AN EFFICIENCY ANALYSIS OF DEFENSIVE TACTICS

RONALD J. GILSON* ALAN SCHWARTZ**

For thirty-five years, courts and scholars have been divided over the effects of defensive tactics in the market for corporate control. Strong defensive tactics locate authority to accept a hostile bid in the target's board. The board can bargain for a higher takeover price than uncoordinated shareholders could realize, but high takeover prices may reduce shareholder returns by reducing the likelihood of receiving a bid. The Delaware Courts themselves disagree. The Delaware Chancery Court would locate ultimate decision authority in the target's shareholders, while the Supreme Court, by permitting strong defensive tactics, allocates extensive power to the target's board. Though the Supreme Court's view settles the legal issue in Delaware for now, the normative debate among scholars and decision makers regarding whether the shareholders or the board should decide remains unresolved.

The Delaware courts ask whether defensive tactics maximize target shareholder welfare: the shareholders' expected return from acquisitions. But the more important question concerns social welfare: do defensive tactics reduce efficiency in the market for corporate control? Empirical difficulties so far have prevented analysts from answering either the private or social welfare question rigorously. Regarding private welfare, the analyst cannot observe bids that a target's defensive tactics level deterred. Regarding public welfare, the analyst cannot observe how an otherwise identical market would behave under either weak or strong defensive tactics levels.

We address the two empirical questions by creating a structural model that predicts how the market for corporate control performs under varying defensive tactics levels and then testing the model by simulating market performance. A simulation permits us to isolate the effect of different defensive tactics levels. It also permits us to solve for a target's optimal tradeoff between the increased share of an acquisition's gain that strong defensive tactics permits a target to capture and the reduced probability of receiving bids in consequence of the acquirer's reduced gain.

The simulated corporate control market performs poorly, making 15% fewer acquisitions under strong defensive tactics than under weak defensive tactics. Target boards, however, apparently have been faithful fiduciaries for their shareholders, choosing defensive tactics levels that optimize the tradeoff between bid frequency and bid returns. On the one hand, we show that the privately optimal target defensive tactics level greatly exceeds the socially efficient level. On the other, we suggest that some firms' recent efforts further to

* Stern Professor of Law and Business, Columbia Law School: Meyers Professor of Law and Business Emeritus, Stanford Law School, and European Corporate Governance Institute.

** Sterling Professor of Law, and Professor of Management, Yale University. We are extremely grateful to Sarah Braasch for creating the Matlab code that permitted us to simulate a model of the market for corporate control, and for running the simulations. This article also benefited from workshops at Columbia, Georgetown and Tel Aviv law schools; from presentations at the Theoretical Law and Economics Conference, the American Law and Economics Association Annual Meeting, the SOIE Annual Meeting and a Networks, Information and Business Conference at Toulouse; and from comments by Albert Choi, Gerard Hertig, Edward Fox, Stephen Fraidin, Zohar Goshen, Benjamin Johnson, John Macey, John Morley, Roberta Romano and Simone Sepe.

strengthen defensive tactics, such as by combining a staggered board with a poison pill, reduce both efficiency and target shareholder welfare.

Our results do not support a call for an immediate regulatory response. Initially, we do not rigorously analyze other possible justifications for defensive tactics, such as that they encourage potential targets to take long-term projects that the market may undervalue. Also, simulations raise an external validity question: do the researcher's assumed simulation parameters capture real world patterns? We argue that our parameters do well on this measure, but a simulated market cannot perfectly capture real world behavior. As well, the magnitude of our results and their consistency with theoretical predictions strongly support our central claim: today's market for corporate control is so unlikely to maximize the number of value-increasing acquisitions that scholars, regulators, and courts should revisit the defensive tactics debate.

Introduction

A. *The Market for Corporate Control*

The "market for corporate control" is the market in which companies or investment vehicles such as private equity firms search for other companies to buy. The companies that search are called "acquirers"; the companies that are searched for are called "targets." A private target usually is controlled by a small number of shareholders; a public target is owned by a much larger number of shareholders. We study the subset of the market for corporate control in which public or private acquirers search for public targets to buy.

Before 1985, an acquirer would approach a potential target's board with an offer to acquire the target. If the board said yes, the two parties would negotiate the terms of an acquisition. The target's shareholders would then accept or reject the deal. Acceptance, as is the case today, could take the form of a vote in favor of the acquisition (if the acquisition was structured as a merger or purchase of the target's assets) or take the form of a direct sale of shares from the shareholders to the acquirer. If the target board rejected the acquirer's offer, however, the acquirer could make an offer directly to the target shareholders—a hostile offer—to buy their stock: a tender offer. If a substantial majority of the shareholders accepted the offer, the acquirer would then control the target. The acquirer would elect its own board that either would merge the target into itself or operate the target as an independent entity. A successful direct offer to buy target shares was, and still is, called a "hostile takeover."

In the mid-1980s, the Delaware Chancery Court, which in Delaware is the trial-level court for corporate legal questions, evaluated the legal status of defensive tactics.[1] These tactics transfer much of the power over a hostile offer from the target shareholders to the target's board of directors. For example, the "poison pill," one of the most effective defensive tactics, entirely precludes a hostile bid by making it impossible for a potential acquirer to realize value from buying target shares.[2] When a target is "pill protected," a potential acquirer's choices are either to make an offer high enough to induce the target's board to agree or to undertake the lengthy, expensive, and uncertain task of running a proxy contest to oust the board and elect new directors that would be more inclined to sell. At the extreme, a hostile bid for a target with a staggered board would require the potential acquirer to win two successive proxy contests.[3]

Reviewing defensive tactics, Delaware Chancery held that a target's board could use the poison pill and other defensive tactics to buy the board time to evaluate a bid and to interest other bidders. But the board's power

---

[1] Chancellor Chandler provides a detailed account of the history of Delaware law in his opinion in *Air Products and Chemicals, Inc. v. Airgas, Inc.*, 16 A.3d 48, 94–101 (Del. Ch. 2011).

[2] *See* Jonathan M. Karpoff & Michael D. Wittry, *Institutional and Legal Context in Natural Experiments: The Case of State Antitakeover Laws*, 73 J. Fin. 657, 696 (2018) ("[W]e agree that classified boards and poison pills combine to offer a strong takeover defense. But this insight does not imply that no other defenses matter. . . . [E]ven for firms with classified boards, other types of defenses can increase a firm's takeover protection.").

[3] A company has a staggered board when only a fraction of its directors are elected annually rather than all of its directors elected annually. A Delaware Chancellor once remarked that no acquirer had succeeded in winning two proxy contests in a row. *See Air Products*, 16 A.3d at 113.

was time limited: ultimately, the board had to let the shareholders accept or reject the bid of a persistent potential acquirer.[4] The Chancery Court's position on defensive tactics created what we call a "defensive tactics unfriendly" legal regime. But in a series of later decisions, the Delaware Supreme Court overruled the Chancery Court, holding that as long as the target's board was acting as a faithful fiduciary for the shareholders, the board could prevent the shareholders from considering a bid.[5] The Delaware Supreme Court thus created what we call a "defensive tactics friendly" legal regime. Hostile takeovers are very much more difficult in this regime.

B. Rationales for Defensive Tactic

There are four rationales for a regime that is friendly to defensive tactics. It is helpful, in explicating these, to set out two relevant definitions of efficiency. "Exchange efficiency" holds that assets should move to an agent who values the assets more highly than the current owner does.[6] Exchange efficiency is realized (on an expected basis) when a private company owner accepts a bid. The acquirer must believe that the target is worth more to it than the bid price, and the owner must believe that the bid is worth more to her than the value she would derive from continuing to own the target.

The market for corporate control is similar but not identical. To see the difference, suppose that the present discounted value of a potential target's net income is $1,000, and there are 100 target shares outstanding. If the market prices the target accurately, each share should sell for $10. Let an acquirer bid $12 a share for all of the shares. The acquirer of a public company must believe, as the acquirer of the private company believed, that the target is worth more than $12 per share in its hands. If the target shareholders accept the bid, the acquisition then is ex ante exchange efficient in the standard way: the acquirer prefers owning the assets, and the sellers—the shareholders—are happy to receive a premium above the target's current value.

The first rationale for defensive tactics holds that board control permits a target to prevent inefficient acquisitions. In particular, this rationale rejects the assumption that the corporate control market prices companies accu-

---

[4] See City Capital Associates v. Interco Inc., 551 A.2d 787 (Del. Ch. 1988).

[5] *See Unitrin, Inc. v. American General Corp.*, 651 A.2d 1361, 1389–90 (Del. 1995); *Paramount Communications, Inc. v. Time, Inc.* (*Time-Warner*), 571 A.2d 1140, 1154–55 (Del. 1990).

[6] The early academic debates largely focused on exchange efficiency. *Compare* Frank H. Easterbrook & Daniel R. Fischel, *Auctions and Sunk Costs in Tender Offers*, 35 Stan. L. Rev. 1, 21 (1982) (arguing that all defensive tactics should be prohibited based on a social welfare measure), *and* Ronald J. Gilson, *Seeking Competitive Bids Versus Pure Passivity in Tender Offer Defense*, 35 Stan. L. Rev. 51, 54 (1982) (arguing that the returns to acquirer search for good targets depends on whether the best searchers are also the best parties to realize acquisition gains), *with* Lucian Bebchuk, *The Case for Facilitating Hostile Tender Offers: A Reply and Extension*, 35 Stan. L. Rev. 23, 24 (1982) (arguing that competing bids are beneficial to both target shareholders and social welfare).

rately. To see what follows from this rejection, make two heuristic assumptions: (a) the market price of our illustrative target is an inaccurately low $7 a share, and (b) the target's board has *private information* that the target actually is worth $10 a share but cannot credibly communicate this information to the market. On these assumptions, target shareholders might accept a bid of $8.50 a share—a 21.4% premium. The acquisition would be exchange inefficient, however, if the target would be worth only $9.50 a share in the acquirer's hands. The target's board, this rationale holds, should have the power to block bids *until* the market comes to see that the target's true value is $10 a share.[7]

The second rationale for defensive tactics is distributional: it holds that a board's power to block a hostile bid yields higher prices for targets than a target's shareholders could realize on their own.[8] The shareholders, being dispersed and unorganized, would accept any bid that is nontrivially above the pre-bid price.[9] By contrast, a board with blocking power has the ability to negotiate as would a single owner of the target's assets. While in the example above target shareholders may accept a 20% or 21% premium, the second rationale holds that a board with control might negotiate a 30% premium.[10]

Two features of this distributional rationale should be noted. Initially, the rationale facilitates inefficient outcomes. If it would be exchange efficient for our illustrative target to change hands at $12 a share, the transaction

---

[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 but the shareholders will not recognize that their company is underpriced. Edward G. Fox, Merrit B. Fox & Ronald J. Gilson, *Economic Crisis and the Integration of Law and Finance: The Impact of Volatility Spikes*, 116 Colum. L. Rev. 325, 398–406 (2016); Ronald J. Gilson & Reinier Kraakman, *Delaware's Intermediate Standard for Defensive Tactics: Is There Substance to Proportionality Review?*, 44 Bus. Law. 247, 260 (1988). Fox et al. evaluates empirically when, if ever, substantive coercion might exist. Fox et al. *supra* note 7, at 333. A board that believes that every bid will likely be below a target's true value can effectively opt out of the market for corporate control by adopting very strong defenses. *Id.* at 398–99. In our simulations, such a firm would be a "noise firm" whom acquirers searching for targets could not buy.

[8] *See* Martin Lipton, *Takeovers in the Target's Boardroom*, 35 Bus. Law. 101, 106–09 (1979) (presenting board discretion argument); Jeremy C. Stein, *Takeover Threats and Managerial Myopia*, 96 J. Pol. Econ. 61, 77 (1988) (formalizing an informationally inefficient but otherwise rational justification for takeover defenses).

[9] The intermediation of equity through institutional investors calls the standard negotiation argument into question. We note but do not address here the tension between the dispersed shareholder argument and increased equity concentration in institutional investors as record holders. For further discussion on this topic, see generally Ronald J. Gilson & Jeffrey N. Gordon, *The Agency Costs of Agency Capitalism: Activist Investors and the Revaluation of Governance Rights*, 113 Colum. L. Rev. 863 (2013); Ronald J. Gilson & Jeffrey N. Gordon, *Agency Capitalism: Further Implications of Equity Intermediation* (Eur. Corp. Governance Inst., Law Working Paper No. 239, 2014).

[10] For suggestive data that defensive tactics permit targets to realize a substantial fraction of an acquisition's expected return, see Theodosios Dimopoulos & Stefano Sacchetto, *Preemptive Bidding, Target Resistance, and Takeover Premiums*, 114 J. Fin. Econ. 444, 445 (2014) (noting target resistance explains the premium in 74% of single-bidder contests).

costs of the acquirer-board negotiations that yield a $13 price are a deadweight *social* loss. Turning to the second feature, a target board that has the power to block bids has an economic problem to solve. Strong defensive tactics give a board the power to increase the price the target can command *conditional on receiving a bid.* But strong defensive tactics, we will see, reduce the probability that the target will receive bids because acquirers are less willing to purchase when the target board's negotiating power reduces the portion of the expected acquisition gain acquirers can keep. Thus, a target board acts in its shareholders' best interest only if it chooses the defensive tactics level that optimally trades off bid size against bid frequency. A target board that rejects bids to protect its independent position, on the other hand, is unfaithful.

The issue for a state court, however, is not whether a target's board is maximizing social welfare—that is, exchange efficiency—but whether the board is a faithful fiduciary. On this understanding, the second distributional rationale is the more important of the two. As we will see, it motivates the Delaware Supreme Court to give target boards great leeway to choose privately efficient defensive tactics levels.

The third rationale for defensive tactics posits that board control facilitates "investment efficiency." This efficiency concept holds that an owner should invest in her assets until the marginal expected value increase equals the marginal investment cost. To understand the relevance of investment efficiency, suppose that the corporate control market accurately values targets as they are currently run, but the market tends to undervalue long-term growth prospects. Then suppose a company has a choice of two projects: project *A* with an expected value of v_A that pays off in two years, and project *B* with an expected value of v_B that pays off in five years. Project *B* (discounted to present value), however, has a higher value than *A*. Now let the market value project *A* correctly but possibly *undervalue* project *B*: the *B* market price per share could be below true project value. As in the example above, if the target pursued project *B*, its shareholders could accept a bid that is lower than the value the target ultimately will come to have. Such a bid would permit *the acquirer* to realize the full value v_B when project *B* matures for a fraction of the investment cost and would leave the target with unreimbursed investment expenses.

The investment efficiency concern, however, manifests ex ante. Conditional on the target taking the higher valued project *B*, society is as well off if much of the gain goes to the acquiring company as society would be if all of the gain went to the target company. But in a world without defensive tactics the target would respond to the prospect of losing investment gains by pursuing the lower valued project *A*. The investment efficiency rationale for defensive tactics thus holds that board control would permit the target to take the higher valued project *B* because a board would block bids until the market recognized the value project *B* would create.

The fourth rationale for defensive tactics concerns the welfare of stakeholders. These are individuals or entities who are neither target nor acquirer shareholders but who are affected by acquisitions. Such stakeholders include customers, suppliers, and employees of a potential target and may include members of a local community such as merchants and property owners. An acquisition may be value maximizing for shareholders of the acquiring and target companies but value reducing for some stakeholders. For example, a successful acquirer may move target assets to another location, thereby disadvantaging local merchants and those employees who are reluctant to relocate. Defensive tactics give a target board the power to weigh the gains to shareholders from an acquisition against the costs to stakeholders. If the costs are too high, the board could use the power that defensive tactics provide to reject a bid that would be value maximizing only for target and acquirer shareholders.[11]

Each of the four rationales raises questions. Regarding the exchange and investment efficiency rationales, academic commentators reject the view that capital market pricing is so inaccurate that it permits many value minimizing takeovers, and also believe that there are few projects with expected virtues a company could not credibly communicate to the market. The second rationale, that protected boards can get higher prices, is correct but socially questionable. Finally, there is a general view that corporate boards should manage for stakeholders as well as for shareholders, but there is no consensus about how boards should do this.[12] Nevertheless, the four rationales are motivating for decision makers and so should be subject to serious scrutiny.

C. What this Article Does

We focus on the first two rationales for defensive tactics: whether defensive tactics are exchange efficient and whether target boards choose privately optimal or excessively high defensive tactics levels. To pursue these questions, we suppose that capital market prices are roughly accurate and

---

[11] We note that decisions regarding how to divide gains among stakeholders other than as dictated by the factor markets in which stakeholders participate presents a distributional decision that is typically a matter of real, not corporate, governance, made by politically accountable decision makers. Under this fourth rationale, these decisions are made by corporate directors. *See* Ronald J. Gilson, *From Corporate Law to Corporate Governance*, *in* Oxford Handbook of Corporate Law and Governance 19 (Jeffrey N. Gordon & Wolf-Georg Ringe eds., 2018).

[12] For example, should a target board prevent its shareholders from considering a bid that has a 20% premium over the prebid price in order to protect local jobs but permit a bid with a 40% premium to go forward? More generally, what weights should a board attach to shareholder and stakeholder interests? Should the weights vary with the type of stakeholder? Today, there are no well-grounded answers to these questions. The theoretical difficulty of deriving weights for stakeholders is analyzed in Michael Magill et al., *A Theory of the Stakeholder Corporation*, 83 Econometrica 1685, 1722 (2015) (analyzing the theoretical difficulty of deriving weights for stakeholders).

that boards can credibly disclose their private information to the market. On these assumptions, the exchange efficient level of defensive tactics actually is zero: acquirers should capture *all* of the expected surplus from an acquisition. This one-sided split would maximize the incentive of acquirers to find good targets to buy. The theoretically optimal level of defensive tactics is impossible to achieve in practice, however, because each target is to some extent unique. As a consequence, targets have monopoly power in themselves and will use that power to extract some surplus from a potentially efficient deal.[13] The question is whether defensive tactics permit targets to extract too much.

