ON UNCERTAINTY, AMBIGUITY, AND CONTRACTUAL CONDITIONS

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ABSTRACT

This article uses the recent Delaware Chancery Court case of Hexion v. Huntsman *as a template for motivating thoughts about how contract law should interpret contractual conditions in general—and "material adverse event" provisions in particular—within environments of extreme ambiguity (as opposed to risk). Although ambiguity and aversion thereto bear some facial similarities to risk and risk aversion, an optimal contractual allocation of uncertainty does not always track the optimal allocation of risk. After establishing these intuitions as a conceptual proposition, I endeavor to test them empirically, using a unique data set of 528 actual material adverse event provisions in corporate acquisitions transactions between 2007 and 2008. My results are consistent with my conceptual account distinguishing risk from uncertainty. Although intuitive, the idea that material adverse event provisions can be a means for allocating uncertainty contrasts with the received wisdom in corporate law scholarship about the nature and purpose of such terms. Using MAC/MAE provisions as an animating narrative, this article concludes that the behavioral economics concept of ambiguity aversion is a helpful device for understanding contractual conditions and excuses.*

I. INTRODUCTION

In the summer of 2007, weeks before credit markets betrayed a fragility that would later escalate into global crisis, two American chemical

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corporations executed a landmark merger. In a $10 billion leveraged acquisition, Hexion Specialty Chemicals, Inc. (Hexion)[1] agreed to purchase all outstanding shares of the Huntsman Corporation (Huntsman) for $28 cash per share, a price representing an approximate 40% premium over Huntsman's trading value.[2] As is typical with such transactions, the written merger agreement contained a litany of warranties, representations, terms, and conditions, including a cancellation fee, due diligence obligations, and assorted contingencies and exclusions related to Hexion's financing, company solvency, regulatory clearance, and shareholder approval. The conditions also included a commonly-used *force majeure* provision known as a "material adverse change"/"material adverse event" clause (sometimes known as a MAC/MAE), that expressly conditioned Hexion's obligation to close on the absence of "any occurrence, condition, change, event or effect that is materially adverse to the financial condition, business, or results of operations of [Huntsman] taken as a whole . . . "[3] Deal in hand, the two companies set course on a due diligence process that—while costly, arduous, and time consuming—promised lucrative results. Once closed, the Hexion-Huntsman merger would result in the world's largest specialty chemical company, a fact not lost on Hexion's CEO, who ebulliently described the acquisition as "'a great opportunity to create a world-class company with leading-edge products and technologies' and a more global reach, especially 'in the high-growth Asia-Pacific region.'"[4]

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[1]Hexion is in turn owned by the private equity firm Apollo Management.

[2]Hexion Specialty Chems., Inc. v. Huntsman Corp., 965 A.2d 715, 724 (Del. Ch. 2008). Huntsman previously had entered an acquisition agreement with Basell A.F., which Hexion topped by 8%. The 40% figure reported in the text reflects the premium over Huntsman's stock price before it was "in play."

[3]*Id.* at 736. In addition, the clause went on to list exceptions (or "carve outs") to the definition of an MAE:

> [I]n no event shall any of the following constitute a Company Material Adverse Effect: (A) any occurrence, condition, change, event or effect resulting from or relating to changes in general economic or financial market conditions, except in the event, and only to the extent, that such occurrence, condition, change, event or effect has had a disproportionate effect on the Company and its Subsidiaries, taken as a whole, as compared to other Persons engaged in the chemical industry; (B) any occurrence, condition, change, event or effect that affects the chemical industry generally (including changes in commodity prices, general market prices and regulatory changes affecting the chemical industry generally) except in the event, and only to the extent, that such occurrence, condition, change, event or effect has had a disproportionate effect on the Company and its Subsidiaries, taken as a whole, as compared to other Persons engaged in the chemical industry . . . .

Id. at 736-37 (emphasis omitted). Such carve outs in these sorts of terms are relatively common. *See infra* Part IV.

