value of that reputation has decreased, then it is an open question whether it is inefficient for the bidder to reject this implicit contract. Finally, this version of the bonding theory lacks significant empirical study. Both versions of the short-term theory thus need more work. Nevertheless, our contribution is on the other side of the ledger: we suggest that defensive tactics alone can increase firm value but also be socially inefficient.

We end this discussion of shareholder welfare with the observation that the evolution of Delaware takeover law that is characterized in our model and simulations reflects a long-standing disagreement between the Delaware Chancery Court (the trial court for corporate cases) and the Delaware Supreme Court, which hears appeals from decisions by the Chancery Court, over what limits on defensive tactics maximizes target shareholder welfare.[60] Interestingly, our model and simulations shed light on this still ongoing dispute. Following the Delaware Supreme Court's original decision to impose a higher standard of review on a board's deployment of defensive tactics, the Chancery Court addressed how this higher standard would be applied. Under the Chancery Court's regime, a target board confronted by a hostile bid could deploy defensive tactics, such as the poison pill, to buy time to seek a higher bid or to explain the target's "real" value to its shareholders. Once the target's board has had that opportunity, however, the shareholders must be allowed to decide whether to accept the offer.[61] As we have seen, the Delaware Supreme Court rejected that time limit on the use of defensive tactics, in favor of a rule that, with the help of a poison pill and a staggered board, allowed the target board formally to delay a bid for as long as two election cycles, a period that in practice no bidder apparently has waited out.[62] Thus, the legal debate between the Chancery and Supreme Courts was between an interior and a corner solution. Our model

[60] Delaware takeover law has not concerned itself with what rule maximize social welfare social welfare.
[61] Interco
[62] Time-Warner, Unitrin, Airgas. This combination of a poison pill and a staggered board may generate a surplus split in favor of targets that is at least as great as the 5/6//1/6 split simulated Part III. In that event, the pill/staggered board combination *both* reduces social welfare and reduces target shareholder welfare

shows that the critical issue in assessing defensive tactics is time: the delay associated with defensive tactics increases target shareholder welfare at the outset but then reduces it as the delay extends past the point when the reduced number of bids resulting from the delay outweighs the increased target shareholder piece of the surplus from actual bids. Seen through the prism of our model and simulations, the Chancery Court has the better of the debate. From the target shareholders' perspective, the Chancery Court was correct in giving the board the time to increase the premium received by the target shareholders, but also correct in constraining the length of that delay. The Chancery Court's informal analysis and our model and simulation point generally in the same direction: giving the target board too much discretion to delay a hostile tender offer reduces target shareholder welfare.

4. Conclusion

The allocation of power between boards and shareholders concerning takeovers raises two basic questions: what level of defensive tactics maximizes social welfare; and what level of defensive tactics maximizes target shareholder welfare. Debate on these questions has focused disproportionately on the shareholder welfare question for two reasons. First, the restrictions on deploying defensive tactics are specified by state courts in the context of litigation brought by shareholders challenging the level deployed in a particular hostile offer. In these courts, the legal question is whether a target board has fulfilled its fiduciary duty to maximize the welfare of the target company's shareholders. The bulk of the legal literature thus asks whether courts answer the fiduciary question correctly. Participants in this debate assess governance techniques along the metric of shareholder interests.

The less obvious reason why debate has focused on target shareholder welfare is that the social welfare effects of various defensive tactics are difficult to evaluate without analyzing the market equilibra the tactics produce. The principal economic and policy question an equilibrium analysis should answer is whether defensive tactics reduce the number of acquisitions to below the socially optimal level. In turn, this question is hard to answer because the number of acquisitions that would have been made *but were not* under various defensive tactics regimes is unobservable.

This paper takes preliminary steps toward redressing the scholarly balance between the two questions. It addresses the social welfare question by simulating equilibrium outcomes in the market for corporate control under two defensive tactics legal regimes: a regime that significantly restricts defensive tactics and a regime, roughly like the current Delaware rules, that depending on the context of a particular bid can give target boards the ability effectively, if not formally, to block a hostile bid. The simulations use plausible relations among the parameters of interest and their results are striking. The simulated market makes about 8% fewer matches – acquisitions – when free to make use of defensive tactics than when not. This is a significant economic result because the market value of U.S. acquisitions is now over a trillion dollars a year.

We stressed above that our results should not be taken as premise for regulatory action. Simulations are inferior to analytical solutions, and our simulations are preliminary: we consider only two market cases using the same set of parameters to characterize both. Nevertheless, the results accord with intuition and they are consistent with how corporate boards behave and with the approach adopted by the trial court – Delaware Chancery -- with the most experience in assessing defensive tactics. Thus, we believe the simulations ground a plausible claim for more equilibrium analyses of the corporate control market.