To answer this question, we need two things: a causal theory explaining how defensive tactics affect corporate control market efficiency and an empirically testable definition of efficiency in this market. Beginning with the definition, the corporate control market is "exchange inefficient" unless it maximizes the number of value-increasing "matches" between searching acquirers and saleable targets. A value-increasing match occurs when the value of the combined company exceeds in expectation the sum of the stand-alone values of the acquirer and the target.[14] To formalize this definition, suppose that in a period there are M in number potential targets that would increase in value were they to combine with an acquirer. Let there be N in number potential acquirers that are searching for targets to buy, one for each. Define the ratio N/M as σ. Then the *market inefficiency* is $1 - \sigma$. To illustrate, assume that every searching acquirer makes a value-increasing match with a target. Then $N/M = 1$ and the acquisition market inefficiency is zero: the market for corporate control would be perfectly exchange efficient. But let only one-

[13] "If the surplus value of the match is divided equally between the partners, then all agents invest too little in search effort because none accounts for the share of the surplus gained by the future partner were the agent to make the match. Search efforts made by all in a Nash equilibrium are efficient when the matchmaker receives all the surplus . . . ." Dale T. Mortensen, *Property Rights and Efficiency in Mating, Racing, and Related Games*, 72 Am. Econ. Rev. 968, 977 (1982). Further, "[a]lthough efficient search obtains when the matchmaker takes all the surplus, the members of any particular pair are not likely to divide the surplus in this way, *ex post.* Once they meet, the two face a bilateral bargaining problem with other more plausible solutions." *Id.* at 975.

[14] Efficiency is commonly measured in matching markets by whether matches are stable. *See* Eduardo M. Azevedo & Jacob D. Leshno, *A Supply and Demand Framework for Two-Sided Matching Markets*, 124 J. Pol. Econ. 1235, 1237–38 (2016). This measure is satisfied by definition in the acquisition market for made matches because ownership of the target transfers to the acquirer. Another efficiency measure appears in the corporate control literature: the credible threat of a takeover may cause target managers to maximize target returns rather than behave self-servingly or ineffectively. This conjecture has been difficult to test empirically. However, a relatively recent paper reported that a rigorous test finds "strong evidence that the enactment of M&A laws [which reduce barriers to takeovers] increases the sensitivity of CEO turnover to poor firm performance. . . . [W]e provide evidence that the external market for corporate control, when available, can be an effective substitute for internal-governance mechanisms." Ugur Lel & Darius P. Miller, *Does Takeover Activity Cause Managerial Discipline? Evidence from International M&A Laws,* 28 Rev. Fin. Stud. 1588, 1590 (2015). Because increasing the ex ante probability of acquisitions increases the pressure on managers to maximize, the match efficiency measure is consistent with the incentive increasing measure.

third of the searching acquirers find a good target to match with, so that $\sigma = 1/3$. Then the market inefficiency is $1 - \sigma = 2/3$. The market fails to make 67% of the possible value-increasing matches.

We are interested in two numbers. Even without defensive tactics, potential acquirers will make suboptimal—that is, too few—searches for targets because the acquirers cannot capture all of the expected surplus from a deal. The first number we are interested in therefore is the "minimally achievable market inefficiency." To illustrate, suppose that acquirer searches yield a σ of 2/3 *only* because targets can command a portion of the acquisition gain. Then the minimally achievable market inefficiency is 33%: the market for corporate control "naturally" fails to make one-third of the possible value-increasing matches. As the second rationale for defensive tactics indicated, board control yields higher prices: that is, board control permits a target to realize *a higher fraction* of expected deal surplus at the expense of the searching acquirer.

Our *causal theory* then follows: defensive tactics would be exchange inefficient if the reduced surplus shares they yield for acquirers materially reduce the number of searches the acquirers make and, thus, materially reduce the number of good matches the market makes. Thus, the second number we are interested in is the *marginal contribution* of defensive tactics to the market inefficiency. Again, to illustrate, suppose that the (fewer) searches defensive tactics induce yield a σ of 1/3. Then the corporate control market inefficiency is 67%. Recalling that in our example the minimally achievable corporate control market inefficiency was one-third, the *marginal contribution of defensive tactics to* the market inefficiency would be one-third.

The ideal way to find the two numbers on which we focus would be to identify the actual number of potential targets and acquirers in the market for corporate control in a specified period, then prevent the targets from using defensive tactics and, finally, find σ (the ratio of actual acquisitions to possible acquisitions). This would reveal the minimally achievable market inefficiency. The researcher next should retain *the same number* of acquirers and targets but now permit the targets to choose privately optimal defensive tactics levels. She would then find the new σ. This method would permit the researcher precisely to identify the marginal contribution of defensive tactics to the market inefficiency. The problem, however, is that this method obviously is impossible to implement. And this restates the basic problem with counterfactual causal analysis: the researcher cannot directly test her causal theory because she cannot keep everything constant *except* the variable of interest. Importantly, the standard empirical fixes for this methodological problem have not worked in the corporate control market because the empirical researcher cannot recover the data: the actual numbers of good targets and acquirers in the corporate control market at any one time.[15] As a result, today *no one knows* how exchange inefficient the market for corporate control is.

This article introduces a new empirical method to test for exchange inefficiency in the market for corporate control. We first create an informal structural model of the corporate control market. The structural method applies "models based in economic theory. Structural modeling attempts to use data to identify the parameters of an underlying economic model, based on models of individual choice or aggregate relations derived from them."[16] In our model, there are two types of potential acquirers: (i) firms seeking to combine with synergy partners to increase the value of the combined firms, and (ii) firms seeking targets whose performance could be improved by better management.[17] There are three types of targets: (i) possible synergy partners, (ii) potentially improvable targets, and (iii) "noise firms"—firms that have chosen defensive tactics levels so high as effectively to opt out of the market for corporate control.

The model supports three predictions: First, even when potential targets do not use defensive tactics, inefficiency in the market for corporate control is high. There are two reasons: (a) targets' natural monopoly power prevents acquirers from capturing all of the surplus from matches, and (b) search is particularly costly in the actual corporate control market because supply-side heterogeneity is substantial: that is, there are several different possible target types. Heterogeneity reduces search effectiveness because a searcher cannot determine whether a firm would be a good acquisition partner without analyzing the firm in detail. As a consequence, the greater the variety of potential targets the more likely it is that an acquirer will visit—that is, analyze—too many firms that the acquirer could not profitably buy; and thereby visit too few potentially profitable targets. Anticipating that much costly search could be wasted, potential acquirers will reduce their search intensity accordingly. This will increase the corporate control market inefficiency. Our second prediction is that defensive tactics should materially increase that inefficiency because they materially reduce the surplus share going to potential acquirers. Third, we predict that a target board that maximizes shareholder welfare would choose a higher defensive tactics level than would a social planner. This is because the board only considers the reduction in bids the target may receive from a high defensive tactics level rather than the

[15] Empirical researchers have studied the effect of single defensive tactics, such as a staggered board, but have not studied the current congeries of tactics as a whole. In our view, the single tactic studies have been illuminating but so far inconclusive. *See infra* Part IV.2.

[16] Aviv Nevo & Michael D. Whinston, *Taking the Dogma out of Econometrics: Structural Modeling and Credible Inference*, 24 J. Econ. Persps. 69, 69–70 (2010).

[17] A synergy acquisition improves value by combining complementary assets (for example, a manufacturer combines with a retail distribution network). An acquisition of an improvable firm increases value by replacing the current target's board (and managers) with a board (and managers) that execute the target's current strategy more effectively or cause the target to switch to a better strategy.

marginal contribution of the firm's high defensive tactics level to the average market defensive tactics level. When every potential target's board considers only its own company's welfare, the average market defensive tactics level is inefficiently high.

We test these theoretical predictions by simulating corporate control market performance. Following the theory, we specify the number and types of the potential acquirers and targets and the strategies they pursue: how the acquirers search and how the targets choose defensive tactics levels. Defensive tactics levels are first permitted only to be weak and then permitted to be strong.[18] The simulation *permits us to run the ideal procedure*. We can simulate corporate control market performance when *everything is the same except for* the targets' defensive tactics levels. The simulation thus permits us to observe the two relevant numbers: the minimally achievable corporate control market inefficiency and the marginal contribution of defensive tactics to that inefficiency.

The (simulated) evidence is consistent with the theoretical predictions. The minimally achievable market inefficiency is large and defensive tactics increase the inefficiency substantially. The second and third predictions together imply, and we observe, *a large marginal contribution* of defensive tactics to corporate control market inefficiency: the simulated market makes 15% fewer acquisitions under the current defensive-tactics-friendly legal regime than would be made under a defensive-tactics-unfriendly legal regime. The actual corporate control market makes over $1.5 trillion of acquisitions a year.[19] Our simulations thus suggest that the Delaware Supreme Court's move, in the 1980s, from the Chancery Court's defensive-tactics-unfriendly legal regime, which *time-limited* defensive tactics, to the current defensive-tactics-friendly legal regime with no time limit, reduced deal value in the market for corporate control by close to $200 billion a year.

Turning to shareholder welfare, the simulations permit us to address a target's optimal trade-off between bid frequency, which falls as the target's defensive tactics level increases, and bid size, which increases as the target's defensive tactics level increases. Our simulations together with real world evidence show, perhaps surprisingly, that target boards choose defensive tactics levels that correspond, more or less, to the theoretically privately optimal levels.[20] However, our third prediction is supported: the privately

[18] In this article, "weak" defensive tactics connote the surplus share from an acquisition that a target's natural—or monopoly—power alone can command. "Strong" or "friendly" defensive tactics connote the tactics—poison pill, staggered board—that potential targets today are legally permitted to adopt to increase the target's share.

[19] In 2018, the market value of deals for U.S. targets totaled $1.7 trillion. THOMSON REUTERS, *Mergers & Acquisitions Review Legal Advisors* 5 (2018).

[20] Directors' faithfulness—that is, their commitment to shareholder welfare—appears to have evolved over the period since the appearance of significant numbers of hostile takeovers. As the business culture came to understand that the directors' obligation in connection with a hostile takeover was to secure the highest return to shareholders, informal constraints on defensive tactics may have become more important. *See* Ronald J. Gilson, *Catalyzing Corporate*

optimal defensive tactics level exceeds the level that would be exchange efficient.

These dramatic results do not support an immediate call for regulatory reform for two distinct reasons. The first is methodological. A simulation is persuasive to the extent that the variables the researcher uses are accurate proxies for the real-world variables the researcher cannot observe. We make the case for the external validity of our variables in Part II below, but the correspondence between the computer simulation program and the world is never exact. Therefore, the primary virtue of a simulation is to develop suggestive evidence regarding the *magnitude*s of the effects that theory predicts will occur in the relevant market.[21]

The second reason why we do not advocate immediate reform is simple: we analyze in depth only two of the four rationales for defensive tactics. A similarly deep study of the third and fourth rationales, discussed in Part III, may justify the current high defensive tactics level. But even putting these two cautions together, the market exchange inefficiency seems so large that the other rationales would require much stronger empirical and theoretical support than now exists to justify current law.

Our analysis proceeds as follows. Part I highlights Delaware law's narrow focus regarding defensive tactics. Part II describes the model in detail and specifies our important assumptions. Part III then describes our simulation program. Part IV presents the simulation market results, and Part V presents the shareholder welfare result. Part V also discusses the conflict between private and social efficiency in the corporate control market and briefly analyzes the defensive tactics rationales we do not consider in detail. Appendix 1 provides a narrative description of the coding and search algorithms for our simulation program, and Appendices 2, 3, and 4 contain relevant tables. The simulation code itself is available to researchers online.[22]

I. Delaware Law's Narrow Focus

A board that uses defensive tactics to block a bid may be faithful[23] and correct—the bid is too low—or faithful and mistaken, or unfaithful. Which of these motives obtains in a particular case is difficult for a court to determine. The Delaware Supreme Court thus has eschewed an inquiry into mo-

---

Governance: The Evolution of the United States' System in the 1980s and 1990s, 24 Co. Sec. L.J. 143, 153–54 (2006) (reviewing evolution of independent directors' perceptions of the change in independent directors' roles in a hostile takeover).

[21] We note a recent methodological observation by two researchers: "simulations have proven to be useful for generating conjectures, and *can be essential for developing quantitative results*." Drew Fudenberg & David K. Levine, *Wither Game Theory? Towards a Theory of Learning in Games*, 30 J. Econ. Persps. 151, 165–66 (2016) (emphasis added). Our interest is in "quantitative results."

[22] Sarah Braasch, Corporate Control Market – Design and Simulation, https://sarahbraasch.wixsite.com/corpcontrolmktdesign (last visited Sept. 26, 2020).

[23] A target board is "faithful" when it uses its power to maximize shareholder welfare rather than insulate itself from being dismissed after a takeover.

tive in favor of a rule-like assessment of whether a defensive tactic either is "draconian" or is "preclusive" of a hostile bid.[24] Though a poison pill would preclude a hostile offer, the Supreme Court explained that the pill is preclusive *only* if it also makes a successful proxy fight to replace directors in favor of candidates who would eliminate defensive barriers "mathematically impossible or realistically unattainable."[25]

The Delaware Supreme Court does not ask whether these defensive tactics maximize social welfare. Rather, the court asks only how defensive tactics affect target shareholder welfare *given that* a potential acquirer has bid. The court's narrow focus is understandable, however, because the legal question hostile takeover lawsuits present is whether the directors' response to a bid violated their fiduciary duty to maximize shareholder welfare, *not* whether their decision negatively affected the public or the shareholders of other companies.[26]

II. Model and Predictions

A. *A Structural Model*

Before introducing our model, we make two comments. Initially, structural models sometimes are solved analytically: that is, the researcher characterizes the model mathematically and then derives the mathematically grounded conclusions that the model's assumptions imply. Some markets, however, are too complex to admit of precise mathematical treatment given the modeling strategies that are available to the researcher. That is the case here. Two types of models characterize markets in which numerous parties attempt to make deals with each other: search models and matching models. Search models explore the relation between buyer shopping behavior and market outcomes, but they fit poorly with the market for corporate control because in search models the buying side searches while the selling side chooses prices, the sellers maintain those prices during a relevant period, and the sellers passively wait for buyers.[27] In the corporate control market, by contrast, a fraction of potential targets actively searches for acquirers who will buy them, targets do not necessarily maintain their prices (that is, they

---

[24] *Unitrin, Inc. v. Am. Gen. Corp.*, 651 A.2d 1361, 1367 (Del. 1995).

[25] *Id.* at 1387–89.

[26] *See Revlon, Inc. v. MacAndrews & Forbes Holdings*, 506 A.2d 173, 185 (Del. 1986) (limiting board's consideration of a takeover only to shareholder value rather than considering its impact on other stakeholders).

[27] Galenianos and Kircher provide a general review of search models in which one side searches and the other side sets prices. *See generally* Manolis Galenianos & Philipp Kircher, *On the Game-Theoretic Foundations of Competitive Search Equilibrium*, 53 Int. Econ. Rev. 1 (2012); *see also* Alan Schwartz, *The Sole Owner Standard Reviewed*, 17 J. Legal Stud. 231, 231–32 (1988); Alan Schwartz, *Search Theory and the Tender Offer Auction*, 2 J. L. Econ. & Org. 228, 231–39 (1986).

may change their defensive levels after being actively searched), and some targets or sellers are reluctant to accept (or will not accept) an offer to buy.[28]

Matching models, which explore how well agents match with complementary agents, also are poor fits because in these models every market participant is actively seeking to match. In the corporate control market, some firms—the financial targets and noise firms—prefer not to match.[29] Thus, current search and matching models cannot yield mathematically grounded predictions regarding how an accurately specified market for corporate control functions under the current Delaware defensive-tactics-friendly legal regime, or how it might function under a defensive-tactics-unfriendly regime.[30]

When analytical solutions are unavailing, the researcher can attempt to solve the model empirically. An empirical solution can take two forms. In both, the researcher uses the relevant theory—for us, search theory—to derive predictions regarding how the market should perform given the assumptions. In the first form, the researcher attempts to find real world evidence that is consistent with, or contradicts, those predictions. For data unavailability reasons, causal theories of the effect defensive tactics have on the market for corporate control cannot be tested directly. Therefore, we use a more novel empirical strategy to simulate how the market for corporate control performs. Our structural model guides the simulation program, and the program's inputs are the assumptions we make about the characteristics of market participants and the market's structure.

Beginning with participants, acquirers in the model search sequentially for targets to buy and (many fewer) potential targets search for acquirers with which to merge. An agent searches sequentially by equating the marginal expected value of finding a good target with one more search—another

---

[28] Wenyu Wang recently did solve a structural model of the corporate control market analytically, but the assumptions that characterized his model are starkly counterfactual. For example, Wang assumed that firms do not use defensive tactics and that every firm that could benefit from an acquisition seeks to match. *See* Wenyu Wang, *Bid Anticipation, Information Revelation and Merger Gains*, 128 J. Fin. Econ. 320, 337 (2018). The model thus is unhelpful to the researcher who seeks to understand a market in which defensive tactics are ubiquitous, and some firms prefer to remain independent.

[29] In the usual matching model, persons search for spouses, or firms search for employees while employees search for firms.

[30] Straska and Waller extensively review the literature concerning the effect on shareholder wealth of antitakeover provisions. *See* Miroslava Straska & H. Gregory Waller, *Antitakeover Provisions and Shareholder Wealth: A Survey of the Literature*, 49 J. Fin. & Quant. Analysis 933, 941 (2014). According to these authors, the literature reaches no firm conclusions. Thus, they suggest as a question for future research: "Does an optimal value-maximizing number of antitakeover provisions exist?" *Id.* at 953. Current data also is compromised by what appear to be errors in the coding of the databases typically used to identify companies' existing defensive tactics. *See generally* Emiliano M. Catan & Marcel Kahan, *The Law and Finance of Antitakeover Statutes*, 68 Stan. L. Rev. 629 (2016); David F. Larcker, Peter C. Reiss & Youfei Xiao, *Corporate Governance Data and Measures Revisited* (Rock Center for Corp. Gov., Working Paper No. 213, 2015), http://ssrn.com/abstract=2694802; Michael Klausner, *Fact and Fiction in Corporate Law and Governance*, 65 Stan. L. Rev. 1325, 1364 (2013).

detailed analysis of a potential target—to the cost of that search. We assume that acquirer search costs are quadratic: that is, the cost of a second search exceeds the cost of the first search; the cost of the third search exceeds the cost of the second search; and so forth.[31] As a consequence of this assumption, an acquirer either will make a good match or exit the market before matching because the increased cost of its next search would exceed the expected gain.