[4]Kevin Kingsbury & Ana Campoy, *Why Apollo Was So Keen To Acquire Huntsman*, WALL

A folk proverb from the American West teaches that timing is the most critical ingredient of a successful rain dance. If so, then Hexion and Huntsman began their proverbial dance—perhaps unwittingly—on the eve of an epic drought. Within weeks of the announcement, worldwide credit tightened, acquisition targets lost value, and capital markets swooned, plunging headlong into uncertainty and pessimism. Evidently not immune to the crisis, Huntsman also began releasing extremely disappointing financial reports; so disappointing, in fact, that Hexion's attorneys started to scour the deal for plausible escape hatches. And so it came to pass that in June 2008 —eleven months after announcing the acquisition—Hexion appeared before the Delaware Court of Chancery seeking declarations that (1) the combined company would be insolvent, thereby excusing Hexion's performance; (2) a material adverse event had occurred, thus again excusing Hexion's performance; and (3) that in any event, Hexion's maximal exposure for breaching the contract would be limited to the $325 million cancellation fee in the merger agreement.[5]

In late September 2008, following a six day bench trial, Vice Chancellor Lamb issued his much anticipated ruling on Hexion's declaratory judgment action.[6] Its eighty-nine pages delivered a stunning rebuke. Lamb first rejected Hexion's assertion that the combined company would be insolvent, holding that Hexion had strategically doctored both companies' earnings projections, effectively engineering an insolvency opinion from its financial adviser and thereby rendering it unreliable.[7] Second, he found that notwithstanding the language of the MAE clause—which bore the linguistic markers of a condition precedent to closing—he would nonetheless construe it as a condition subsequent.[8] The effect of this finding was to place the burden squarely on Hexion's shoulders (rather than Huntsman's) to prove that a material adverse event had occurred.[9] Hexion, he concluded, had not met this burden.[10] Finally, Lamb held that because Hexion's duties were not excused, it had knowingly and intentionally breached numerous covenants of the agreement, and consequently was subject to specific performance of the transaction, or in the alternative, damages unbounded by the cancellation fee,

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ST. J., July 13, 2007, at A7 (quoting Craig O. Morrison, Hexion chairman and chief executive officer).

[5] *See Hexion*, 965 A.2d at 721-22 (outlining the arguments in the complaint).

[6] *Id.* at 720.

[7] *Id.* at 727-30.

[8] *Id.* at 741-42.

[9] *Hexion*, 965 A.2d at 739-40. Although the MAE provision was stated in the Representations and Warranties section of the merger agreement, compliance with the representations and warranties was later enumerated as one of many "Conditions Precedent" to closing. *Id.* at 748 n.93.

[10] *Id.* at 743 ("Ultimately, the burden is on Hexion to demonstrate the existence of an MAE in order to negate its obligation to close, and that is a burden it cannot meet here.").

possibly exceeding the $10 billion purchase price.[11] Almost immediately, the ruling generated shock waves through the mergers and acquisitions (M&A) community that reverberate to this day.[12]

In some respects, the Hexion-Huntsman saga may be little more than an aberration. As observers noted as far back as 2007, the deal contained a number of provisions that—while not unheard of individually—aggregated to an agreement that was peculiarly advantageous to the seller.[13] These terms included a specific performance clause, a clause requiring Hexion to use best efforts to enforce financing commitments from third parties, relatively lax buyer-side covenants, and a "hell or high water" clause requiring Hexion to take all actions necessary to make the deal pass regulatory muster.[14] In light of these provisions, Lamb's unsentimental censure of Hexion was perhaps as unsurprising as it was understandable. After all, the parties had entered into a contract that they knew involved risks, and yet they chose to proceed in an expedited fashion and on relatively seller-friendly terms. To excuse Hexion's obligations now would be to violate the very risk allocation decisions that manifestly defined the deal. In short, Hexion had concocted a noxious stew of speculation, leverage, and peril, and Vice Chancellor Lamb was now merely compelling Hexion to eat its own cooking.

But if the facts of the case were so idiosyncratic, what explains the tremendous attention (and apprehension) that the case attracted within the business law community? Perhaps it had something to do with the dollar amounts at stake, the profile of the companies and law firms involved, or the morbid fascination that any public train wreck attracts. Yet while the Hexion-Huntsman dispute had all these factors, so do many others. It is more likely, I conjecture, that notwithstanding its unique attributes (indeed possibly because of them), the Hexion-Huntsman deal provides a benchmark

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[11] *Id.* at 762-63.