We also revisit the shareholder welfare debate, though from a slightly different viewpoint. It has been difficult to assess the effect of various defensive tactics on shareholder welfare without a way to translate the tactics into expected value losses or gains. We suggest that the common metric among defensive tactics is delay: different tactics permit targets to forestall acquisitions for different lengths of time. Shareholder payoffs are increasing and acquirer payoffs are decreasing in the time to deal completion. We use this fact to argue that shareholder welfare is strictly concave in the level of defensive tactics; that is, there is a unique maximizing level for each possible target. Our equilibrium simulations are illuminating here: they suggest that target shareholders do better when boards have some discretion to use defensive tactics to buy time to increase an offer, but that shareholder payoffs fall as the delay is extended. These results have substantive and methodological implications. Substantively, the results suggest that current legal rules allow a level of defensive tactics levels that are privately as well as socially inefficient. Interestingly, they also shed light on a lengthy debate between the two levels of the Delaware courts over precisely this issue. Methodologically, our results suggest the utility of evaluating defensive tactics in an equilibrium framework in addition to studying their effect on the profitability of particular companies.

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Appendix

Matching Problem Model/Code Description

All market models were crafted and simulated in Matlab, a software program designed specifically for the manipulation of matrices. Matlab allows a user to write code to generate and simulate an agent-based model under various parameters. A simulation run of the market model begins by populating a population of a specified size (in our case, 47 total agent-firms) with agent-firms of one of 6 specified types. There are 26 total A (Acquiring) agent-firms. Acquiring firms are actively seeking to match with a target firm. Of these 26 A agent-firms, 10 are synergy (AS) type acquiring firms, and 16 are hedge fund (AH) type acquiring firms. AS type acquiring firms are actively seeking to match with those target firms with whom they may form a synergistic collaboration, e.g., an auto manufacturer seeking to match with a tire manufacturer.

Synergy target firms with whom AS type firms will seek to match may be either themselves actively seeking to match with AS type firms (TA type target agent-firms), or they may be passive synergy targets who are, nonetheless, willing to match with AS type firms, if approached (TP type target agent-firms). There are 3 TA type active, synergy, target agent-firms, and 3 TM type passive, mismanaged, target agent-firms. AS type acquiring firms only seek to match with either TA or TP type target firms. AH type acquiring firms are actively seeking to match with mismanaged, passive target (TM) firms. There are 12 TM type passive, mismanaged, target agent-firms. AH type acquiring firms only seek to match with TM type target firms. Thus, there are 18 total T type target agent-firms: 12 TP firms, 3 TA firms, and 3 TM firms. Additionally, there are 3 totally passive (P) type agent-firms who neither match nor search. If either an AS or an AH or a searching TA agent-firm finds a P type firm, the searching agent-firm incurs searching costs for having searched the P type firm, but no match takes place. These P firms are the noise firms. And, a P type agent-firm never incurs search costs, because it never searches.

The simulations begin by randomly populating the 47 total agent-firms. Starting with TA type firms, the code randomly selects an index (i.e., a location within the population matrix). If the indexed location within the population matrix is already occupied, the code selects again until an unoccupied indexed location has been selected. Then, the code populates that indexed location with one of the TA agents. This process repeats until all of the TA agents have been placed in indexed locations within the population matrix. This process repeats for all six of the different agent-firm traits/types until the entire population matrix has been populated. The order in which the 6 different agent-firm traits/types are placed within the population matrix is: TA, TP, TM, P, AS, and AH.

Once the agent-firms have been populated, the searching process begins. All of the searching agent-firms search over the same sample size for 1000 simulation runs. There are 5 different sample sizes: 1 agent, 2 agents, 3 agents, 4 agents, or 5 agents. There are 1000 simulation runs at each sample size. Thus, the population matrix is repopulated 1000 times for each sample size. For each of the 1000 simulation runs at a sample size of 1 agent, all of the searching agent-firms search over a sample size of 1 agent, and so forth at a sample size of 2 agents, etc.

For each simulation run at each sample size, each of the searching agent-firms (i.e., the AS, AH, and TA agent-firms) in the population matrix has an opportunity to search over the specified sample size for its desired match (AS firms search for TA and TP firms, AH firms search for TM firms, and TA firms search for AS firms). If a searcher has been matched when its opportunity to search comes around, it does not search. When a searching agent-firm is matched, either because it found a desired match or has been found by a desired match, the agent ceases searching. Search is truncated even if the searching firm is in the midst of a search over a sample of several possible partners. For example, if a searching agent matches with the first agent in a sample of 5 agents, then the agent ceases searching over the subsequent 4 agents in its sample. Hence, no searching agent-firm incurs search costs after it has made a desired match.

When a match is made, only the searching agent incurs search costs; the found agent firm does not incur search costs. This is so even when the found agent is itself a searching type. Also, the agent-firm being searched, even when the search fails to result in a match, does not incur search costs. Only the searching agents incur search costs.