A potential target (who is not searching) has a different maximization problem. In the model, the target's task is to choose a defensive tactics level. This is not simple because strong defensive tactics increase the target's gain from an acquisition, *conditional on* the target receiving a bid, but a high defensive tactics level *reduces* the probability of receiving a bid (because the lower the acquirer's expected gain from a made deal is, the lower the potential acquirer's incentive to search for such a deal).

To isolate the exchange efficiency effect of defensive tactics, we assume that target boards maximize their companies' expected return from an acquisition. A faithful board chooses the defensive tactics level that implements its company's optimal trade-off between maximizing the probability of a bid and maximizing the price conditional on a bid actually occurring.

The market is populated with many potential targets and many potential acquirers.[32] There are three target types. A "synergy target" is maximizing expected returns from its assets and business model, and so would not do better under different management. However, the synergy target's assets may complement the assets of at least one of the potential acquirers. A value-increasing match would occur when two firms with complementary assets conclude a deal. A "financial target" does not maximize expected returns. A value-increasing match would occur if an acquirer with the ability to improve firm performance finds a financial target. A "noise firm" is not a target: the firm, that is, would reject every bid.

There are two acquirer types. A "synergy buyer" searches for an efficient synergy target. We assume that this searcher lacks the technology to improve firm performance other than by combining complementary assets and so would not bid for a financial target if the searcher discovered one. A "financial buyer" searches for targets whose performance the acquirer has the capacity to improve. We assume that a financial buyer is not a synergy match for, and so would not bid for, a synergy target.[33] Some synergy targets search for acquirers with which to match. For reasons detailed below, we assume that many more acquirers search than do targets. Hence, we focus on acquirer search, but note here that target search and acquirer search are complements: theory predicts and our simulations show that the probability that

[31] We motivate the assumption of quadratic search costs in Part III *infra*.

[32] We set our assumptions out largely in narrative form.

[33] Financial buyers usually are private equity firms whose only "asset" is the ability to improve target performance, often by causing the target to cease certain business strategies or to choose others.

an acquirer and a target will match is higher when acquirers and targets both search.

The corporate control market is "semi-strong information efficient."[34] Therefore, a potential target's market price—price per share times the number of shares—approximates the target's stand-alone value plus the expected premium from a possible bid. This assumption importantly implies that every successful acquisition is ex ante exchange efficient because a willing buyer and a willing seller concluded it. A potential acquirer would not bid unless it believed that it would realize value in excess of the bid price and the target's board would not recommend that its shareholders accept a bid unless the bid exceeded the probable target shareholders' reservation price, which exceeds the target's stand-alone value.[35] *Failed acquisitions*, however, are not necessarily efficient. A target board may reject a value-increasing bid because it wants to remain independent or because it mistakenly believes that the target can do better by remaining independent.

---

[34] Semi-strong efficiency exists in the market for corporate control when the market price of a company (price per share times number of shares) incorporates all *public* information relevant to the company's value. *See* Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 556–57 (1984). The assumption is particularly plausible in the acquisition context. A board that opposes an offer based on private information can release that information and so make the market more informationally efficient. While the effectiveness of disclosure is limited by the strategic costs of disclosure or by the difficulty of making a credible disclosure given the target board's potentially mixed motivations, the option to disclose does move the target's price toward information efficiency.

[35] Recent evidence is consistent with our assumption that many matches are ex ante efficient. *See* Matthew D. Cain, Stephen B. McKeon & Steven Davidoff Solomon, *Do Takeover Laws Matter? Evidence from Five Decades of Hostile Takeovers*, 124 J. FIN ECON. 464, 480 (2017) ("Column 1 reports a strong and economically significant correlation between takeover susceptibility and firm value, indicating that firm value is increasing in its susceptibility to hostile takeovers."); Asli M. Arikan & René M. Stulz, *Corporate Acquisitions, Diversification, and the Firm's Life Cycle*, 71 J. FIN. 139, 140–41 (2016) ("We find strong support for the predictions of neoclassical theories that acquisitions are made by better-performing firms and firms with better growth opportunities, and that acquisitions create value. . . . Our evidence of a positive relation between a firm's acquisition rate and its Tobin's *q* supports the neoclassical view of acquisitions, which holds that firms use acquisitions to reallocate corporate assets to more productive uses."); Vojislav Maksimovic, Gordon Phillips & Liu Yang, *Private and Public Merger Waves*, 68 J. FIN. 2177, 2179 (2013) ("We find that acquisitions are efficiency improving, both on and off the [merger] wave."). Wang, *supra* note 29, at 337, applies his structural matching model of the M&A market to data and finds that "the value of an active merger market is estimated to be 12.56% for an average acquirer and 47.32% for an average target." Ran Duchin & Breno Schmidt, *Riding the Merger Wave: Uncertainty, Reduced Monitoring, and Bad Acquisitions*, 107 J. FIN. ECON. 69, 69, 71 (2013) is in part consistent with these conclusions; it finds favorable results for mergers in general but less favorable results for acquisitions that take place during a wave of acquisitions. A potentially large source of inefficiency exists in stock for stock mergers because acquirers may bid with overvalued shares based on private information available only to the bidder, thereby purchasing targets though other possible bidders have higher valuations. Li et al. use a structural model to estimate the magnitude of the inefficiency, with a sample of 2,503 deals from 1980 to 2013, finding "that an overvalued bidder crowds out a bidder with a higher synergy in 7.0% of deals . . . the aggregate efficiency loss is 0.63% of the target's preannouncement value, with a standard error of 0.19%." Di Li, Lucian A. Taylor & Wenyu Wang, *Inefficiencies and Externalities from Opportunistic Acquirers*, 130 J. Fin. Econ. 265, 267 (2018).

At the beginning of a market period, potential targets choose their defensive tactics levels and potential acquirers choose their search strategies. Acquirers know the average market defensive tactics level but not the level at particular firms. To learn that, and other relevant information, the acquirer must investigate.[36] Because a target board can adopt a poison pill quickly, however, and because pills increase target bargaining power, potential acquirers (in our simulations and in actual practice) assume that every target will have a pill when an offer is made.[37] While an individual target cannot affect the market average defensive tactics level by the level it chooses, the target can affect the probability that it will be bought. A sequential searcher may pass on a firm whose defensive tactics level seems high in light of the acquirer's view of the distribution of defensive tactics levels in the market. The targets in our model thus act as do sellers in standard search models, whose choice of a price—here a defensive tactics level—cannot affect the market price distribution but can affect the individual seller's demand. Finally, a potential target can increase the cost of buying it *after* receiving a bid—for example, by finding competitive bidders.[38]

B. Predictions

This model generates three qualitative predictions:[39]

---

[36] We follow the standard convention in search models that sellers do not advertise: a searcher can learn the firm's price only by investigating the firm. Because, we later show, defensive tactics largely determine prices, we thus assume that a potential acquirer can learn how a potential target's defensive tactics level affects the division of expected deal surplus only by investigating the target.

[37] *See* Emiliano M. Catan, *The Insignificance of Clear-Day Poison Pills* 48 J.LEG. STUD. 1 (2019*)* ; *see also* John C. Coates IV, *Takeover Defenses in the Shadow of the Pill: A Critique of the Scientific Evidence*, 79 TEX. L. REV. 271, 298 (2000).

[38] It is not customary to include information intermediaries in search models, but investment banks sometimes play an intermediary role in the market for corporate control. To see why we do not take into account investment banks, consider "conjunctive search" for goods: the searcher screens potential products using one or two "cutoff attribute levels" such as product safety. The searcher then makes full attribute comparisons over the products that survive the screen. In the market for corporate control, the bankers sometimes perform the first of these functions: identifying a subset of firms in which an acquirer is likely to be interested. The acquirer then makes a full investigation of a fraction, or all, of the potential targets in the subset. Define the cost of creating the screened subset c_s and the cost of making a full comparison c_f, so $c = c_s + c_f$. Impressionistic evidence suggests that c_s/c is small: the majority of acquirer costs is incurred in making full investigations. Some acquirers use investment bankers while others do not, but the relative fraction of banker users is unknown. For these reasons, we let $c_s = 0$. Relaxing this assumption would have an ambiguous effect on our results. On the one hand, search costs would increase to include bankers' fees; on the other hand, bankers may increase the probability that an acquirer finds a good target. We do not characterize this tradeoff here.

[39] A qualitative prediction can be signed but is imprecise. For example, increasing defensive tactics levels *reduces* acquirer search. The benefit of a simulation is that it adds precision to a qualitative prediction. For example, our simulations show *how many* draws—that is, searches of firms—an acquirer makes under weak and then under strong defensive tactic levels.

One: *The minimally achievable corporate control market inefficiency would be high even if defensive tactics were banned.* This is because acquirer search is suboptimal.[40] There are three reasons: search is especially costly, insufficiently rewarding, and ineffective at locating good targets. In the usual search model, agents search for low prices, and price information is convenient to access. In the market for corporate control, acquirers search for matching targets but match information is costly to acquire. Whether a potential target is a good synergy match for a strategic buyer commonly requires investigation into how combining the two firms would produce a larger joint gain. Similarly, whether and by how much a financial buyer could improve a potential target commonly requires careful investigation and (usually) access to non-public information concerning the nature of existing management's failures and the extent to which an acquirer's management has the skills to eliminate or ameliorate those failures. In addition, both types of acquirers must identify and evaluate the efficacy of each potential target's defensive tactics level.

Further, acquirer search could be socially efficient *only if* the acquirer could capture the full return from searching. But as explained in the Introduction, targets are not fungible, which implies that each target has some monopoly power. As a result, concluding an acquisition or match necessarily requires bilateral bargaining in which, after a potential acquirer finds an appropriate target, the two sides negotiate to divide the expected match gain.

Finally, heterogeneity among potential targets reduces search effectiveness because it increases the number of wasted searches: searches in which an acquirer "hits on" the wrong target.[41] For example, a financial buyer may find a target that would only be valuable as a synergy partner. Similarly, a synergy buyer may find a target that requires improvement. Finally, either buyer type may find a noise firm, which is not for sale. The costs of determining that an acquirer had found the wrong partner type or a noise firm are wasted. Wasted searches are especially inefficient in our structural model because search costs increase in the number of prior searches. To explain this effect, consider a sequence of three searches: the first costs $100, the second $110, and the third $120. An acquirer initially hits a noise firm, which is a wasted search. But now, the second and third searches, over potentially profitable matches, become the first and second searches. In effect, because the acquirer wasted a $100 search, it is restricted to two draws from the distribution of possible good matches, with the first draw costing $110

[40] Acquirer search is suboptimal because acquirers do not equate the *social* marginal gain to their private marginal cost. Rather, acquirers equate their private marginal gain to their private marginal cost. Because the private marginal gain is less than the social marginal gain, acquirers stop searching before a social planner would want them to stop. The text next explains why acquirers truncate search.

[41] Schwartz and Wilde first show that search becomes less effective as goods for sale become more heterogeneous. Alan Schwartz & Louis L. Wilde, *Competitive Equilibria in Markets for Heterogeneous Goods Under Imperfect Information: A Theoretical Analysis with Policy Implications*, 13 Bell J. Econ. 181, 182 (1982).

and second costing $120. In short, wasted searches increase the cost of productive searches. The consequence is to increase the probability that a potential acquirer will exit the market before it matches. And for these three reasons, acquirer search is suboptimal, so that the corporate control market, even in the pre defensive tactics era, should have been materially exchange inefficient.

Two: The marginal contribution of defensive tactics to the market inefficiency is large. There are two reasons. To understand the first, suppose that heterogeneity is absent: all targets are alike. Defensive tactics nevertheless increase a target's bargaining power in an acquisition negotiation above the power the target's monopoly power alone could command.[42] The less match surplus searching acquirers expect to realize, the lower is acquirer search intensity. Second, and more subtly, supply side heterogeneity and defensive tactics should be mutually (negatively) reinforcing. As just argued, defensive tactics *reduce* the acquirer's gain from search, and supply side heterogeneity *increases* the acquirer's cost of search. The combination of strong defensive tactics *and* supply side heterogeneity thus should reduce acquirer search intensity more than either factor alone could do.

Three: *A faithful target board chooses a defensive tactics level that (a) permits an acquirer to share in the expected surplus from a match, but (b) exceeds the socially efficient level.* Regarding (a), potential acquirers that expect to receive no portion of the surplus from the transaction will not search, so the target would receive no bids. Regarding (b), a faithful target board chooses the defensive tactics level that optimizes the trade-off between maximizing target surplus conditional on receiving a bid and maximizing bid frequency. The board, however, will not consider the effect of its choice on the market average defensive tactics level. Because every board considers only its own shareholders' welfare, the market average defensive tactics level will exceed the socially efficient level.[43]

Theory yields these predictions, but the decision maker would like to know the magnitude of the predicted effects. The public decision maker—a legislature, say—cannot control the number and type of targets in the market and their intrinsic uniqueness. The decision maker, however, can control the level of defensive tactics firms choose. The policy-relevant empirical issue thus concerns the *marginal contribution* of defensive tactics to the market inefficiency. The greater that contribution is, the less efficient the current Delaware defensive-tactics-friendly law becomes. For the reasons set out in the Introduction, assessing the magnitude of defensive tactics' marginal contribution cannot be done "naturally" because the researcher cannot observe the number and type of targets that are available to buy. As well, the private

---

[42] Part VI *infra* explains in detail how defensive tactics increase target bargaining power.

[43] We describe here a standard search externality: sellers choose prices or contract terms without taking into account the effect of their choices on the total amount of search in the market.

welfare question—the strategy that best serves target shareholders—turns on the number of bids that a particular firm's defensive tactics level deterred, but the researcher cannot observe unmade bids. A simulation overcomes these limitations for the simulated market.

III. Proxy Variables and Simulated Search

A corporate control market simulation specifies search strategies for acquirers (and searching targets) and defensive tactics strategies for targets. The simulation also specifies the different surplus divisions between acquirers and targets that different legal regimes governing defensive tactics yield. Finally, the simulation specifies parameter values: (a) the total number of matches that it is possible for agents to make—the m in our social welfare measure; (b) the number of acquirers and targets in the market and their types; and (c) the cost function for searching acquirers.

A. *Market Participants*

We simulate the takeover market for public companies. Hence, our actors maximize expected monetary returns. A target is a firm that would be a good match for the appropriate acquirer, and an acquirer makes at most one match per period. In this, Part III.A, we discuss how we chose the number of agents of each type in the simulated market and the ratios among them. Part III.B then describes the acquirers' search strategy and derives the surplus splits under the two legal regimes: defensive-tactics-friendly and unfriendly.[44]

The actual number of good targets in the market in any period is not observable, but the number and type of acquisitions that took place in that period is observable. For two reasons, we suppose that the ratio of actual synergy acquisitions to actual financial acquisitions should reflect the true ratio of synergy targets to financial targets in the full market population. First, if the observed acquisition ratio is consistent across time—say at three to one—there should be roughly three times as many potentially good synergy matches as financial matches in the market at large *unless* it is much less costly for a synergy buyer to evaluate a potential synergy match than it is for a financial buyer to evaluate a financial match. There is no reason to believe that such a cost difference exists.

Our second reason follows from statistical analysis. Consider an urn that has red balls and white balls: the total number of balls and the ratio of

---

[44] Burkart and Raff's model has shareholders permitting managers to make ex ante inefficient acquisitions (that generate private benefits for the managers) to induce the managers to exert high effort in earlier periods. In our model, acquirers maximize expected utility by making matches. We do not consider the Burkart and Raff possibility because it is difficult to assess the magnitude of the effect. Mike Burkart & Konrad Raff, *Performance Pay, CEO Dismissal, and the Dual Role of Takeovers*, 19 Rev. Fin. 1383, 1409 (2015).

red balls to white balls are unknown. An experimental subject will draw ten balls from the urn, each time returning the chosen ball to the urn, and then estimate the red-to-white ratio. The initially uninformed experimental subject's rational strategy would begin with the assumption that the experimenter filled the urn randomly. On this assumption, there should be a fifty-fifty division of red and white balls in the urn. Now suppose that, on her initial try, the subject draws three red balls and seven white balls. A rational subject would update her initial belief to suppose that the urn contains considerably fewer red balls than white balls.[45] Let the subject then repeat the ten-draw process four more times. On average, she consistently draws three red balls and seven white balls. Using the ten draw process, the experimental subject should believe that the urn population is much closer to a ratio of three red balls to seven white balls than to a ratio of half of each (though the subject still would not know how many balls in total the urn contains).

We assume that nature distributes potential target types in the corporate control market. Accordingly, we suppose that each completed acquisition is analogous to the draw of a ball from an urn the total population of which is unknown. We have five years of data, which is equivalent to five draws from the urn. If the ratio of actual synergy to financial acquisitions is consistent across time, statistical analysis supports the view that the synergy-financial acquisition ratio approximately reflects the true market ratio. Both intuitive and statistical reasonings suggest, therefore, that the data regarding actual acquisitions are informative about the market population.

Turning to the data, Table 1 contains for recent years the number of acquisitions in which the acquiring company was public (a synergy-motivated match) or private (a financially motivated match).

[45] If the ratio of red balls to white balls in the urn is .5, the binomial formula shows that the chance of the subject drawing three red balls in ten trials is 11.7%. The formula is

$$\Pr(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

where the number of trials is $n = 10$, the number of successes is $k = 3$ (that is, red balls drawn), and the assumed probability of red balls in the urn is $p = .5$.