[12] Although far from a scientific inquiry, as of mid-November 2008, there had been more than a quarter of a million Google searches related to the dispute between Hexion and Huntsman.

The case also began toppling a string of high-profile litigation dominos between Hexion, Huntsman, and the debt capital providers for the deal, Deutsche Bank and Credit Suisse. After the court of chancery ruling, both banks refused to fund the deal, citing their own MAE provisions with Hexion. The banks were later sued by both Hexion (in New York) and Huntsman (in Texas) for their refusal to move forward. In December 2008, Hexion and Huntsman terminated the merger, the terms of which required Hexion, Apollo, and the banks to pay Huntsman $1 billion in cash and notes. *See* Peter Lattman, *Apollo, Huntsman Reach Amicable Split*, WALL ST. J., Dec. 15, 2008, at C1.

[13] *See* DealBook, *Huntsman-Hexion: A Deal Agreement to Applaud*, N.Y. TIMES, http://dealbook.blogs.nytimes.com/2008/01/11/huntsman-hexion-a-deal-agreement-to-applaud/ (Jan. 11, 2008, 16:34 EST) (praising the agreement).

[14] *Id.*

for the thousands of corporate and commercial transactions undertaken before the current financial crisis began and which are now proceeding in an economic environment filled with unpredictability and ambiguity.[15] The case gives us pause precisely because it raises the possibility that *any* contract, even a corporate acquisition negotiated by sophisticated attorneys, may be ill equipped to deal with the wild gyrations that have characterized capital markets during the last year. At its core, *Hexion* invites us to re-evaluate the very nature of contracting itself and how the law does (or should) excuse contractual commitments within environments of extreme unpredictability. The analytic domain of this question, in turn, transcends the narrow (though important) boundaries of MAC/MAE clauses, applying to numerous other contract doctrines, such as constructive conditions, material breach, frustration of purpose, impracticability, and mutual mistake.

This article uses the *Hexion* case to motivate some preliminary thoughts about how contract law should interpret contractual conditions in general—and MAC/MAE provisions in particular—within environments of extreme ambiguity. I advance the thesis that contract law and doctrine must be sensitive to two different sources of randomness: risk and uncertainty. "Risk" refers to randomness whose probabilistic nature is extremely familiar and can be characterized with objective probabilities (such as the outcome odds that attend the roll of a fair die). "Uncertainty," in contrast, refers to randomness whose probabilistic behavior is extremely unfamiliar, unknown, or even unknowable. Although this distinction was historically neglected in classical economics (and much of law and economics), it is now relatively common fare in behavioral economics and finance literature.[16] If an

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[15]As one notable firm's client letter put it: "While the *Hexion* Court has not created controversial precedent, the facts and circumstances of this case are nonetheless instructive to dealmakers and their deal counsel in drafting and negotiating merger agreement provisions, especially in the present environment of illiquid credit markets and extraordinary market occurrences." Hexion v. Huntsman: *Delaware Court Offers Interpretive Guidance on Key Terms of Disputed Merger Agreement*, CORP. GOVERNANCE GROUP CLIENT LETTER ALERT (Milbank, Tweed, Hadley & McCloy LLP, New York, N.Y.), Oct. 13, 2009, at 1-2, *available at* http://www.milbank.com/NR/rdonlyres/80BBC5CF-BAB0-4C88-8206 FEF197238729/0/Hexion _v_Huntsman.pdf.

[16]The origins of the risk/uncertainty distinction trace back nearly a century to Frank Knight. *See generally* FRANK H. KNIGHT, RISK, UNCERTAINTY AND PROFIT (1921).