A simulation run unfolds as follows: The code iterates through the entire population matrix of 47 agent-firms, one by one. First, it checks to make sure that the current population member is not already matched with a partner firm. In addition to the population matrix, which is called “pop,” there is a matching matrix, which is called “popMatch.” The population matrix, pop, has a single column, but the matching matrix, popMatch, has two columns. The rows of the first column of the popMatch (matching) matrix are initially populated entirely with zeros (at the beginning of each new simulation run). As agent-firms are matched with one another, these rows in the first column of the popMatch matrix are filled with ones to indicate that the agent-firms in the corresponding indexed locations (rows) in the population matrix, pop, have been matched with partner firms. Thus, the first column of the matching matrix, popMatch, is populated entirely by ones and zeros. The code finds whether an agent-firm has already been matched or not, by checking the agent-firm’s index in the pop matrix within the first column of the popMatch matrix; there has been a match if the indexed location (row) in the first column of the popMatch matrix is a one, but not if it is a zero. Throughout the search process, the code repeatedly checks to see if the current population member (agent-firm) has already been matched or not. This ensures that an agent-firm immediately ceases searching upon having achieved a desirable match, and immediately ceases incurring search costs as well. The second column of the popMatch matrix holds the indexed location (row) in the pop matrix of the agent-firm with whom the current population member is matched, if there is a match. Therefore, we know not only whether an agent-firm is matched, but with whom the firm is matched.

Once the code has checked that the current population member is not already matched with an agent-firm, the code checks whether the current population member is a searching agent-firm. To see how the simulations then proceed, suppose that the current population member is an AS – that is, a synergy searching -- firm. The code searches for a match for this firm. To begin the search over a specified sample size (either 1 agent, 2 agents, 3 agents, 4 agents, or 5 agents), the code randomly selects an initial agent-firm within the population matrix, pop, as its starting point. The code next checks to make sure that this initial agent-firm is not the current population member engaging in a search. The code then starts searching, iterating through the entire sample, one by one, looking for desired matches for the searching population member. If the current, searcher is an AS type, the code looks for either TA or TM type firms with whom the AS type may match. If, however, the AS firm searches a TP, AS, AH or P type, then the AS firm incurs search costs in consequence of these searches, *but* it will not match with any of the searched firms. The searching AS population member will also incur search costs for searching any TA and TM firms that have already been matched. And, as said, the AS firm incurs search costs upon finding a desired match, though it also realizes a payoff from that match. The payoffs from matches, and the costs from searches, are recorded for each population member in a matrix called "popFitness." The popFitness matrix is a single column, and the indexed location in the popFitness matrix holds the total net payoff of the agent-firm population member in the corresponding indexed location in the pop matrix. The popFitness matrix is initialized as a column of zeros at the beginning of each new simulation run.

As an example, suppose that the code is searching another AS type firm on behalf of the AS searcher, and the other AS firm is the first firm in a sample of 2 agent-firms that is being searched. Upon recognizing that the current firm being searched is an AS type, the code immediately checks whether or not the current, searching As firm is already matched. This occurs before each and every instance of the code imposing costs or awarding payoffs to current, searching population members. This is so, because the current population member ceases to search and ceases to incur search costs immediately upon having achieved a desired match. Once the code has determined that the current, searching population member has not already been matched, the code imposes search costs upon the AS type for having searched another AS type firm with whom, of course, the current, searching population member does not match.

Turning to how the code calculates search costs, the cost for searching a sample of a single agent is -1 util. The code is instructed that search costs are quadratic; they vary according to sample size as follows:

$$\text{Search costs} = -1 - (\text{sample size}/10)^2 + .01$$

Thus, the search cost for searching a sample size of 1 agent-firm is -1 util; the search cost imposed for searching a sample size of 2 agent-firms is -1.03 utils, and so on. The indexed location of the current, searching population member in the pop matrix is altered in the popFitness matrix, so that the current total net payoff of the current, searching population member reflects these search costs for having searched and failed to match with an AS type firm. The line of code appears as follows:

```
popFitness(i) = popFitness(i) + cc;
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where cc is the variable for search costs for a given sample size. Remember that the popFitness matrix is initialized as a column of zeros at the beginning of each simulation run. If the current AS type had met and searched an AH or a TP or a P type agent-firm, the same cost imposition process would have occurred. This also is the case if the current AS type had met and searched either a TA or a TM type that had already been matched with a different AS type firm.

The code next turns to the next agent-firm in the AS firm's sample. Suppose that this second agent firm to be searched is an unmatched TA type. The code checks whether this agent is already matched by checking the indexed location (row) in the first column of the popMatch matrix that corresponds to the indexed location (row) in the pop matrix of the TA firm being searched. If the code determines that the TA type being searched is unmatched, the code checks again to make sure that the searching AS type is unmatched. If neither firm is matched, the code makes a match, records it, charges search costs to the searching firm and allocates payoffs between the agents. In particular, the code first alters the indexed location (row) of the popFitness matrix that corresponds to the indexed location (row) in the pop matrix of the current, searching AS type population member. The popFitness matrix is altered as follows:

```
popFitness(i) = popFitness(i) + B + cc
```

where B is the payoff that an AS type firm receives for matching with a TA type firm.

To see how B is calculated, suppose that the surplus generated by a successful match is split evenly between the A (acquiring) type agent-firm and the T (target) type agent-firm. (Various splits of the surplus are possible. Asymmetric splits that favor either A or T agents are employed to approximate the markets that result from legal regimes that favor target agent defensive tactics or not.) Because we approximate the cost of searching a sample of a single agent at 3% of the surplus generated by a successful match, and we set the search cost of searching a sample of a single agent at 1 util, B is equal to 33*(1/2). This is the payoff that an AS type agent-firm receives for successfully matching with a TA type agent-firm. The TA type agent-firm that is searched (the second of two agent-firms in a sample of 2 agent-firms) receives a payoff for having achieved a desired match (by being found, but not by having found a match), but incurs no search costs. The popFitness matrix is altered as follows:

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popFitness(jj) = popFitness(jj) + E
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where E is the payoff that a TA type firm receives for successfully matching with an AS type firm; and jj is the indexed location (row) in the pop matrix of the TA type firm that is being searched. Because the surplus generated by a successful match is being split evenly between the A (acquiring) type agent-firm and the T (target) type agent-firm, E also is equal to 33 utils * (1/2). The TA type agent-firm being searched incurs no search costs.

Having allotted payoffs to both firms that are now successfully matched with one another, as well as costs for having searched, the code now records the match. The code records that each is now matched, and also records who is matched with whom. First, the code places a “1” in the indexed location (row) in the first column of the popMatch matrix that corresponds to the indexed location (row) in the pop matrix of the current, searching AS type firm. Then, the code places a “1” in the indexed location (row) in the first column of the popMatch matrix that corresponds to the indexed location (row) in the pop matrix of the current TA type firm being searched. The second column of the popMatch matrix is reserved for recording the identities of the partners with whom the agent-firms are matched. An agent-firm’s identity is its indexed location (row) in the pop matrix. For example, the current, searching AS type firm’s second column of its indexed location (row) in the popMatch matrix is populated with the indexed location (row) in the pop matrix of the current TA type firm being searched. Similarly, the current TA type firm’s second column of its indexed location (row) in the popMatch matrix is populated with the indexed location (row) in the pop matrix of the current, searching AS type firm. These lines of code appear as follows:

```
popFitness(i) = popFitness(i) + B + cc;

popFitness(jj) = popFitness(jj) + E;

popMatch(jj,1) = 1;
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popMatch(i,1) = 1;
popMatch(i,2) = jj;
popMatch(jj,2) = i;
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In the example discussed above, a successful match was made, but agents may fail to match. Even so, each agent-firm member of the two draw sample has been searched as a potential match. Because the AS firm has exhausted its search, the code moves on to the next agent-firm in the pop matrix. And, the process continues. As mentioned above, an AS type agent-firm seeks to match with TA and TP type agent-firms, and does not match with AH, TM, and P type agent-firms. The same process described above occurs when AH and TA type agent-firms search for matches. TP and TM type agent-firms do not search, but they will match, if approached. And, P type agent-firms neither search nor match. AH type agent firms seek to match with TP type agent-firms. And, TA type agent-firms seek to match with AS type agent-firms.

When all of the searching agent-firms in the population have either had a chance to search for a desired match or have been successfully matched by having been found, then the simulation run is nearly over. It remains to record how well or poorly each agent type fared over each simulation run, and, subsequently, over the thousand simulation runs for each sample size. For each simulation run, the code records (for each agent-firm type) the number of matched agents, the total payoff of the matched agents, the total payoff for all agent-firms of that type, and the total payoff of the unmatched agents, as well as the number of agents of that type. Subsequently, the code records the averages of each of these values over the thousand simulation runs for each sample size.

The code also records, for each simulation run, the expected utility of each agent type, as well as the probability of matching, for each agent type. The expected utility is calculated as the total payoff of matched agents (of whichever type) plus the total payoff of unmatched agents (of whichever type), the sum of which is divided by the number of agents of that type. The probability of matching for a particular agent type is the number of actual matched agent (of whichever type) divided by the number of agents of that type. Subsequently, the code records the averages of each of these values over the thousand simulation runs for each sample size. These total payoffs, probabilities of matching, and expected utilities for the various agent-firm types are then manipulated in an excel spreadsheet to determine which markets (identified by various parameters) are more or less match efficient.

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