Table 1. U.S. Public and Private Acquirers
(Source: Bloomberg Law, Mergers and Acquisitions, Deal Attributes)

Year	Total Acquisitions of U.S. Public Companies	Public Acquirer	Private Acquirer	% Public
2016	473	341	132	72.09
2015	415	278	137	66.98
2014	348	261	87	75.0
2013	335	232	103	69.25
2012	344	245	99	71.22
Explanation for choices: 1. Target has to be public (otherwise defensive tactics issue doesn't arise) 2. Public acquirer is a proxy for strategic searcher 3. Private acquirer is a proxy for financial searcher				

Table 1 exhibits a consistent ratio between synergistic and financial acquisitions: between 2012 and 2016, synergy acquisitions averaged about 70% of the total, with a standard deviation of 2.7%.[46]

The market also contains noise firms, which are not for sale. When we interviewed market participants about how a potential target responded to an inquiry to buy, the most common response the participants received was that the target "is not for sale." Actual searching firms also remarked that they hit many "dry holes"—targets that were costly to search but that ultimately proved not to be a match. We reflected these answers in our simulations by assuming that noise firms are a large fraction of the firms over which potential acquirers may search.

To complete our market description, we let there be relatively few synergy targets who search. There are three reasons. First, search for synergy partners requires a different skill set than running a business; many firms in the normal course specialize in running their businesses but will consider a good offer should one appear.[47] Second, a synergy-seeking firm can either buy a synergy target or recast itself as a synergy target and 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 analysis, impressionistic evidence suggests that non-distressed firms seldom attempt to sell themselves. Finally, synergy search is an

[46] The Table is drawn from Bloomberg Law, Mergers and Acquisitions. We also searched FactSet for acquisitions during the same period. The FactSet database has fewer acquisitions in each category but the ratio of synergy acquisitions to financial acquisitions is approximately the same. The FactSet Table is in Appendix 4.

[47] Gilson, *supra* note 7, at 54–55.

endgame: the target synergy searcher wants to sell itself. In contrast, acquirer search is common, with some acquirers making repeated acquisitions.[48] The number of searchers for a particular target type should be a function of the number of targets of that type acquirers expect the market to contain. We use this reasoning to suppose that the ratio of synergy searchers to financial searchers approximates the ratio of synergy targets to financial targets.

The actual numbers we used for the simulations are: passive synergy targets, 96; active synergy targets that search for acquirers, 4;[49] materially improvable targets, 50; noise firms, 525; synergy searchers, 295; and financial searchers, 130. A little less than 70% of the simulated targets would be synergy matches, and a little more than 30% would be improvable matches. Hence, 19% of the total firms over which acquirers search in the simulated market (150/775) are "targets": firms that would be good matches for the appropriate acquirers. Given what market participants report about the difficulty of finding matches, this percentage may be high. We chose it because we wanted to analyze the strongest case for current law. The higher the ratio of actual targets to total firms, the more productive an acquirer's search for targets should be, even under strong defensive tactics.

B. Strategies, Search Costs, and Surplus Splits

Choosing a defensive tactics level is effectively choosing a price because the level determines the split of acquisition surplus.[50] Thus, we follow the convention of assuming that searchers learn the prices at particular firms only by investigating those firms. Searching for targets in the corporate control market, however, differs from searching for prices in standard search

---

[48] *See* Andrey Golubov, Alfred Yawson & Huizhong Zhang, *Extraordinary Acquirers*, 116 J. FIN. ECON. 314, 315 (2015); Nihat Aktas, Eric de Bodt & Richard Roll, *Learning from Repetitive Acquisitions: Evidence from the Time Between Deals*, 108 J. FIN. ECON. 99, 104 (2013); *see also* Ludovic Phalippou, Fangming Xu & Huainan Zhao, *Acquiring Acquirers*, 19 REV. FIN. 1489, 1528 (2015).

[49] In additional simulations (available on request), and holding the other parameters constant, σ (the ratio of made matches to total available matches) did not materially increase as the number of synergy searchers increased until these searchers comprised much more than 10% of the total synergy targets in the simulated market. For the reasons in text, this is an unrealistically high fraction. Because σ is insensitive to increases in the number of searching targets below 10%, we use the apparently realistic number of four searching targets.

[50] Regarding the relation between defensive tactics and bid prices, define an acquirer's value from an acquisition as v and the target's cost—its standalone value—as c. The deal surplus thus is $S = v - c$. Then let the acquirer's share of the deal surplus, as a function of the target's defensive tactics level, be λ ($0 < \lambda < 1$) and let the acquirer's bid be b. The acquirer's net gain from the deal thus is $v - b = \lambda S$: that is, the acquirer's gain is the share of the surplus the acquirer can realize under the defensive tactics level the seller chose. Rearranging terms, the bid must be $b = v - \lambda S$. The lower the acquirer's surplus share is (that is, the smaller λ is), the higher the acquirer's bid must be. Intuitively, defensive tactics create the target's bargaining power: the higher the defensive tactics level, the more bargaining power the target has. Targets use strong bargaining power—that is, larger surplus shares—to extract higher prices from acquirers.

models. While prices are immediately apparent in search models, determining a potential target's defensive tactics level and hence the likely price necessary to accomplish the acquisition requires investigation.

There are two search strategies in the search literature: sequential search and fixed sample size search. When search is sequential, the acquirer searches until the marginal cost of the next target search equals the expected marginal gain. In contrast, when the agent searches over a preset universe, the agent chooses a sample size to explore before beginning, and buys at the best price her sample revealed.[51] Our model supposes that acquirers search sequentially because fixed sample size search is unrealistic in the corporate control context. An agent searching pursuant to a fixed sample size strategy would return to an earlier draw if it yielded the lowest price. Fixed sample size models thus assume that sellers *do not alter their prices* after buyers visit them. In contrast, a searched target is likely to learn that it is in play. The target may then use the defensive tactics that it had adopted to increase the price. For example, a firm with poison pill protection may attempt to attract competing bidders. The corporate control market searcher thus seldom can return to the "same" firm that it initially visited because, in a Heisenberg-like effect, the initial visit changes the target. Therefore, agents in our model search sequentially: that is, they search until the agent finds a target, or the next search would yield a negative expected gain.

We set the costs of an initial search at about 2% of the match surplus.[52] The researcher may assume either constant or increasing search costs. In-

---

[51] Honka and Chintagunta provide a more extensive definition: "We study two search methods, namely, simultaneous and sequential search. Under a simultaneous [that is, fixed sample size] search strategy, the consumer samples a fixed number of alternatives and purchases the alternative with the lowest price (or highest utility) in this set. The set of alternatives searched is obtained by looking at the subset for which the expected maximum utility net of search costs is the highest among all possible subsets. A limitation of the simultaneous search strategy is that it does not take into account new information that the consumer might obtain during the search process. So if the consumer observes a very low price (or very high utility) for an alternative early in the search process, the benefit from an additional search may be below the marginal cost of that search. In a sequential search strategy, on the other hand, the number of alternatives searched is not fixed, but is a random variable that depends on the outcome of the search; this allows a consumer to economize on information costs. In this case, the consumer weighs the expected benefits and costs of gathering additional price information after each new quote is obtained. If an acceptable price is obtained early on, the expected gains from additional searches are small and there is no need to pay the cost of additional searches . . . ." Elisabeth Honka & Pradeep Chintagunta, *Simultaneous or Sequential? Search Strategies in the U.S. Auto Insurance Industry*, 36 Mktg. Sci. 21, 21–22 (2017). A more technical definition of sequential search holds that the agent begins searching with a reservation value—the acceptable value of a deal—and continues searching until the current option less the cost of another draw equals the reservation value. Taking the next draw thus would yield a negative return. *See* Jean-Michel Benkert, Igor Letina & Georg Nöldeke, *Optimal Search from Multiple Distributions with Infinite Horizon* 6 (U. of Zurich Dep't of Econ., Working Paper No. 262, 2017). Our simulated agents follow this search rule.

[52] Data about actual acquirer search costs is difficult to observe. Breakup fees compensate a bidder for costs incurred if a target that provisionally accepted a bid changes its mind. These fees are observable and today approximate 4% of deal value. Fernσn Restrepo & Guhan Subramanian, *The New Look of Deal Protection*, 69 Stan. L. Rev. 1013, 1015 (2017). An acquirer

creasing costs is more realistic here because both synergy and financial acquirers order search. An acquirer begins its search with possible targets that, as its prior knowledge suggests, may be good matches. These targets would be less costly to evaluate than firms with which the acquirer is less familiar. If the acquirer has not matched, it will search for less familiar targets that should be costlier to evaluate. In the simulations, then, search costs increase as the searcher analyzes more possible targets.[53]

The empirical researcher cannot conveniently observe actual surplus splits. However, we can derive the simulated splits we use for the two legal regimes from actual market data. To see how we proceed, let p be the (correct) pre bid market price of the target; p thus is the target's cost of accepting a bid. The acquirer's value for the target is v; the winning bid is b. We let $b = (1 + \alpha)p$, where $0 < \alpha < \infty$ is the premium acquirers pay; and $v = (1 + \beta)p$, where $0 < \beta \leq \infty$ is the gross value the acquirer expects to realize. Note that both the bid and the value are specified as a function of the target's pre bid price p. The acquirer's return is value less price: $v - b$, or $(1 + \beta)p - (1 + \alpha)p = p(\beta - \alpha)$. The match surplus is value less cost, or: $(1 + \beta)p - p = p\beta$. The successful acquirer realizes λ of the surplus from a completed transaction, where λ is the buyer's gain divided by the match surplus, or $\frac{p(\beta-\alpha)}{p\beta} = \frac{\beta-\alpha}{\beta}$. This is less than one because $\alpha > 0$ and $\beta > \alpha$.

Regarding the surplus shares we use, a paper studied 5,136 takeover contests between 1988 and 2006 (during which time the legal regime was friendly to defensive tactics) and found an average premium above the pre bid price of 50% (the α in the algorithm derived above) and estimated an average acquirer value above the pre bid price of .81 (the β).[54] Using our

that receives a breakup fee, however, has concluded its initial search, begun due diligence and negotiated with the target. We are interested in the first of these costs—deciding whether a potential target would be a good match. We let that cost be half the breakup fee average.

[53] In the simulations, the surplus from a deal is 100 utils, which sellers and buyers divide. The MATLAB code sets the cost of searching over one potential target as minus 2 utils. Search costs increase as the agent searches more possible targets under the rule: $\textit{search costs} = 2 + (\textit{number}/2)^2 - .25$. This function is quadratic over whole integers such as the number of sequential searches an acquirer makes. Constant marginal search costs would be a plausible assumption if every seller is as convenient to evaluate as every other seller. Standard search models thus often assume constant marginal search costs because the agent is observing each visited firm's price. In contrast, we argue that it is costlier for an acquirer to investigate (visit in search theory terms), say, the third potential target than to visit the first because acquirers begin with the potential targets (or industries) they know best. Consumers behave in the way we assume firms behave: that is, consumers order search beginning with the product that they believe is likely to generate the highest match utility and be the least costly to evaluate. *See* Mark Armstrong, *Ordered Consumer Search*, 15 J. EUR. ECON. ASS'N 989, 990 (2017).

[54] *See* Dimopoulos & Sacchetto, *supra* note 11, at 444–45, 468. Recent data regarding premiums, adjusted for the market anticipating a deal, is consistent with the earlier data. When the market anticipates a deal, the target's share price will increase above its standalone value to reflect a part of the match surplus the target could capture from a bidder. Hence, measuring the true deal premium by the difference between the bid and the target's share price when a deal closes understates how much the acquirer must pay above the target's standalone value. Reflecting this analysis, a study of acquisitions between 2001 and 2010 found a premium over the target's price when the market first learned that the company was in play of 51.4%. *See* Harold

algorithm for λ, an acquirer's surplus share from completing an acquisition would be .39. Because market participants believe that premiums may have fallen in recent years, our simulations use a surplus split of .4 for acquirers and .6 for targets when defensive tactics are strong. We lack firm data for the defensive-tactics-unfriendly regime. Market participants estimate premiums then to be around 30% above the pre bid price. If bidder valuations were then as they are now, a successful bidder would have received 63% of the surplus.[55] Our simulations use a conservative defensive-tactics-unfriendly regime split of .6 for acquirers and .4 for targets.

A potential acquirer, however, will discount its surplus share by the probability that it will not buy a promising target its search uncovers. There are two reasons. First, an acquirer is imperfectly informed about a potential target's reservation price and the target is imperfectly informed about the acquirer's value. Attempted deals when both parties are uninformed sometimes fail. We do not analyze this cause of deal failure but note its qualitative effect below. Second, a target may interest other bidders. We represent this second effect formally as follows: the probability that the first searcher to discover the target buys it is denoted x. The probability that the target runs an auction is y. If the target does run an auction, the probability that the first acquirer succeeds is the probability, z, that the acquirer is the highest valuing bidder. The probability that the first acquirer buys thus is

$$x = (1 - y) + yz$$

Importantly, y, the auction probability, is *increasing* in the defensive tactics level because strong defensive tactics give the target time to interest other possible bidders. As y increases, the probability that the first searcher buys the target falls.

Turning to the data, a study estimated the fraction of initial bidders that acquire targets as .9. However, this fraction falls if other bidders enter.[56]

Mulherin & Serif Aziz Simsir, *Measuring Deal Premiums in Takeovers*, 44 Fin. Mgmt. 1, 10 (2015). A more recent paper found an average deal premium, measured a week before deal closing, of 36%, but the paper also estimated the "embedded premium"—the portion of the target's share price that reflected the possibility that the target may be acquired—at 10%. Benjamin Bennett & Robert Dam, *Merger Activity, Stock Prices, and Measuring Gains from M&A* 2, 31 (Jan. 2018) (unpublished manuscript) (on file with SSRN), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3000574. The deals these papers studied also occurred under the current strong defensive tactics regime. In those deals, the real average premium thus exceeded 46%. *Id.*; *see also* Mulherin & Simsir, *supra*, at 10. An acquirer's total cost includes the bid, transaction costs, and deal implementation costs. Hence, the finding that the acquirer's value (the $\hat{a}$ parameter) was .81 is plausible and is the figure we use.

55 Firms in Wang's structural model of the M&A market do not use defensive tactics (so all efficient matches are consummated). Thus, his market is similar to the pre-1985 defensive-tactics-unfriendly legal regime we analyze. Using more current data, he estimates the acquirer's share of deal surplus as 0.629, which is essentially identical to our estimate of 0.630. *See* Wang, *supra* note 29, at 41. As the text states, we use a slightly lower acquirer share in the simulations to make the strongest case for defensive tactics.

56 *See* Dimopoulos & Sacchetto, *supra* note 11, at 462. Heron and Lie also find that multiple entrants reduce the likelihood that the initial bidder succeeds but do not increase the

Another study estimated the fraction of single bidder contests that succeed as .74 and the number of auctions that result in sales *to one* of the bidders as .78.[57] We use this data and our analysis to suppose (a) every target that is visited by an acquirer with whom it would be a good match sells to someone, and (b) the probability that a searching acquirer buys the target is materially lower when the defensive tactics level is high.

IV. Results I: Exchange Efficiency

A. *How the Simulations Work*[58]

The simulated model calculates the expected utility of acquirers (and targets) that search sequentially using our cost parameters, an assumed total value of a match (as a multiple of assumed acquisition costs) and an assumed split.[59] An agent's expected utility from a search is reported as the average of a thousand simulations for each one of the possible draws. How many acquisitions take place in the control market is a function of acquirer search intensity because every acquirer searches, but a target can only match with an acquirer.

Turning to the corporate control market inefficiency, we calculate the probability that a particular target will match given the number of searches acquirers who want to buy targets of that type make. For example, if financial acquirers would optimally make three searches for possible improvable targets, we solve for the probability that an acquirer will buy such a target when its search intensity is three. We then multiply the total number of improvable targets in the market by this probability to get the number of improvable 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 the number of ex ante efficient matches that the market could make yields the market σ. The market inefficiency is $1 - \sigma$. Finally, our tables often specify a whole number plus a fraction: that is, there are 5.3 matches. Because we do thousands of simulations, such a result means that agents make five matches under the specified parameters with a 30% chance of making a sixth.

---

probability that the target remains independent. *See* Randall A. Heron & Erik Lie, *The Effect of Poison Pill Adoptions and Court Rulings on Firm Entrenchment*, 35 J. Corp. Fin. 286, 287 (2015).

[57] *See* Thomas W. Bates, David A. Becher & Michael L. Lemmon, *Board Classification and Managerial Entrenchment: Evidence from the Market for Corporate Control*, 87 J. Fin. Econ. 656, 665 (2008).

[58] Appendix 1 more extensively describes how the model unfolds; our online Appendix sets out the simulation program code. *See* Braasch, *supra* note 23.

[59] Recalling that the program measures results in utils, we report expected utility as whole numbers and fractions of utils: for example, 2.35.

B. The Exchange Efficiency Result

The central empirical question we address is the marginal contribution of defensive tactics to the corporate control market inefficiency. We begin our empirical approach to this question with a "base case" as a benchmark. There is no heterogeneity in the base case: all acquirers are identical as are all targets. To facilitate reading, we summarize the results here.[60]

The market inefficiency should be lower in the base case market than in the actual corporate control market because every target is a good match for every acquirer; a wasted search can occur only when a searcher hits a noise firm. Importantly, because there is no heterogeneity among the target sellers, the base case is an almost pure test of how different surplus splits affect the corporate control market inefficiency. When defensive tactics are weak—acquirers capture 60% of expected match surplus—the market inefficiency is about **16%**. Because defensive tactics are weak (in effect, absent), this is the minimally acheivable market inefficiency: the market naturally makes 84% of the available matches. Given the size of the corporate control market, this result is consistent with our first prediction: the market naturally is materially inefficient. We let the target capture 60% of expected match surplus under the defensive-tactics-friendly legal regime. The market inefficiency then increases to **26%**. This result is consistent with our second prediction. In the simplified conditions the base case assumes, *the market makes 10% fewer matches* under the defensive-tactics-friendly legal regime.

We next add realism to the simulated corporate control market. The market now contains two types of acquirers—financial buyers and strategic buyers. And the market contains three types of targets: materially improvable firms (financial buyer targets), which do not search; passive potential synergy targets; and searching potential synergy targets. There also are noise firms. The more realistic simulations thus test for the joint importance of the surplus split *and* the effect of demand side heterogeneity on the corporate control market inefficiency.