Although the specific distinction between risk and uncertainty I focus on here is a dominant one in the literature, it is not alone. One alternative view posits the distinction to relate to future states that can be conceived or described *ex ante* (risk) and those that cannot (uncertainty). *See* ADRIAN VERMEULE, JUDGING UNDER UNCERTAINTY (2006); Richard N. Langlois & Metin M. Cosgel, *Frank Knight on Risk, Uncertainty, and the Firm: A New Interpretation*, 31 ECON. INQUIRY 456 (1993). Another view simply rejects the distinction between them altogether. *See* MILTON FRIEDMAN, PRICE THEORY (1976). I conjecture that to some degree, the approach I take here might be extended to either of these alternative views (particularly the former). *See infra* notes

individual is willing to expend resources to avoid uncertainty (as distinct from risk), she is said to be ambiguity averse.[17]

I argue below that while ambiguity aversion bears some facial similarity to risk aversion, an optimal contractual allocation of uncertainty does not always track the optimal allocation of risk. Consequently, if ambiguity-averse parties operate amidst both uncertainty and risk, they will prefer contract terms that are sensitive to both phenomena. In particular, prospective uncertainty about the gains from trade can dampen (sometimes substantially) the benefit that the parties perceive *ex ante* from carrying out their transaction. When such prospective uncertainty becomes extreme, moreover, an optimal contract can respond in an analogously extreme way, calling for complete contractual rescission (effectively reimposing autarky).

After establishing these intuitions as a conceptual proposition, I then endeavor to test them empirically, using a unique data set of 528 actual MAC/MAE provisions in corporate acquisitions transactions between 2007 and 2008. Using this data, I devise a simple set of "scores" meant to capture the breadth of MAC/MAE provisions within each deal. Consistent with an ambiguity aversion account, I find MAC/MAE breadth to be consistently responsive to indicators of market uncertainty prevailing at the time of negotiation: as market uncertainty grows (controlling for other variables, including those conventionally associated with risk), the ensuing MAC/MAE provisions tend to become increasingly expansive.[18] The positive relationship between MAC/MAE breadth and market uncertainty, moreover, appears robust across industries, as well as all combinations of public and private acquirers and targets. In contrast, conventional measures of risk used in corporate finance have little or no predictive power on the breadth of MAC/MAE provisions (although they do have a predictive effect on the value of consideration paid). These findings provide preliminary support for the proposition that acquisition agreements respond to the presence of "ambient" uncertainty by expanding the scope and coverage of MAC/MAE provisions.

Although intuitive, the idea that MAC/MAE provisions are a means for allocating uncertainty contrasts with the received wisdom in corporate law scholarship about the nature and purpose of such terms. In an important treatment of the topic, Ron Gilson and Alan Schwartz advanced the thesis

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27-58.

[17]*See* Colin Camerer & Martin Weber, *Recent Developments in Modeling Preferences: Uncertainty and Ambiguity*, 5 J. RISK & UNCERTAINTY 325, 333 (1992) (discussing "Ellsberg-type settings," which demonstrate why individuals pay "substantial amounts to avoid ambiguity").

[18]To capture market uncertainty, I use the Chicago Board of Exchange's "VIX" index, sometimes referred to as the "fear index" (and transformations thereof). For a discussion of the relationship between VIX and market uncertainty, see *infra* note 51.

that MAC/MAE terms serve not as an uncertainty or risk allocation device, but rather as a means for providing incentives for sellers to make investments that complement the deal's "synergies."[19] By arming the buyer with a credible threat to abandon the deal, they argue, MAC/MAE conditions impose an actuarial cost on sellers who fail to invest adequately.[20] Their "moral hazard" account of MAC/MAEs has proven to be influential among numerous scholars and judges.[21]

Gilson and Schwartz's moral hazard story is not mutually exclusive with ambiguity aversion as a general matter. It is conceivable that MAC/MAEs serve both purposes (and perhaps others) simultaneously. The 2007 and 2008 data I study here, however, do not seem to bear this possibility out strongly.[22] In any event, the role of ambiguity aversion may prove to be significant over the months and years to come, as courts, practitioners, and legal scholars increasingly confront the challenge of how to interpret analogous terms within an uncertain economic environment.

A few caveats deserve specific mention before proceeding. First, my conceptual analysis employs a somewhat familiar utilitarian/contractarian framework, albeit one that is rooted in behavioral economics. Specifically, I am interested in understanding the characteristics of an "optimal contract" between the parties, which I equate with the terms that maximize the parties' perceived payoffs as of the time of contracting. This characterization largely spawns both (1) a prediction of the express contract terms the parties adopt if bargaining/drafting were costless *ex ante*, and (2) a prescription about what implied (majoritarian) terms courts should employ to save the parties from the costs of such express contracting. I do not explore non-utilitarian normative frames, such as the morality of promise keeping or corrective justice commitments. Nor do I explore (possibly) utilitarian normative frames concerning minimizing the workload of courts or forcing information about prospective ambiguity from an informed party. While these concepts may be worthy alternative normative perspectives, I have nothing to say about them here.

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[19]Ronald J. Gilson & Alan Schwartz, *Understanding MACs: Moral Hazard in Acquisitions*, 21 J.L. ECON. & ORG. 330, 357 (2005).

[20]*Id.* at 338-39.

[21]*Id.* at 338. Outside of the Gilson and Schwartz framework, there may be other plausible reasons for parties to adopt MAC/MAE provisions. A number of practitioners interviewed for this essay report that MACs create a reference point around which to encourage deal restructuring when necessary. Alternatively, MACs may create a counter-ballast against private information, misrepresentation, or fraud. Many of these alternative accounts are consistent with (and may even be complementary to) ambiguity aversion. *See infra* notes 82-88.

[22]I will speculate as to why *infra* Part IV.

A related point concerns the capability limitations of a utilitarian/contractarian approach as a normative frame within the realm of behavioral economics. As is well documented, the very notion of utilitarian "social welfare" can lose some of its meaning when parties' preferences do not remain constant through time or across cognitive domains.[23] In such situations, a utilitarian normative goal would not only have to consider what policy choices maximize some measure of welfare for a given set of utility functions, but also would have to compare across different utilitarian frames as perceived preferences shift across domains and time, possibly in a manner that is possibly endogenous to the legal rule itself. Not only is this reasoning complex, but in contractual settings it also raises the possibility that courts should resist simply effectuating the *ex ante* intent of the parties and should instead entertain more paternalistic goals. This is complicated terrain for normative economic theory. Here, fortunately, my normative commitments are much more practical: within contract law settings, if the application of a doctrine strays too far from the parties' *ex ante* interests (or at least their perceptions of them), the parties can be expected to subvert it through substantially more detailed (and costly) express terms, seeking alternative adjudicative forums (such as arbitration), or simply choosing not to contract. Consequently, even if *ex ante* contractarianism within behavioral economics is a troubled normative frame, the volitional nature of contracting implies that courts may not be able to stray too far from it. Viewed in this sense, contractarianism still makes a great deal of sense, albeit on pragmatic (rather than ideal theory) grounds.[24]

The remainder of this essay proceeds as follows. Part II briefly describes the distinction between risk and uncertainty, and canvasses the current status of the ambiguity aversion literatures within behavioral finance, economics, and law. Part III develops a simple numerical example of contracting in environments of risk and uncertainty. Using this example, I show that if one or more parties is ambiguity averse, and if the surplus from contracting is subject to uncertainty, then the terms of the resulting agreement will generally reflect those preferences. In cases where prospective ambiguity is particularly severe, an optimal contract/interpretive scheme may permit the contract to be voided entirely. In Part IV, I test the intuitions

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[23] *See, e.g.*, Aviad Heifetz et al., *Market Design with Endogenous Preferences*, 58 GAMES & ECON. BEHAV. 121, 122 (2007) (noting that "cognitive dispositions appear to be highly context specific, rising to first-order importance in certain settings, while curiously marginal in others" (citation omitted)).

[24] *Cf.* George G. Triantis, *Contractual Allocations of Unknown Risks: A Critique of the Doctrine of Commercial Impracticability*, 42 U. TORONTO L.J. 450, 483 (1992) (questioning whether cognitive errors and biases place a limit on the potential for contract law).

generated by this example empirically, using data from acquisitions agreements announced between 2007 and 2008. I find that the breadth and reach of MAC/MAE clauses appears to be consistently related to market uncertainty during negotiations. This effect persists, moreover, when one controls for risk attributes, industry effects, acquirer characteristics, and financial control variables. Section IV proceeds to discuss how one might apply the intuitions developed earlier to two well-known cases involving the interpretation of MAC/MAE provisions. Section V concludes the article.