Our second prediction, recall, is that the market inefficiency should be materially greater in this realistic market than in the base case market. The simulation results are consistent with the model's prediction. The results are set out in Tables 2 and 3. In the Tables, an *AH* agent is a financial buyer who is searching for a materially improvable firm; an *AS* agent is a strategic buyer who is searching for a synergy match; a *TM* agent is a passive synergy target; a *TA* agent is an active, synergy target; a *TP* agent is a passive improvable target; and a *P* agent is a noise firm. Table 2 characterizes the defensive-tactics-friendly legal regime; Table 3 characterizes the defensive-tactics-unfriendly regime. Again, an acquirer searches over potential targets until it either matches or exits the market because the next search would yield negative utility.

---

[60] The supporting Tables are in Appendix 2.

TABLE 2

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (30 TA's; 50 TP's; 70 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.4 A, .6 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 30 TA's, and 70 TM's
525 P's

Sample Size	1	2	3	4	5	6	
Prob TP (50)	0.1126	0.208	0.2889	0.358	0.4232	0.4758	
Prob TA (30)	0.4331	0.655	0.7889	0.8626	0.9107	0.9378	
Prob TM (70)	0.2335	0.3979	0.5184	0.6068	0.6808	0.7336	
Sigma	0.23312	0.38602	0.496	0.575027	0.640913	0.688507	
Sigma TP	0.1126	0.208	0.2889	0.358	0.4232	0.4758	
Sigma TA & TM	0.29338	0.47503	0.59955	0.68354	0.74977	0.79486	
Sigma TA	0.4331	0.655	0.7889	0.8626	0.9107	0.9378	
Sigma TM	0.2335	0.3979	0.5184	0.6068	0.6808	0.7336	
Sigma AS	0.0994	0.161	0.2032	0.2317	0.2541	0.2694	
Sigma AH	0.0433	0.08	0.1111	0.1377	0.1628	0.183	
Sigma A	0.08224	0.136224	0.175028	0.202947	0.226173	0.242972	
A Matches Made	34.952	57.895	74.387	86.2525	96.1235	103.263	
Total Matches Made	34.968	57.903	74.4	86.254	96.137	103.276	
Total AS Payoff	816	1090	963	430	-473	-1839	
Total AH Payoff	65	46	-87	-363	-784	-1410	
Total TP Payoff	337.8	624	866.8	1073.9	1269.5	1427.5	
Total TA Payoff	729.4	1087.8	1290.9	1387.1	1434.8	1447.4	
Total TM Payoff	980.6	1671.4	2177.1	2548.6	2859.2	3081.1	
Total T Payoff	2047.8	3383.2	4334.8	5009.6	5563.5	5956	
Total Payoff (Welfare)	2928.8	4519.2	5210.8	5076.6	4306.5	2707	
Payoff per Match Made	83.7565774	78.0477695	70.0376344	58.8564009	44.7954482	26.2113172	3
A Agent Expected Utility	2.07294118	2.67294118	2.06117647	0.15764706	-2.9576471	-7.6447059	-
AS Agent Expected Utility	2.7666	3.6939	3.2635	1.4578	-1.6035	-6.235	
AH Agent Expected Utility	0.5034	0.3517	-0.6671	-2.791	-6.0301	-10.8499	
TP Agent Expected Utility	6.756	12.48	17.3352	21.4788	25.3908	28.5492	
TA Agent Expected Utility	24.3124	36.2585	43.031	46.2365	47.8266	48.2459	
TM Agent Expected Utility	14.0091	23.8766	31.1014	36.4089	40.8454	44.016	
Expected Welfare	19.5253333	30.128	34.7386667	33.844	28.71	18.0466667	2

TABLE 3

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (4 TA's; 50 TP's; 96 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.6 A, .4 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 4 TA's, and 96 TM's
525 P's

Sample Size	1	2	3	4	5	6	7	8
Prob TP (50)	0.1144	0.2048	0.2896	0.3599	0.4175	0.4745	0.5241	0.5642
Prob TA (4)	0.4193	0.6647	0.7953	0.8712	0.9125	0.9473	0.963	0.9745
Prob TM (96)	0.2374	0.4016	0.5243	0.6172	0.6883	0.7412	0.785	0.8212
Sigma	0.201251	0.343016	0.453293	0.538207	0.604012	0.657796	0.70278	0.739621
Sigma TP	0.1144	0.2048	0.2896	0.3599	0.4175	0.4745	0.5241	0.5642
Sigma TA & TM	0.244676	0.412124	0.53514	0.62736	0.697268	0.749444	0.79212	0.827332
Sigma TA	0.4193	0.6647	0.7953	0.8712	0.9125	0.9473	0.963	0.9745
Sigma TM	0.2374	0.4016	0.5243	0.6172	0.6883	0.7412	0.785	0.8212
Sigma AS	0.0829	0.1397	0.1814	0.2127	0.2364	0.2541	0.2685	0.2805
Sigma AH	0.044	0.0788	0.1114	0.1384	0.1606	0.1825	0.2016	0.217
Sigma A	0.071001	0.121072	0.159988	0.189973	0.213214	0.232199	0.248036	0.261076
A Matches Made	30.1755	51.4555	67.995	80.7385	90.616	98.6845	105.4155	110.9575
Total Matches Made	30.1876	51.4524	67.994	80.731	90.6018	98.6694	105.417	110.9432
Total AS Payoff	1105	1650	1754	1430	659	-589	-2340	-4614
Total AH Payoff	183	244	204	4	-383	-939	-1719	-2774
Total TP Payoff	228.8	409.6	579.1	719.9	834.9	949	1048.2	1128.5
Total TA Payoff	60.318	94.2802	110.1822	117.0865	118.8607	121.8385	120.1333	118.718
Total TM Payoff	911.7	1542.3	2013.2	2370.2	2643.2	2846.3	3014.5	3153.4
Total T Payoff	1200.818	2046.18	2702.482	3207.187	3596.961	3917.139	4182.833	4400.618
Total Payoff (Welfare)	2488.818	3940.18	4660.482	4641.187	3872.961	2389.139	123.8333	-2987.382
Payoff per Match Made	82.4450437	76.5791333	68.5425508	57.4895208	42.7470613	24.2135708	1.17469953	-26.92713
A Agent Expected Utility	3.03058824	4.45647059	4.60705882	3.37411765	0.64941176	-3.5952941	-9.5505882	-17.383529
AS Agent Expected Utility	3.7473	5.5934	5.9465	4.8468	2.2352	-1.9969	-7.9338	-15.6417
AH Agent Expected Utility	1.4111	1.8747	1.5694	0.0285	-2.9444	-7.2195	-13.2232	-21.338
TP Agent Expected Utility	4.5752	8.1912	11.5824	14.3976	16.6984	18.98	20.9632	22.5696
TA Agent Expected Utility	15.0795	23.5701	27.5456	29.2716	29.7152	30.4596	30.0333	29.6795
TM Agent Expected Utility	9.4971	16.0658	20.9713	24.6892	27.5333	29.6492	31.4008	32.8479
Expected Welfare	16.59212	26.267868	31.0698813	30.9412433	25.819738	15.92759	0.82555533	-19.91588

In the defensive-tactics-friendly regime (the current Delaware regime), financial buyers either make a match or exit after two searches; strategic buyers either make a match or exit after four searches. The market makes 68 matches, yielding a σ of .45 and a market inefficiency of 55%. In the defensive-tactics-unfriendly regime, the financial buyers either make a match or exit after four searches; the strategic buyers either make a match or exit after making five searches. Because potential acquirers search more intensely in the defensive-tactics-unfriendly regime, the market should make more matches. The simulations generate approximately 91 matches, which yields a σ of .60, and a market inefficiency of 40%. A move from the defensive-tactics-friendly legal regime to the defensive-tactics-unfriendly regime thus *would reduce* inefficiency in the market for corporate control by 15%.[61]

The more realistic simulations also suggest that it is particularly important to encourage financial buyer search because it creates a positive externality. A deterred synergy match is only a welfare loss. A deterred financial match also is a welfare loss, but the possibility that a financial buyer will purchase a materially improvable target may increase the incentive of target managers to protect their positions by improving their firms. In our simulations, there is twice as much financial buyer search in the defensive-tactics-unfriendly legal regime than in the Delaware Supreme Court's current defensive-tactics-friendly regime. Thus, returning to the earlier Chancery Court's defensive-tactics-unfriendly regime would do more than produce additional matches; it also would increase the market's ability to discipline shirking managers.

Practitioners and academics sometimes argue that defensive tactics deter an immaterial number of bids because there are many acquisitions each year. To the contrary, our simulations suggest that the corporate control market is much less exchange efficient under the defensive-tactics-friendly legal regime. Today's corporate control market makes almost $2 trillion of deals per year. Our simulations show that moving to a defensive-tactics-unfriendly legal regime would increase ex ante efficient acquisitions by a third. Thus, to the extent that our simulations resemble the real world, strong defensive tactics reduce deal value by over $150 billion a year.[62]

We conclude our exploration of the corporate control market inefficiency with some qualifications. These suggest that the actual inefficiency could be either larger or smaller than the simulation results yield. Regarding a smaller inefficiency, some deterred acquisitions could have turned out

---

[61] Another way to view this result is that, if there are T total targets, moving to the defensive-tactics-unfriendly regime would increase the number of made matches by a third: $(.60 - .45)T/.45T = .33$. Our results concerning the relative intensity of search in the two regimes are broadly consistent with two recent studies. One study of the antitakeover laws passed in the last five decades found that a firm's susceptibility to a hostile takeover peaked at 40% in 1973 (when modern defensive tactics had not yet been developed and no state antitakeover laws existed), and fell to about 8.6% in 2014. *See* Cain et al., *supra* note 36, at 484. The second study found that "deal hostility has fallen dramatically since the 1980s. While 34% of our sample takeovers was hostile in the 1980s, this fraction falls to less than 10% in the latter two periods." Tingting Liu & J. Harold Mulherin, *How has Takeover Competition Changed over Time?*, 49 J. Corp. Fin. 104, 112 (2018).

[62] Comparing the possible inefficiency here to other search deterring market practices that have recently been uncovered, a paper measured the loss from the lock-in effect that capital gains taxes exert on M&A activity. The authors estimate an efficiency loss of $3.06 billion per year for the United States. *See* Lars P. Feld et al., *Taxing Away M&A: The Effect of Corporate Capital Gains Taxes on Acquisition Activity* 2 (ZEW, Discussion Paper No. 16-007, 2016). Another paper estimated the welfare loss that price dispersion caused, due to inefficient consumer search, in the credit card market. If every consumer purchased at the lowest market price, welfare (exclusive of search costs) would improve by $36 billion per year. Victor Stango & Jonathan Zinman, *Borrowing High Versus Borrowing Higher: Price Dispersion and Shopping Behavior in the U.S. Credit Card Market*, 29 Rev. of Fin. Stud. 979, 981 (2015).

badly. The welfare loss from unmade acquisitions should be adjusted to reflect the possibility that these transactions would not have improved performance or achieved synergy. Further, though the data suggest that acquisitions are ex ante efficient as a general matter, some acquisitions may occur in service of acquirer management empire building. or because the acquirer is paying for the acquisition with overvalued stock. Finally, our simulations count an acquirer's investigation of a matched firm as a wasted search.[63] This is unrealistic because, in life, already matched firms are easy to distinguish from unmatched firms; public targets are required to disclose when a match occurs so an acquirer can cheaply identify a matched firm. Therefore, while in our simulations an acquirer may stop searching after, say, three searches, if one of those searches hit on a matched firm, a real-world acquirer may make a fourth search. Acquirers thus may search somewhat more than our simulation program permits, which would reduce the corporate control market inefficiency.

On the other hand, our simulations also may understate acquisition market inefficiency. Initially, we let the ratio of possible target matches to total firms be unrealistically high. This made acquirer search more effective than in fact it probably is. Further, the simulations suppose that lawyer and investment banker fees are invariant to the legal regime. These transaction costs should be considerably higher when an acquirer has to overcome a strong defensive tactics barrier rather than a weak barrier. If so, search costs are higher in the defensive-tactics-friendly legal regime than the simulations allow, which will reduce search. As a consequence, the simulated results overstate the probability that acquirers make matches in that regime. Finally, we assume that bargaining between acquirers and targets always results in a value improving match. Bargaining between parties with asymmetric information, however, sometimes fails, so that an acquirer who finds a good target may not succeed in buying it. The prospect of bargaining failure also should reduce search.

Although these competing considerations are difficult to net out, there is nonetheless a clear result. The simulation parameters are plausible, the exchange inefficiency results accord with theoretically grounded predictions, and those results are very large. Decision makers therefore should take as a working assumption that the marginal contribution of defensive tactics to corporate control market inefficiency is substantial.

---

[63] Because we define a match as a completed deal, we do not permit an acquirer to make a competing bid when its search uncovers a matched firm.

V. Results II: Private Welfare

A. *Defensive Tactics and Shareholder Welfare*

The board of directors authorizes defensive tactics in response to management recommendations.[64] In turn, courts set the level of allowable defensive tactics while resolving litigation brought by shareholders or by the acquirer with respect to a particular transaction.[65] As Part I showed, the Delaware courts now give target boards great leeway in setting the level of defensive tactics. There are two difficulties in assessing whether this board discretion is desirable. The first is a measurement problem: how do different defensive tactics levels affect shareholder welfare (recall that Delaware courts do not consider social welfare). Comparing defensive tactics levels is difficult, however, because they are "qualitative." For example, is a poison pill a stronger deterrent to hostile bids than a fair price law? It would be helpful, in answering such questions, to have a method for converting defensive tactics levels into the common metric of money: how various tactics affect the target's share of expected acquisition surplus.[66] To date, no such metric exists. Even after deriving a metric, the second difficulty is identifying the defensive tactics level that maximizes expected target shareholder welfare.

We begin with the measurement problem. Bargaining theory permits us to develop a common metric by which the effect of different defensive tactics levels can be assessed. Two factors affect bargaining power in a negotiation: the bargainers' disagreement points and their discount rates. Regarding the first factor, the better a party's alternative to bargaining failure, the better the agent will do in the bargain: the counterparty will have to give up a larger portion of the surplus to make the deal. Regarding the latter factor, the

---

[64] Some defensive tactics, most importantly poison pills, can be authorized and deployed by the board without shareholder approval. Other defensive tactics, such as a staggered board or a barrier to a post-acquisition freeze-out of target shareholders, require a charter amendment, and therefore shareholder approval after board initiation. Defensive tactics that require shareholder approval are unnecessary because the ultimate defensive tactic is for shareholders to reject insufficient bids. The adoption of a staggered board is an exception—shareholder approval ties later shareholders' hands. Eliminating a staggered board also requires a charter amendment and so requires the board to initiate the process (or shareholders to launch a proxy fight) before a charter amendment can be presented to the shareholders.

[65] There are exceptions. The original Delaware Supreme Court decision that approved the legality of the initial (and less toxic) version of a poison pill intended to discourage offers was challenged by a Household director and large shareholder, who favored selling the company. *Moran v. Household Int'l*, 500 A.2d 1346, 1349–50 (Del. 1985).

[66] The empirical legal literature in particular focuses on the impact of defensive tactics once an offer is made. *See, e.g.*, Lucian A. Bebchuk, John C. Coates IV & Guhan Subramanian, *The Powerful Antitakeover Force of Staggered Boards: Theory, Evidence and Policy*, 54 Stan. L. Rev. 885, 887 (2002) (measuring impact of the presence of a staggered board on success rates for hostile tender offers). We are interested in the ex post effect of a defensive tactic because that effect can be anticipated by a potential bidder and so affects its level of search.

lower a party's discount rate relative to her counterparty, the greater that party's bargaining power. The high discount rate party is less patient: that is, less able to wait for a better offer. A party seldom can affect her counterparty's disagreement point or her discount rate. A target, however, can stretch the future out so that, even if a target and acquirer have the same discount rate, the acquirer is functionally less patient.

A long future is unfriendly to an acquirer. Its payoff—its share of expected deal surplus—falls as the time between finding a possible target and buying it increases. 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 confront a competitor for the acquisition opportunity. In addition, time permits the target to continue a value-decreasing strategy or to delay implementing a value-increasing strategy. This not only reduces target value, but also may constrain the acquirer's ability to increase value, depending on the type of acquirer, by integrating the acquirer and target in a synergy-motivated acquisition or by improving the target in a financially motivated acquisition.

Defensive tactics permit targets to extend the period between receiving a bid and possibly concluding a deal. Different defensive tactics *permit targets to delay* for different periods. A poison pill can delay an acquisition for up to a year because it can take up to a year for the acquirer to win a proxy contest and elect directors who will remove a pill.[67] A poison pill with a staggered board can delay an acquisition for over two years because the acquirer must win two proxy contests, which in practice may block the offer. Other defensive tactics also facilitate delay.

To summarize, the longer the period during which defensive tactics prevent the acquirer who has identified a target from making an offer to target shareholders, the less the acquirer's bargaining power relative to the target. As a result, there is a positive relationship between different tactics' delay facilitating properties and the share of acquisition surplus a tactic permits the target to realize.[68]

The expected value of an acquisition to a target, however, also is a function of bid probabilities—the likelihood that the target will receive a bid. A firm can choose a defensive tactics level sufficiently high to preclude bids altogether; that is, it can become a noise firm. A firm that does not completely reject acquisitions will consider bid probabilities because these affect the likelihood of an acquirer appearing. A faithful target board's problem, then, is to solve for the defensive tactics level that optimally trades off the probability of receiving a bid—which increases with weak defenses—

[67] Heron & Lie, *supra* note 57, at 287, find that "poison pills induce greater final takeover premiums, mostly as a result of bid increases after the initial bid."