II. A BRIEF TOUR THROUGH AMBIGUITY AVERSION

In order to set the stage for later discussion, this section presents a brief review of the distinction between ambiguity and risk, and the related concept of ambiguity aversion. Because this literature is now quite large (and still growing), I cannot canvass it in its entirety. I will instead concentrate on some of its core insights, particularly within law, economics, and corporate finance.

Ambiguity aversion is a phenomenon that grows out of the distinction between risk and uncertainty. As noted in the introduction, "risk" refers to a type of randomness about which we are sufficiently familiar to characterize with objective probabilities. "Uncertainty" refers to randomness whose probabilistic behavior is extremely unfamiliar, unknown, or perhaps even unknowable. Perhaps the most cited example of this distinction (at least until recently[25]) is the canonical thought experiment originally proposed by Daniel Ellsberg.[26] An individual is asked to choose between two mutually exclusive gambles associated with selecting a ball at random from one of two urns: "Urn A" is known to contain 100 balls, consisting of 50 red balls and 50 blue balls; "Urn B" is also known to contain 100 red and blue balls, but their frequencies are left unspecified. Regardless of which gamble she chooses, the individual is told that she will win a monetary prize (say $100) if and only if a *blue* ball is selected from her chosen urn. In this setting, Ellsberg conjectured that most subjects would strictly prefer the Urn A

[25]Ellsberg's formulation may have been recently eclipsed by former Defense Secretary Donald Rumsfeld's oft-quoted soliloquy on the Iraq war: "[A]s we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know." Secretary of Defense Donald H. Rumsfeld, Department of Defense News Briefing (Feb. 12, 2002), *available at* http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=2636.

[26]*See* Daniel Ellsberg, *Risk, Ambiguity, and the Savage Axioms*, 75 Q. J. ECON. 643, 650-51 (1961) (describing the experiment).

gamble over the Urn B gamble. Ellsberg further conjectured that were the experimenter to reverse the stakes, so that the monetary prize in each gamble ensues if and only if a *red* ball is chosen, most individuals would continue strictly to prefer Urn A to Urn B. Although Ellsberg did not attempt to test the predictions of his thought experiment, they have been largely confirmed in experimental settings, in both within- and between-subject settings.[27]

Ellsberg's explanation for Urn A's persistent attractiveness is that it represents pure risk rather than uncertainty; that is, in Urn A it is clear that the probability of a blue ball is precisely 1/2, neither more nor less. Urn B's randomness, in contrast, is imprecise in a way that reflects uncertainty; that is, even the *probability* of drawing a blue ball from Urn B is itself unknown. All else constant, Ellsberg conjectured, most individuals would wish to avoid the unspecified form of randomness Urn B represents for the "known unknown" of Urn A. It is this persistent preference for risk over uncertainty that characterizes ambiguity aversion.

Ellsworth's conjecture, while intuitive, also poses a serious challenge to the received expected utility paradigm developed by von Neumann and Morganstern, Savage, and others.[28] Savage in particular was interested in decision making under uncertainty, and its relationship to the expected utility framework.[29] He famously demonstrated that even when prior probabilities are left unspecified, expected utility theory (or something very close to it) is still a viable approach for modeling decision making.[30] Rather than using "true" objective probability assessments, however, decision makers would be represented as assigning consistent subjective probabilities to all plausible outcomes. Using those subjective probabilities (in a consistent fashion), decision makers could then be represented theoretically as acting to maximize their expected utility, treating their subjective probabilities as objective ones.

As applied to the domain of Ellsbergian urns, Savage's subjective expected utility (SEU) framework delivers some important (though ultimately troubling) predictions. Most pertinently, SEU implies that an

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[27]For a review, see Camerer & Weber, *supra* note 17; *cf.* Craig R. Fox & Amos Tversky, *Ambiguity Aversion and Comparative Ignorance*, *in* CHOICES, VALUES, AND FRAMES 540 (2000); Craig R. Fox & Amos Tversky, *Ambiguity Aversion and Comparative Ignorance*, 110 Q.J. ECON. 585, 599 (1995) (noting that for some between-subject specifications, the effect can dampen with experienced subjects).