[68] Ronald J. Gilson, *A Structural Approach to Corporations: The Case Against Defensive Tactics in Tender Offers*, 33 STAN. L. REV. 819, 844–45 (1981), provides an early statement of this position.

against the price conditional on a bid being made—which increases with strong defenses.[69]

A target board thus should maximize a function such as

$$Max_d\ E(R) = \pi(s(1 - \lambda(d))) - c(d)$$

where *E(R)* is the target's expected return from a possible acquisition, *d* is the target's defensive tactics level, π is the probability an acquirer will bid, *(1 - λ(d))* is the target's expected share of the acquisition surplus,[70] which is *s*, and *c(d)* is the cost of implementing defenses.[71] A target board that maximizes this revenue function will choose an "interior solution." To enact no defensive tactics would cause *λ(d)* to approach one, which indicates that most of the deal's surplus would go to the acquirer. As a result, the expected

[69] Jonathan M. Karpoff, Robert J. Schonlau & Eric W. Wehrly, *Do Takeover Defenses Deter Takeovers?*, 30 Rev. Fin. Stud. 2359, 2365 (2017) is consistent with this analysis: "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. In a later paper, these authors "find that 11 of the 24 G-index provisions are robustly and negatively related to takeover likelihood." The eleven provisions that negatively relate to takeover likelihood are "anti-greenmail provisions, blank check preferred stock, classified boards, director contracts, director indemnification, director liability provisions, directors' duties provisions, executive severance contracts, fair price provisions, supermajority vote requirements, and unequal voting rights." Jonathan M. Karpoff, Robert Schonlau & Eric Wehrly, *Which Antitakeover Provisions Matter?* 1–2 (Mar. 14, 2018) (revised Apr. 12, 2020) (unpublished manuscript) (on file with SSRN), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3142195. The authors find that poison pills do not differentially affect bid probability because every firm in effect has a pill, but they do not consider that pills deter acquirer entry and so can increase the market inefficiency. *See also* Dirk Jenter & Katharina Lewellen, *CEO Preferences and Acquisitions*, 70 J. Fin. 2813, 2815 (2015) ("the evidence suggests that managerial self-interest causes the overall frequency of takeovers to be lower than optimal for target shareholders"). Vicente Cuñat, Mireia Giné & Maria Guadalupe, *Price and Probability: Decomposing the Takeover Effects of Anti-Takeover Provisions*, 75 J. Fin. 2591, 2593 (2020), show that a shareholder vote to remove a takeover defense increases the probability of a takeover within five years by about 4.1%. Similarly, a recent working paper found that antitakeover legislation materially reduced the likelihood of becoming a takeover target. Marc Frattaroli, *Does Protectionist Anti-Takeover Legislation Lead to Managerial Entrenchment?* 5 (Swiss Fin. Inst. Res., Working Paper No. 17-66, 2017), https://ssrn.com/abstract=3013077. Also, combining a poison pill with a staggered board materially reduces the probability that a particular firm is acquired. *See, e.g.*, Duc Giang Nguyen, *The Endogeneity of Poison Pill Adoption and Unsolicited Takeovers* 25 (Graduate School of Economics, Waseda University, Working Paper, 2015); Tatyana Sokolyk, *The Effects of Antitakeover Provisions on Acquisition Targets*, 17 J. Corp. Fin. 612, 613 (2011); Bates et al., *supra* note 58, at 660. Finally, reducing supermajority voting requirements increases tender offers for Delaware targets. Audra Boone, Brian Broughman & Antonio Macias, *The Cost of Supermajority Target Shareholder Approval: Mergers Versus Tender Offers* 3 (Indian. Legal Stud., Res. Paper No. 331, 2015), http://ssrn.com/abstract=2629424. Many of the models that find negative correlations between corporate governance indices and firm value, however, may suffer from serious endogeneity problems. A recent study directly confronts this concern. Xin Chang & Hong Feng Zhang, *Managerial Entrenchment and Firm Value: A Dynamic Perspective*, 50 J. Fin. & Quant. Analysis 1083, 1101 (2015), argues that managerial entrenchment, which defensive tactics facilitate, materially reduces firm value.

[70] Recall that *ë* is the acquirer's surplus share.

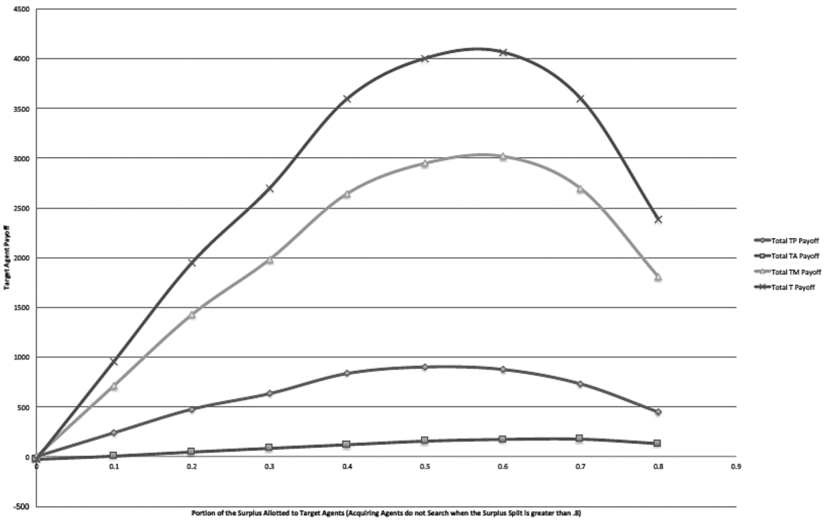
[71] The cost of choosing a defensive tactics level includes legal and investment banker fees for advice as well as the cost, where applicable, of soliciting shareholder approval.

revenue function approaches zero. A board that instead choses a very high defensive tactics level would cause $\lambda(d)$ to approach zero, which indicates that almost none of the deal's surplus would go to the acquirer. This would cause the bid probability π to approach zero as well, because potential buyers would not search. The target's revenue function would then become negative, because it would incur implementation costs but make no gains. Intuitively, at one "corner," the target would save the costs of enacting defensive tactics but realize no revenue and, at the other "corner," the target would incur the costs of enacting defensive tactics but also realize no revenue.

Unless a firm is willing to deter acquisitions altogether, the privately optimal defensive tactics level therefore must permit a successful acquirer to realize a material gain. Given that expectation, some potential acquirers will search for targets to buy. On this reasoning, a target's expected payoff must increase as its defensive tactics level increases *until* the reduction in the bid probability effect dominates the increase in the surplus share effect. Expressed mathematically, a target's expected revenue function should be strictly concave (that is, maximized at a single point).

The simulation results are consistent with our model's third prediction. We solved for the optimal acquirer search intensity—in other words, the amount of acquirer search—under each of ten surplus splits for acquisition gains, ranging from 0.1 of the surplus going to the target to all going to the target. We then calculated a target's expected return under each split, given that acquirers were searching optimally against that split. Figure 1 summarizes the results. In the Figure, the horizontal axis plots the target's share of the surplus, with increasing values for $(1 - \lambda(d))$, and the vertical axis plots the target's payoff.

FIGURE 1



The lowest curve, *TM*, is the return to passive synergy targets who will match with a synergy acquirer. The second curve, *TA*, is the return to synergy targets that search for acquirers. This return is higher, despite the target's search costs, because there is a greater probability of matching. The third curve, *TP*, is the return to passive, materially improvable targets, which do best because they match with financial acquirers but do not search themselves. The highest curve, *T*, sums the other three.[72]

The target's revenue function is strictly concave, which implies that the target allows the searching acquirer to realize some surplus.[73] Further, the return function is maximized at a target surplus share of approximately 0.6. This, as Part IV showed, is inefficiently high.[74]

We make four remarks about the simulated private welfare result. Initially, the result supports our model and choice of parameters. The model predicts that a curve describing target expected returns as a function of target defensive tactics levels will be strictly concave, which is what the simulations yield. Further, the curve has a left-hand skew. This result is consistent with the sequential search strategy we specified for acquirers. That strategy assumes convex search costs: later searches are more costly for acquirers than earlier searches. Acquirer surplus shares, however, necessarily decrease linearly: an acquirer share would be 0.5, say, under moderate defensive tactics; 0.4 under stronger defensive tactics; 0.3 under still stronger defensive tactics; and so on. Note that *target* expected returns fall as acquirer search

---

[72] Appendix 3 contains the relevant tables from which Figure 1 is derived.

[73] This is (a) of the model's third prediction. *See supra* Part II. B.

[74] This is (b) of the model's third prediction. *Id.*

intensity falls. Because an acquirer's search intensity falls quadratically when the acquirer's expected surplus share falls linearly, the *target's return* should fall by a larger and larger amount with each increase in the target's share. For example, a target's expected return should be greater when its share increases from 0.3 to 0.4 of deal surplus than when its share increases from 0.4 to 0.5. But then, the target's expected return should decline more rapidly as its surplus share *exceeds* the maximizing share—here, 0.6—than the target's expected return should increase as its share approaches the maximum. This is because the acquirer's search costs are increasing at a higher rate beyond the target's optimal surplus share than before it. Visually, our model predicts that a curve describing a target's expected return as a function of the defensive tactics level it choses will *both* be concave and skewed to the left. That the curve we derive behaves this way supports our model and choice of parameters.

Second, and substantively, the private welfare result we derive suggests that target boards have been optimally trading off bid frequency against bid size. To see why, recall that the market simulations set out in Part IV let targets receive about 60% of the acquisition surplus under strong defensive tactics. This share was derived from actual market data. In our simulation, a faithful target board maximizes the target's expected return when the target receives about 60% of acquisition surplus. This result suggests that the 60% share, which targets realize in real life, *approximates* the maximizing share.[75]

Third, it is a live question whether courts have allowed boards to go too far. The data we use to infer a 60% split in favor of targets ended in 2006. Delaware courts now allow the poison pill-staggered board combination to create a delay period of up to two years. Therefore, some potential targets' currently chosen defensive tactics levels may yield surplus splits that exceed the privately optimal division. This possibility is concerning if targets' expected returns in the real world fall off as sharply when targets choose excessive defensive tactics levels as they do in the simulations.

Finally, the simulations show that private and social welfare conflict. Target shareholder welfare in the simulations and, apparently, in the actual market, is maximized when a target's share of the acquisition surplus is around 60%. But as Part IV shows, this share yields a suboptimal level of matches. The large difference between individual and collective welfare reflects the search externality described above. Recall that because an individual target cannot influence the average defensive tactics level in the market, faithful target boards should ignore the search dampening effect of their choices. In equilibrium, every potential target thus chooses a defensive tac-

[75] Liu & Mulherin, *supra* note 61, at 105 (arguing that because "takeover premiums have not declined over time," boards are choosing defensive tactics levels to increase their bargaining power rather than to entrench themselves). This claim is consistent with our result: that boards appear to have chosen privately optimal defensive tactics levels, at least over the period for which we have data. *See supra* Part II. B.

tics level that, when aggregated, yields a market average level that is higher than the collectively efficient level. Because potential acquirers choose search intensities with the market average in mind, boards that maximize shareholder welfare are collectively reducing exchange efficiency in the corporate control market.

B. The Delaware Courts: Reprise

Our simulation results also illuminate the disagreement between the Delaware Chancery Court and the Delaware Supreme Court over the acceptable level of defensive tactics. The Supreme Court in *Unocal* initially developed a standard of review for defensive tactics that falls between the strict "entire fairness" standard, which is applied to ordinary conflict-of-interest transactions, and the lenient "business judgment" rule, which operates to shield a board's decision from judicial review when there is no conflict.[76] This intermediate standard, which requires a defensive tactic be proportional to the threat that the board perceived in the offer, was apt, because a board can deploy defensive tactics either to increase target welfare by strengthening target bargaining power, or to reduce target welfare by entrenching the directors and managers.

The Chancery Court then needed to decide how courts should apply the novel intermediate review standard.[77] Under the Chancery Court's regime, first announced in *Interco,* a faithful target board could deploy defensive tactics, such as the poison pill, to buy time to seek higher bids or to explain to its shareholders why the target's market price understates the target's real value. After the needed time has passed, however, the shareholders should be allowed to decide whether to accept an offer for the firm.[78] That the shareholders might accept an offer over the board's objections was not a threat that would warrant the board preventing the shareholders from determining the offer's outcome.[79]

Two years after *Interco,* the Delaware Supreme Court rejected the Chancery Court's approach. Reading that approach as the Chancery Court "substituting its judgement for what is a 'better' deal for that of a corporation's board of directors," the Supreme Court held in *Time-Warner*: "[t]o the extent that the Court of Chancery has recently done so . . . we hereby

---

[76] *Unocal Corp. v. Mesa Petroleum Co.*, 493 A.2d 946, 954–55 (Del. 1985).

[77] Gilson & Kraakman, *supra* note 8, at 252 (setting out the issues that remained open for Chancery Court resolution following the Supreme Court's decision in *Unocal*).

[78] *City Capital Assocs. v. Interco Inc.*, 551 A.2d 787, 797–98 (Del. Ch. 1988).

[79] "To acknowledge that directors may employ the recent innovation of 'poison pills' to deprive shareholders of the ability effectively to choose to accept a noncoercive offer, after the board has had a reasonable opportunity to explore or create alternatives, or to attempt to negotiate on the shareholders' behalf, would, it seems to me, be so inconsistent with widely shared notions of appropriate corporate governance as to threaten the legitimacy and authority of our corporation law." *Id.* at 799–800.

reject such an approach."[80] The Supreme Court next extended *Time-Warner* in *Unitrin* to allow a board to maintain its poison pill, unless the pill would make a successful proxy fight to replace directors in favor of candidates who would redeem the pill "mathematically impossible or realistically unattainable."[81] As a result, a target board can delay a bid for as long as two election cycles.

Our results provide the first rigorous support for the Chancery Court's solution. In the simulations, defensive tactics increase target shareholder welfare at the outset but later reduce it. They permit an extended delay that reaches the point where the effect of a reduced number of bids outweighs the effect of an increased target share. Therefore, if private welfare is the relevant measure, time-limiting defensive tactics are a good strategy. The Chancery Court's informal analysis and our simulations thus point generally in the same direction: giving the target board too much discretion over delaying a hostile tender offer reduces social welfare, and can also reduce target shareholder welfare.

C. The Investment Efficiency Defense of Defensive Tactics

Recently, scholars have developed two versions of an investment efficiency justification for defensive tactics: the myopic-market response and the customer-and-supplier rationale. The first version supposes that the capital market is myopic; that is, a firm's market price will not fully reflect the return from a project that takes a long time to mature.[82] When the target's share price is inefficiently low, its shareholders may accept a bid that is materially above that price but also materially below the company's real value. Directors and managers may respond to this possibility by rejecting firm-specific human capital investments that could create value for the com-

[80] *Paramount Commc'ns, Inc. v. Time, Inc.* (*Time-Warner*), 571 A.2d 1140, 1153 (1989).The Court went on to justify this result in part by the concern that "Time shareholders might elect to tender into Paramount's cash offer in ignorance or a mistaken belief of the strategic benefit which a business combination . . . might produce." *Id.* For an analysis of the difficulty of assuming shareholder ignorance as a justification for blocking shareholders' ability to choose to accept a tender offer in the face of the fact that 70% of the shareholders of large U.S. public corporations are institutional investors. *See* Gilson & Gordon, *supra* note 10, at 865.

[81] *Unitrin, Inc. v. Am. Gen. Corp.*, 651 A.2d 1361, 1389 (Del. 1995). *See* Ronald J. Gilson, Unocal *15 Years Later (and What We Can Do About It),* 26 Del. J. Corp. L. 491, 502 (2001) (highlighting the Delaware Supreme Court's unexplained preference for control changes through elections rather than takeovers); Ronald J. Gilson & Alan Schwartz, *Sales and Elections as Methods for Transferring Corporate Control*, 2 Theoretical Inq. L. 783, 784 (2001) (same).

[82] The empirical claim that the stock market is myopic, on which this argument is based, is contested. Roe surveys the empirical and legal literature concerning short-termism. *See, e.g.*, Mark J. Roe, *Corporate Short-Termism—In the Boardroom and in the Courtroom*, 68 Bus. Law. 977, 978–79 (2013) (summarizing the literature); Mark J. Roe, *Stock Market Short-Termism's Impact*, 167 U. Pa. L. Rev. 71, 73–77 (2018).

pany in the long term.[83] To be sure, managers are partially compensated with stock, but stock is an inadequate response if the future value of the managers' investments is not fully reflected in the target's current price. Target shareholders are said to recognize that their firm's controllers may manage for the short term. They attempt to preclude this possibility by authorizing strong defensive tactics. These tactics, therefore, represent the shareholders' commitment to the managers that they will not sell the target prematurely.[84]

There are two difficulties with the myopic-market efficiency justification for defensive tactics. First, it assumes that shareholders authorize all defensive tactics. However, shareholders do not have to approve the adoption of a poison pill. They also do not have to approve combining the poison pill with a preexisting staggered board which shareholders had approved before the era of hostile takeovers. Boards can unilaterally adopt these defensive tactics and use them, either to increase value or to entrench themselves.

Further, deciding which efficiency concept deserves more weight in the market for corporate control raises an empirical question. Scholars have recently approached this empirical question by analyzing the effect of staggered boards—the strongest defensive tactic—on firm value. In our view, while the investment efficiency defense of staggered boards remains theoretically plausible, the evidence to date remains mixed at best.[85] The exchange

---

[83] This argument first appeared in Stein, *supra* note 9, at 71; *see also* John Kay, The Kay Review of UK Equity Markets and Long-Term Decision Making, 9–11, 14, 16–20 (2012).

[84] This argument resurrects the Delaware Supreme Court's concern in *Time-Warner*—that sophisticated shareholders might tender erroneously—now because the shareholders lack information that the board and management have, but somehow cannot credibly convey to the shareholders. *See Time-Warner*, 571 A.2d at 1153.

[85] Cremers, Sepe, and coauthors have written several papers claiming that staggered boards increase firm value. *See* K.J. Martijn Cremers, Lubomir P. Litov & Simone M. Sepe, *Staggered Boards and Long-Term Value, Revisited*, 126 J. Fin. Econ. 422, 422–24, 425, 427–28 (2017); K.J. Martijn Cremers & Simone M. Sepe, *The Shareholder Value of Empowered Boards*, 68 Stan. L. Rev. 67, 70–75, 100–08 (2016); K.J. Martijn Cremers, Saura Masconale & Simone M. Sepe, *Commitment and Entrenchment in Corporate Governance*, 110 Nw. U. L. Rev. 727, 730–35, 749–53, 755–76 (2016). Their empirical analysis is contested. On the theoretical level, if staggered boards do increase value, then the shareholders of destaggering firms have voted for a value-reducing governance change, which seems implausible, especially given the intermediation of equity and, in particular, the rise of index-holding by institutions. A recent paper made this point, corrected for what its authors believe are spurious correlations in the data of the earlier papers, and argued that destaggering boards does not reduce firm value. *See* Emiliano M. Catan & Michael Klausner, *Board Declassification and Firm Value: Have Shareholders and Boards Really Destroyed Billions in Value?* 38–39 (NYU L. & Econ. Res. Paper Series, Working Paper No. 17–39, 2017), https://ssrn.com/abstract=2994559. A more recent paper corrected for other empirical defects in the Cremers et al. papers and showed that any value-increasing effect was not statistically significant. *See* Yakov Amihud et al., *Settling the Staggered Board Debate*, 166 U. Pa. L. Rev. 1475, 1476–80, 1487, 1491, 1507–08 (2018).

efficiency objection to defensive tactics should thus be given more weight than the myopic market investment efficiency response.[86]

The second version of the investment efficiency rationale holds that the prospect of a hostile takeover may discourage a firm's customers and suppliers from making relationship-specific investments in the firm. An acquirer, who has no particular loyalty to these stakeholders, may exploit the sunk cost aspect of such investments by renegotiating the target's deals.[87] Anticipating such behavior, the stakeholders would be unwilling to make investments that generate higher returns for the target firm than for other firms. In this version of the investment efficiency justification, defensive tactics allow the firm's managers to reassure customers and suppliers by making a credible commitment that the firm has protected them from a potential acquirer's strategic behavior.

There are theoretical concerns with the customer-and-supplier version of the investment efficiency justification. A supplier can protect itself with a long-term contract because such contracts can bind a future acquirer. A contract seems more secure than an implicit reputational sanction. To be sure, some contracts between companies and their customers and suppliers are implicit; it is sometimes too costly to form explicit contracts about possibly significant future actions. Nevertheless, the relationship specific theory is incomplete: if implicit contracts are sufficiently attractive to existing management to make voluntary compliance in the target's interest—both to facilitate deals and to create a good reputation—then the implicit contracts should be equally attractive to an acquirer. The converse would follow as well. Thus, proponents of the relationship specific customer-and-supplier justification need to explain why a strategy that is maximizing for the target when independent is not also maximizing for the target as part of the acquirer.

---

[86] Contracting may also ameliorate the investment inefficiency concern. A firm's executives often have golden parachutes and compensation packages with a significant variable component. In the event of a successful hostile bid, an executive would receive a large payment from her golden parachute and, if the historical average regarding surplus splits holds, a large payoff from her stock. Sepe and Whitehead show that golden parachutes create incentives for managers to invest in innovation by compensating them if they are dismissed before the innovation bears fruit. *See* Simone M. Sepe & Charles K. Whitehead, *Rethinking Chutes: Incentives, Investment and Innovation*, 95 B.U. L. REV. 2027, 2032–37, 2042–49 (2015). Fich et al. also show that golden parachutes materially increase deal completion probabilities, create large gains for target CEOs, and may benefit target shareholders. Eliezer M. Fich et al., *On the Importance of Golden Parachutes*, 48 J. FIN. & QUANT. ANALYSIS 1717, 1718–21 (2013). And, more recently, Karpoff et al. found that "[t]wo provisions are positively related to takeover likelihood – golden parachutes and restrictions on action by written consent." Karpoff et al., *supra* note 70, at 2.

[87] *See* William C. Johnson et al., *The Bonding Hypothesis of Takeover Defenses: Evidence from IPO Firms*, 117 J. FIN. ECON. 307, 310 (2015). This position was introduced in Andrei Shleifer & Lawrence H. Summers, *Breach of Trust in Hostile Takeovers*, *in* CORPORATE TAKEOVERS: CAUSES AND CONSEQUENCES 33, 34, 41–42 (Alan J. Auerbach ed., 1988).

VI. Conclusion

Strong defensive tactics give a target's board substantial discretion to decide whether to accept an offer to buy the company; weak defensive tactics permit the target's shareholders to decide even when the target's board disfavors the offer. Delaware law permits public firms to adopt strong defensive tactics, and most firms have done so. There are four justifications for Delaware Law. First, markets may underprice public companies, so that shareholders may mistakenly tender to bids below a target's true value. As a result, target assets sometimes move from higher- to lower-valuing acquirers, which is exchange inefficient. Board control can prevent such inefficient takeovers. Second, boards with control can negotiate for higher prices than atomized shareholders could realize on their own. Third, unregulated defensive tactics may be investment inefficient. Markets may underprice growth, allowing acquirers to expropriate target projects with long-term payoffs. Anticipating this, targets would eschew such projects, leading to investment inefficiency. Board control prevents this result. Fourth, empowered boards can better protect stakeholders from acquisition-caused losses.

This article extensively considers the first two justifications and reviews the case for the third. Regarding the first, we assume, along with most academic commentators, that capital market prices do not routinely skew low. Therefore, defensive tactics are unnecessary to achieve exchange efficiency. Indeed, these tactics are exchange inefficient because they permit targets to acquire a large share of the expected surplus from an acquisition and therefore reduce the acquirers' returns from finding and buying good targets. While this theoretical result has been in the literature for a long time,[88] the policy issue is in magnitudes: in the market, does corporate control create exchange efficiency of the first or second order? This is an empirical question, but conventional empirical techniques cannot yield an answer. This largely is because the researcher cannot run this real world experiment: how the *same market* with the *same agents* performs under weak and strong defensive tactics levels. Also, we argue, market-wide, cross-sectional, and time series studies have been too difficult for empiricists to do in the market for corporate control.

Turning to private welfare, a target board should trade off the bid-reduction effect of strong defensive tactics against their surplus-maximizing effect, *conditional* on bids occurring. The empirical researcher, however, cannot observe whether actual boards are making this trade-off efficiently or choosing entrenching levels of defensive tactics. Importantly, this is because the researcher cannot observe unmade bids; that is, the bids that particular targets' defensive tactics levels have deterred.

---

[88] *See* Alan Schwartz, *Search Theory and the Tender Offer Auction*, 2 J.L. Econ. & Org. 229, 238–39 (1986).

We attempt to answer the exchange efficiency and private welfare questions by developing an informal structural model of the corporate control market. In this model, potential acquirers search sequentially for potential targets to buy, taking into account targets' chosen levels of defensive tactics; and targets choose defensive tactics levels, taking into account acquirers' search strategies. The model supports three theoretically grounded predictions. First, the corporate control market inefficiency[89] is substantial, defensive tactics aside, largely because search is particularly costly in the corporate control market and because potential acquirers must share expected acquisition surplus with targets. Because the acquirer must split the surplus with the target, the acquirer equates its partial share of the marginal return from search to its private marginal cost, thus searching too infrequently from an exchange efficiency viewpoint. Second, the marginal contribution of strong defensive tactics to market inefficiency is large because strong defensive tactics both take additional surplus from acquirers and make search less productive. Third, faithful target boards will choose defensive tactics levels that are privately efficient but socially excessive, because the boards do not take into account the search-dampening effect of their individual choices on the corporate control market as a whole.

Simulations permit us to test these theoretical predictions by running the natural experiment and observing how the same corporate control market performs under the two defensive tactics legal regimes: (1) a defensive-tactics-unfriendly regime that constrains defensive tactics and (2) a defensive-tactics-friendly regime, roughly like the current Delaware Supreme Court's position, which gives target boards significant discretion to choose their level. Our results are consistent with the model's predictions: the corporate control market inefficiency is substantial even when defensive tactics are weak; the marginal contribution of defensive tactics to the market inefficiency is high; and faithful boards do choose socially excessive defensive tactics levels.

It is important to highlight the second exchange inefficiency result. The simulated market makes 15% fewer acquisitions under strong defensive tactics levels than under weak defensive tactics levels. The resulting efficiency loss, if real, would be very large, because the U.S. corporate control market today concludes close to $2 trillion a year of deals.

We do not argue that these results, standing alone, justify major legal change. The parameters we use—such as the ratio of financial to synergy targets—are derived from real world data, but are not directly observed. Also, simulations are not reality. Rather, our goal is to revive the debate

---

[89] We define the "market inefficiency" as one minus the ratio of made matches to total available matches during a period in which the corporate control market functions. For example, if searching acquirers and targets made sixty of a possible hundred matches, the market inefficiency would be 40%. The "marginal contribution" of defensive tactics to the market inefficiency is the difference between the market inefficiency when defensive tactics are strong and when they are weak.

about the desirability of defensive tactics. We do claim that our parameter values are plausible, and that our model is intuitive and theoretically grounded. In turn, the sizable magnitude of our results—over a $100 billion of foregone deals a year—strongly suggests that we should seriously rethink current Delaware law.

As for private welfare, our simulations suggest that despite legal rules that are sub-optimally restrictive, and contrary to the views of many academics, target boards have been relatively faithful fiduciaries for their shareholders. We note, however, that corporate culture is dynamic, as powerfully evidenced by the Business Roundtable's recent (and perhaps largely rhetorical) statement that a board's obligations run first to stakeholders and then to shareholders.[90] Though this result also suggests that we should rethink simple agency theory explanations for a board's choice of defensive tactics, we stress that whether boards are optimizing private welfare is quite different from whether the corporate control market is performing efficiently. Finally, we argue briefly that the evidence does not support the investment efficiency justification for strong defensive tactics. We leave the stakeholder question for another day.[91]

Our results have substantive and methodological implications. Substantively, the results suggest that current legal rules allow defensive tactics levels that are privately as well as socially inefficient. Interestingly, they also shed light on a lengthy methodological debate, over precisely this issue, between the Delaware Supreme Court and the Delaware Chancery Court. On this one, the Chancery Court has the better of the argument.

---

[90] *See Business Roundtable Redefines the Purpose of the Corporation to Promote 'An Economy That Serves all Americans'*, Bus. Roundtable (Aug. 19, 2019), https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans.

[91] Gilson, *supra* note 12, frames the issue.

Appendices

Appendix 1. Matching Problem Model-Code Description

All acquisition market models were simulated in MATLAB, a software program designed 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 specifying a population size (in our case, 1,100 total risk neutral agent-firms) with agent-firms of one of six specified types. There are 425 total acquiring (*A*) agent-firms in the simulated population. These firms are actively seeking to match with a target firm. Of these 425 *A* agent-firms, 295 are synergy (*AS*) type acquiring firms, and 130 are private equity (*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, for example, an auto manufacturer seeking to match with a tire manufacturer.

Synergy target firms with whom *AS* type firms 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 willing to match with *AS* type firms, if approached (*TM* type target agent-firms). There are four *TA* type active, synergy target agent-firms, and ninety-six *TM* type passive, synergy target agent-firms. *AS* type acquiring firms only seek to match with either *TA* or *TM* type target firms. There are fifty materially improvable firms. *AH* type acquiring firms are actively seeking to match with these passive target (*TP*) firms. There are 525 *TP* type passive, noise firms.

The simulations begin by randomly populating the 775 total agent-firms. Starting with *TA* type firms, the code randomly selects an index (that is, 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 are in indexed locations within the population matrix. This process repeats for all six of the different agent-firm traits and types until the entire population matrix is populated. The order in which the six different agent-firm traits and types are placed within the population matrix is *TA*, *TP*, *TM*, *P*, *AS*, and then *AH*.

After the agent-firms are populated, the searching process begins. All of the searching agent-firms search over the same target universe. We let acquirers and actively searching synergy target (*TA*) agent-firms make up to twenty searches.[92] There are 1,000 simulation runs of each total search. A total search is defined as the point at which each acquiring agent-firm and

---

[92] Restricting searches to twenty is without loss of generality because, in the simulations, it is never optimal for an acquirer to take more than ten draws.

each actively searching synergy target (*TA*) agent-firm has had an opportunity to complete a search of a specified number of agent-firms (this is their "search intensity"). First, all of the searching agent-firms search a single agent-firm, then two agent-firms, then three, and so on, until completing a total search, which is defined as the point at which all of the searching agent-firms have had an opportunity to complete a search of twenty-two agent-firms. Thus, the population matrix is repopulated 1,000 times for each total search.

For each simulation run at each search intensity, every searching agent-firm (that is, the *AS, AH*, and *TA* agent-firms) in the population matrix can search for its desired match (*AS* firms search for *TA* and *TM* firms, *AH* firms search for *TP* firms, and *TA* firms search for *AS* firms). If a searcher has matched when its opportunity to search comes around, it does not search. Search is terminated in two ways: a searching agent-firm is matched because it found a desired match or has been found by a desired match, or the next search would generate negative utility for the acquiring agent-firm. Illustrating the latter possibility, let a potential acquirer realize positive expected utility at its third search, but the acquirer would realize negative expected utility from a fourth search. Then the model has this acquirer either matching in one of its first three searches, or exiting after fruitlessly searching three possible targets. It is the expected utility of the acquiring agent-firms (the *AS* and *AH* agent-firms) that dictates whether search occurs and what an agent's search intensity is.

To be clear, we determine the point at which the acquiring agent-firms cease searching by having all of the searching agent-firms conduct a total search at each level of search intensity (over one agent-firm, over two agent-firms, . . . , over twenty agent-firms) for 1,000 simulation runs. If the expected utility for an acquiring agent-firm is positive when it searches over three agent-firms, but negative when it searches over four agent-firms, then this acquiring agent-firm stops searching after it has searched over three agent-firms.

When a match occurs, only the searching agent incurs search costs. This is so 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 searching agents incur search costs.

A simulation run unfolds as follows: The code iterates through the entire population matrix of 775 agent-firms, one by one. First, it checks to ensure 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, 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 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 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 been matched or not. This ensures that an agent-firm ceases searching upon having achieved a match, and 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 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, an acquiring synergy searching—firm. The code searches for a match for this firm. To begin a search over one, two, . . ., twenty agent-firms, 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 universe, 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* 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 been matched. Searching acquirers (*AS* and *AH* type agent-firms) do not incur search costs when they meet other searching acquirers, however. Searching, active, synergy target (*TA*) type agent-firms also do not incur search costs when they meet passive, materially improvable target (*TP*) agent-firms. 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 a *TP* type firm on behalf of the *AS* searcher, and the other firm is the first firm to be searched. Upon recognizing the type of current firm being searched, the code immediately checks whether the current, searching *AS* firm is already matched. This occurs before 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 been matched, the code imposes search costs upon the *AS* type for having searched a firm with whom the current, searching population member did not match.

Turning to how the code calculates search costs, the cost for searching a sample of a single agent is -2 utils. We chose this value because search costs, we assume, are 2% of the match surplus, which is set at 100 utils. The code is instructed that search costs are quadratic; they vary according to the number of draws (number of agent-firms searched) as follows: *Search costs = -2 - (draw number/10)*^{2} *+ .25.*

Thus, the search cost for searching one agent-firm is -2 utils; the search cost imposed for searching a second agent is -2.75 utils, and so on. Search becomes costlier as the search continues. 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 a *TP* type firm. The line of code appears as follows: *popFitness(i) = popFitness(i) + cc*; where *cc* is the variable for search costs for the possible number of agent-firms searched. 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 a *P* type agent-firm, the code uses the same process for imposing costs. 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 that the *AS* firm will search. Suppose that this second agent firm to be searched is an unmatched *TA* type. The code checks whether this agent is 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 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 equally between the *A* (acquiring) type agent-firm and the *T* (target) type agent-firm. (Various splits of the surplus are possible. The code calculates asymmetric splits, that favor either *A* or *T* agents, to approximate the markets that result from legal regimes that are either friendly or unfriendly to defensive tactics). Because we approximate the cost of searching a single agent at 2% of the surplus generated by a successful match, and we set the search cost of searching a sample of a single agent at 2 utils, *B* is equal to *100*(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 being searched) 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: *popFitness(jj) = popFitness(jj) + E*, 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, in this example, is split equally between the *A* (acquiring) agent-firm and the *T* (target) agent-firm, *E* also equals *100 utils*(1/2)*. The *TA* 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 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;
popMatch(i,1) = 1;
popMatch(i,2) = jj;
popMatch(jj,2) = i;
```

In the example discussed above, a successful match was made, but agents may fail to match. Even so, each agent-firm member within the two-draw search intensity of the example 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.

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, 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 1,000 simulation runs for each relevant search intensity. 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 1,000 simulation runs for each search intensity level.

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 agents (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 1,000 simulation runs for each sample size (search intensity level). 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 matched efficiently.

Appendix 2.

Table 4

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (425 AH's), 525 P's, 150 T's (150 TP's)
2% Costs

A and T Split Surplus Asymmetrically

(.4 A, .6 T)

425 AH's

150 TP's
525 P's

Sample Size	1	2	3	4	5	6	7
Prob TP (150)	0.3209	0.5182	0.6465	0.7357	0.7968	0.8401	0.8741
Prob TA (0)	0	0	0	0	0	0	0
Prob TM (0)	0	0	0	0	0	0	0
Sigma	0.3209	0.5182	0.6465	0.7357	0.7968	0.8401	0.8741
Sigma TP	0.3209	0.5182	0.6465	0.7357	0.7968	0.8401	0.8741
Sigma TA & TM	0	0	0	0	0	0	0
Sigma TA	0	0	0	0	0	0	0
Sigma TM	0	0	0	0	0	0	0
Sigma AS	0	0	0	0	0	0	0
Sigma AH	0.1133	0.1829	0.2282	0.2597	0.2812	0.2965	0.3085
Sigma A	0.1133	0.1829	0.2282	0.2597	0.2812	0.2965	0.3085
A Matches Made	48.1525	77.7325	96.985	110.3725	119.51	126.0125	131.1125
Total Matches Made	48.135	77.73	96.975	110.355	119.52	126.015	131.115
Total AS Payoff	0	0	0	0	0	0	0
Total AH Payoff	1400	1940	1830	1140	-130	-2030	-4580
Total TP Payoff	2888.1	4663.7	5818.3	6621.2	7171.3	7561.3	7866.7
Total TA Payoff	0	0	0	0	0	0	0
Total TM Payoff	0	0	0	0	0	0	0
Total T Payoff	2888.1	4663.7	5818.3	6621.2	7171.3	7561.3	7866.7
Total Payoff (Welfare)	4288.1	6603.7	7648.3	7761.2	7041.3	5531.3	3286.7
Payoff per Match Made	89.0848655	84.9569021	78.8687806	70.3293915	58.9131526	43.8939809	25.0673073
A Agent Expected Utility	3.29411765	4.56470588	4.30588235	2.68235294	-0.3058824	-4.7764706	-10.776471
AS Agent Expected Utility	0	0	0	0	0	0	0
AH Agent Expected Utility	3.3024	4.5583	4.2976	2.6882	-0.3108	-4.7791	-10.766
TP Agent Expected Utility	19.254	31.0912	38.7888	44.1416	47.8084	50.4088	52.4448
TA Agent Expected Utility	0	0	0	0	0	0	0
TM Agent Expected Utility	0	0	0	0	0	0	0
Expected Welfare	28.5873333	44.0246667	50.9886667	51.7413333	46.942	36.8753333	21.9113333

Here, we simulate only acquirers—the *A* row—and targets—the *T* row. The zero rows reflect market agents we do not simulate, such as financial buyers.

Table 5

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (425 AH's), 525 P's, 150 T's (150 TP's)
2% Costs

A and T Split Surplus Asymmetrically

(.6 A, .4 T)

425 AH's

150 TP's
525 P's

Sample Size	1	2	3	4	5	6	7	8	9
Prob TP (150)	0.3231	0.5185	0.6472	0.7348	0.7972	0.842	0.8735	0.8996	0.9185
Prob TA (0)	0	0	0	0	0	0	0	0	0
Prob TM (0)	0	0	0	0	0	0	0	0	0
Sigma	0.3231	0.5185	0.6472	0.7348	0.7972	0.842	0.8735	0.8996	0.9185
Sigma TP	0.3231	0.5185	0.6472	0.7348	0.7972	0.842	0.8735	0.8996	0.9185
Sigma TA & TM	0	0	0	0	0	0	0	0	0
Sigma TA	0	0	0	0	0	0	0	0	0
Sigma TM	0	0	0	0	0	0	0	0	0
Sigma AS	0	0	0	0	0	0	0	0	0
Sigma AH	0.114	0.183	0.2284	0.2594	0.2814	0.2972	0.3083	0.3175	0.3242
Sigma A	0.114	0.183	0.2284	0.2594	0.2814	0.2972	0.3083	0.3175	0.3242
A Matches Made	48.45	77.775	97.07	110.245	119.595	126.31	131.0275	134.9375	137.785
Total Matches Made	48.465	77.775	97.08	110.22	119.58	126.3	131.025	134.94	137.775
Total AS Payoff	0	0	0	0	0	0	0	0	0
Total AH Payoff	2390	3500	3770	3340	2270	500	-1980	-5190	-9240
Total TP Payoff	1938.5	3110.9	3883.1	4409	4783.2	5051.9	5241.3	5397.9	5511
Total TA Payoff	0	0	0	0	0	0	0	0	0
Total TM Payoff	0	0	0	0	0	0	0	0	0
Total T Payoff	1938.5	3110.9	3883.1	4409	4783.2	5051.9	5241.3	5397.9	5511
Total Payoff (Welfare)	4328.5	6610.9	7653.1	7749	7053.2	5551.9	3261.3	207.9	-3729
Payoff per Match Made	89.3118745	85.0003214	78.8329213	70.3048449	58.9831075	43.9580364	24.8906697	1.54068475	-27.065868
A Agent Expected Utility	5.62352941	8.23529412	8.87058824	7.85882353	5.34117647	1.17647059	-4.6588235	-12.211765	-21.741176
AS Agent Expected Utility	0	0	0	0	0	0	0	0	0
AH Agent Expected Utility	5.612	8.2278	8.8822	7.8666	5.3357	1.1808	-4.6533	-12.2043	-21.7413
TP Agent Expected Utility	12.9232	20.7392	25.8872	29.3931	31.8883	33.6792	34.9419	35.9859	36.7403
TA Agent Expected Utility	0	0	0	0	0	0	0	0	0
TM Agent Expected Utility	0	0	0	0	0	0	0	0	0
Expected Welfare	28.8566667	44.0726667	51.0206667	51.66	47.0213333	37.0126667	21.742	1.386	-24.86

APPENDIX 3.

In the order the tables are set out, the target realizes .4, .5, .6 and .7 of the surplus. The target's expected return is maximized at the .6 split, and the positive difference between the .5 and .6 splits is smaller than the negative difference between the .6 and.7 splits. Figure 1 in Part V. A. is represented continuously because it connects all of the splits. This is why a target's maximum expected return is set at approximately a 60% share.

TABLE 6

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (4 TA's; 50 TP's; 96 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.6 A, .4 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 4 TA's, and 96 TM's
525 P's

Sample Size	1	2	3	4	5	6	7	8
Prob TP (50)	0.1144	0.2048	0.2896	0.3599	0.4175	0.4745	0.5241	0.5642
Prob TA (4)	0.4193	0.6647	0.7953	0.8712	0.9125	0.9473	0.963	0.9745
Prob TM (96)	0.2374	0.4016	0.5243	0.6172	0.6883	0.7412	0.785	0.8212
Sigma	0.201251	0.343016	0.453293	0.538207	0.604012	0.657796	0.70278	0.739621
Sigma TP	0.1144	0.2048	0.2896	0.3599	0.4175	0.4745	0.5241	0.5642
Sigma TA & TM	0.244676	0.412124	0.53514	0.62736	0.697268	0.749444	0.79212	0.827332
Sigma TA	0.4193	0.6647	0.7953	0.8712	0.9125	0.9473	0.963	0.9745
Sigma TM	0.2374	0.4016	0.5243	0.6172	0.6883	0.7412	0.785	0.8212
Sigma AS	0.0829	0.1397	0.1814	0.2127	0.2364	0.2541	0.2685	0.2805
Sigma AH	0.044	0.0788	0.1114	0.1384	0.1606	0.1825	0.2016	0.217
Sigma A	0.071001	0.121072	0.159988	0.189973	0.213214	0.232199	0.248036	0.261076
A Matches Made	30.1755	51.4555	67.995	80.7385	90.616	98.6845	105.4155	110.9575
Total Matches Made	30.1876	51.4524	67.994	80.731	90.6018	98.6694	105.417	110.9432
Total AS Payoff	1105	1650	1754	1430	659	-589	-2340	-4614
Total AH Payoff	183	244	204	4	-383	-939	-1719	-2774
Total TP Payoff	228.8	409.6	579.1	719.9	834.9	949	1048.2	1128.5
Total TA Payoff	60.318	94.2802	110.1822	117.0865	118.8607	121.8385	120.1333	118.718
Total TM Payoff	911.7	1542.3	2013.2	2370.2	2643.2	2846.3	3014.5	3153.4
Total T Payoff	1200.818	2046.18	2702.482	3207.187	3596.961	3917.139	4182.833	4400.618
Total Payoff (Welfare)	2488.818	3940.18	4660.482	4641.187	3872.961	2389.139	123.8333	-2987.382
Payoff per Match Made	82.4450437	76.5791333	68.5425508	57.4895208	42.7470613	24.2135708	1.17469953	-26.92713
A Agent Expected Utility	3.03058824	4.45647059	4.60705882	3.37411765	0.64941176	-3.5952941	-9.5505882	-17.383529
AS Agent Expected Utility	3.7473	5.5934	5.9465	4.8468	2.2352	-1.9969	-7.9338	-15.6417
AH Agent Expected Utility	1.4111	1.8747	1.5694	0.0285	-2.9444	-7.2195	-13.2232	-21.338
TP Agent Expected Utility	4.5752	8.1912	11.5824	14.3976	16.6984	18.98	20.9632	22.5696
TA Agent Expected Utility	15.0795	23.5701	27.5456	29.2716	29.7152	30.4596	30.0333	29.6795
TM Agent Expected Utility	9.4971	16.0658	20.9713	24.6892	27.5333	29.6492	31.4008	32.8479
Expected Welfare	16.59212	26.267868	31.0698813	30.9412433	25.819738	15.92759	0.82555533	-19.91588

TABLE 7

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (4 TA's; 50 TP's; 96 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.5 A, .5 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 4 TA's, and 96 TM's
525 P's

Sample Size	1	2	3	4	5	6	7
Prob TP (50)	0.1149	0.2071	0.2884	0.3601	0.4221	0.4738	0.5192
Prob TA (4)	0.4385	0.662	0.8017	0.881	0.908	0.942	0.9577
Prob TM (96)	0.2353	0.4034	0.5246	0.614	0.6876	0.7429	0.7847
Sigma	0.200585	0.344863	0.453256	0.536487	0.604977	0.658509	0.700813
Sigma TP	0.1149	0.2071	0.2884	0.3601	0.4221	0.4738	0.5192
Sigma TA & TM	0.243428	0.413744	0.535684	0.62468	0.696416	0.750864	0.79162
Sigma TA	0.4385	0.662	0.8017	0.881	0.908	0.942	0.9577
Sigma TM	0.2353	0.4034	0.5246	0.614	0.6876	0.7429	0.7847
Sigma AS	0.0825	0.1403	0.1816	0.2118	0.2361	0.2545	0.2683
Sigma AH	0.0442	0.0796	0.1109	0.1385	0.1623	0.1822	0.1997
Sigma A	0.070785	0.121733	0.159974	0.189379	0.213526	0.232385	0.247316
A Matches Made	30.0835	51.7365	67.989	80.486	90.7485	98.7635	105.1095
Total Matches Made	30.0878	51.7294	67.9884	80.473	90.7466	98.7764	105.122
Total AS Payoff	856	1245	1219	785	-43	-1333	-3129
Total AH Payoff	128	147	55	-175	-580	-1180	-1987
Total TP Payoff	287.4	517.6	720.9	900.2	1055.2	1184.5	1298
Total TA Payoff	81.05	120.238	143.3537	154.8663	154.0517	156.125	155.9
Total TM Payoff	1129.3	1936.3	2517.9	2947.2	3300.5	3566	3766.4
Total T Payoff	1497.75	2574.138	3382.154	4002.266	4509.752	4906.625	5220.3
Total Payoff (Welfare)	2481.75	3966.138	4656.154	4612.266	3886.752	2393.625	104.3
Payoff per Match Made	82.483598	76.670868	68.4845312	57.314457	42.8308245	24.2327621	0.99218051
A Agent Expected Utility	2.31529412	3.27529412	2.99764706	1.43529412	-1.4658824	-5.9129412	-12.037647
AS Agent Expected Utility	2.9018	4.2218	4.1324	2.6618	-0.1465	-4.5194	-10.6051
AH Agent Expected Utility	0.9812	1.1344	0.4206	-1.3451	-4.4627	-9.0758	-15.283
TP Agent Expected Utility	5.747	10.353	14.418	18.005	21.103	23.689	25.961
TA Agent Expected Utility	20.2625	30.0595	35.8384	38.7166	38.5129	39.0312	38.975
TM Agent Expected Utility	11.763	20.1698	26.2281	30.7005	34.3802	37.1458	39.2339
Expected Welfare	16.545	26.44092	31.0410247	30.748442	25.911678	15.9575	0.69533333

Table 8

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (4 TA's; 50 TP's; 96 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.4 A, .6 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 4 TA's, and 96 TM's
525 P's

Sample Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Prob TP (50)	0.1112	0.2089	0.2917	0.3611	0.4229	0.4742	0.5241
Prob TA (4)	0.4392	0.657	0.7915	0.87	0.9147	0.9407	0.9625
Prob TM (96)	0.2342	0.4002	0.5237	0.6182	0.6871	0.7431	0.7863
Sigma	0.198667	0.343281	0.453508	0.539215	0.605103	0.658736	0.703599
Sigma TP	0.1112	0.2089	0.2917	0.3611	0.4229	0.4742	0.5241
Sigma TA & TM	0.2424	0.410472	0.534412	0.628272	0.696204	0.751004	0.793348
Sigma TA	0.4392	0.657	0.7915	0.87	0.9147	0.9407	0.9625
Sigma TM	0.2342	0.4002	0.5237	0.6182	0.6871	0.7431	0.7863
Sigma AS	0.0822	0.1391	0.1812	0.213	0.236	0.2546	0.2689
Sigma AH	0.0428	0.0803	0.1122	0.1389	0.1627	0.1824	0.2016
Sigma A	0.070148	0.121114	0.160094	0.190334	0.213579	0.232515	0.248314
A Matches Made	29.813	51.4735	68.04	80.892	90.771	98.819	105.5335
Total Matches Made	29.8	51.4922	68.0262	80.8822	90.7654	98.8104	105.5398
Total AS Payoff	608	818	679	173	-743	-2084	-3910
Total AH Payoff	62	47	-82	-356	-789	-1418	-2242
Total TP Payoff	333.7	626.6	875.1	1083.4	1268.7	1422.7	1572.4
Total TA Payoff	98.726	145.3825	172.6308	187.1933	192.4932	194.8402	194.3085
Total TM Payoff	1349.2	2305	3016.6	3560.6	3957.7	4280.4	4529.2
Total T Payoff	1781.626	3076.983	4064.331	4831.193	5418.893	5897.94	6295.909
Total Payoff (Welfare)	2451.626	3941.983	4661.331	4648.193	3886.893	2395.94	143.9085
Payoff per Match Made	82.2693289	76.5549442	68.522581	57.4686804	42.823512	24.2478545	1.36354721
A Agent Expected Utility	1.57647059	2.03529412	1.40470588	-0.4305882	-3.6047059	-8.24	-14.475294
AS Agent Expected Utility	2.0614	2.7721	2.3009	0.5855	-2.5181	-7.0655	-13.254
AH Agent Expected Utility	0.4782	0.3646	-0.6281	-2.7415	-6.0729	-10.9099	-17.2485
TP Agent Expected Utility	6.6732	12.5316	17.502	21.6672	25.374	28.4544	31.4472
TA Agent Expected Utility	24.6815	36.3456	43.1577	46.7983	48.1233	48.7101	48.5771
TM Agent Expected Utility	14.0544	24.01	31.4225	37.09	41.2263	44.5875	47.1794
Expected Welfare	16.3441733	26.2798833	31.0755387	30.9879553	25.9126213	15.9729347	0.95939

Table 9

Larger Set of Agents with 2% Costs (1100 Agents -- 425 A's (130 AH's; 295 AS's), 525 P's, 150 T's (4 TA's; 50 TP's; 96 TM's)
2% Costs

AS and TA Split Surplus Asymmetrically
AH and TP Split Surplus Asymmetrically
(.7 A, .3 T)
AS and TM Split Surplus Asymmetrically
295 AS's and 130 AH's
150 T's
50 TP's, 4 TA's, and 96 TM's
525 P's

Sample Size	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Prob TP (50)	0.1114	0.2091	0.2885	0.3591	0.4218	0.4761	0.5206	0.5649
Prob TA (4)	0.4457	0.6615	0.789	0.8642	0.91	0.9337	0.9613	0.974
Prob TM (96)	0.2319	0.4057	0.5265	0.6159	0.6877	0.745	0.7883	0.8197
Sigma	0.197435	0.346988	0.454167	0.536921	0.604995	0.660399	0.70368	0.738881
Sigma TP	0.1114	0.2091	0.2885	0.3591	0.4218	0.4761	0.5206	0.5649
Sigma TA & TM	0.240452	0.415932	0.537	0.625832	0.696592	0.752548	0.79522	0.825872
Sigma TA	0.4457	0.6615	0.789	0.8642	0.91	0.9337	0.9613	0.974
Sigma TM	0.2319	0.4057	0.5265	0.6159	0.6877	0.745	0.7883	0.8197
Sigma AS	0.0815	0.141	0.182	0.2121	0.2361	0.2551	0.2696	0.28
Sigma AH	0.0429	0.0804	0.111	0.1381	0.1622	0.1831	0.2002	0.2173
Sigma A	0.069693	0.122464	0.160282	0.189465	0.213495	0.233076	0.248372	0.260821
A Matches Made	29.6195	52.047	68.12	80.5225	90.7355	99.0575	105.558	110.849
Total Matches Made	29.6152	52.0482	68.125	80.5382	90.7492	99.0598	105.552	110.8322
Total AS Payoff	1322	2088	2301	2042	1348	176	-1516	-3801
Total AH Payoff	230	361	345	182	-159	-698	-1486	-2480
Total TP Payoff	167.1	313.6	432.8	538.6	632.7	714.1	781	847.4
Total TA Payoff	46.784	67.3575	77.408	81.3577	82.6365	80.595	78.5687	76.9403
Total TM Payoff	668	1168.5	1516.2	1773.8	1980.7	2145.7	2270.3	2360.7
Total T Payoff	881.884	1549.458	2026.408	2393.758	2696.037	2940.395	3129.869	3285.04
Total Payoff (Welfare)	2433.884	3998.458	4672.408	4617.758	3885.037	2418.395	127.8687	-2995.96
Payoff per Match Made	82.1836084	76.8222052	68.5858055	57.3362417	42.810697	24.4134856	1.21142849	-27.031492
A Agent Expected Utility	3.65176471	5.76235294	6.22588235	5.23294118	2.79764706	-1.2282353	-7.0635294	-14.778824
AS Agent Expected Utility	4.4822	7.0786	7.7992	6.9236	4.5708	0.5949	-5.1382	-12.8852
AH Agent Expected Utility	1.7662	2.7799	2.6501	1.3968	-1.2258	-5.3666	-11.4308	-19.0732
TP Agent Expected Utility	3.3426	6.2724	8.6556	10.773	12.6546	14.2818	15.6192	16.947
TA Agent Expected Utility	11.696	16.8394	19.352	20.3394	20.6591	20.1487	19.6422	19.2351
TM Agent Expected Utility	6.9584	12.1716	15.7941	18.4769	20.6325	22.3512	23.6494	24.5909
Expected Welfare	16.2258933	26.6563833	31.1493867	30.7850513	25.9002433	16.1226333	0.852458	-19.973065

Appendix 4. Acquisition Types

Table 10: U.S. Public and Private Acquirers (Source: FactSet)

Year	Total Acquisitions of U.S. Public Companies	Public Acquirer	Private Acquirer	% Public
2016	293	182	37	62.11%
2015	310	209	35	67.41%
2014	261	188	27	72.03%
2013	236	160	40	67.9%
2012	261	172	46	65.90%