[28]*See* LEONARD J. SAVAGE, THE FOUNDATIONS OF STATISTICS 73-82 (1954); JOHN VON NEUMANN & OSKAR MORGENSTERN, THEORY OF GAMES AND ECONOMIC BEHAVIOR 31-33 (1944) (introducing briefly the structure of this paradigm).

[29]SAVAGE, *supra* note 28, at 76-77.

[30]*Id.* at 76-81.

individual's observed strict preference for Urn A over Urn B in the "blue ball wins" condition reveals that she must subjectively believe the ratio of blue balls in Urn B to be less than 50%. At the same time, however, her continued strict preference for Urn A in the "red ball wins" condition reveals a subjective belief that the ratio of red balls in Urn B must be less than 50%. Those two beliefs cannot simultaneously be true for any set of consistent subjective probabilities, exposing a troubling contradiction. In effect, ambiguity-averse behavior appears to violate one or more tenets of SEU theory, making it an unreliable tool for predicting and assessing behavior (at least in these contexts).[31]

In the last four decades, Ellsberg's challenge to expected utility theory subsequently spawned hundreds of efforts among psychologists, philosophers, economists, and others exploring more satisfying alternatives to the Savage framework in the presence of ambiguity.[32] These efforts have been largely directed to formulating alternative axiomatic representations of preferences and what they imply for understanding choice under uncertainty. A particularly noteworthy branch of that literature focuses on what has become known as the multiple priors approach.[33] Put simply, this approach posits that in uncertain environments decision makers will assemble all plausible probabilistic attributes of an uncertain state and then formulate a probability distribution over those environments (a probability distribution of probabilities, of sorts).[34] In the Ellsberg thought experiment, for example, one could imagine a decision maker formulating 101 different plausible priors about the number of blue balls in Urn B (and thus the probability of a blue ball selection).[35] Once these multiple plausible prior probabilities are assembled, the decision maker would attempt to assign a subjective likelihood to each one of them. An ambiguity-neutral person might, for example, assign a uniform probability to each one of the 101 red-blue ball

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[31]This is not to say, of course, that SEU is categorically a poor theory, but rather that its predictive powers are likely domain specific. *See* Colin Camerer & Eric Talley, *Experimental Study of Law*, *in* 2 HANDBOOK OF LAW AND ECONOMICS (Steven Shavell & A. Mitchell Polinsky eds., 2007). Indeed, neuro-economists have begun to formalize ways in which behavior consistent with expected utility versus prospect theory may be context specific. *See generally* Jennifer H. Arlen & Eric L. Talley, *Experimental Law and Economics: Introduction*, *in* EXPERIMENTAL LAW AND ECONOMICS (Jennifer H. Arlen & Eric L. Talley eds., 2008).

[32]For a good review, see generally Mark J. Machina, *Non-Expected Utility Theory*, *in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS (Steven N. Darlauf & Lawrence E. Blume eds., 2008).

[33]*See* Itzhak Gilboa et al., *Probability and Uncertainty in Economic Modeling*, 22 J. ECON. PERSP. 173, 182-84 (2008) (surveying assorted applications of the multiple priors approach).

[34]*Id.* at 182.

[35]That is {0 Blue; 100 Red}, {1 Blue; 99 Red}, {2 Blue; 98 Red}, and so forth.

possibilities (at least in the absence of additional information). Such an assignment would be consistent with SEU, which effectively requires that one's prior probabilities be independent of the stakes assigned to any particular gamble.[36] It would be inconsistent, however, with the behavior predicted by Ellsberg.

An ambiguity-averse decision maker, in contrast, would tend to skew her priors in a manner that is responsive to how the stakes in the problem are presented. Consider, for instance, perhaps the most popular representation of ambiguity aversion in the behavioral economics literature: Maximin Expected Utility (MEU).[37] Under the MEU approach, an ambiguity-averse decision maker assigns full "weight" to the prior probability assessment that makes her worst-off under the posited gamble. If one changes the stakes or nature of the gamble, the worst-off assessment may change as well, which can generate inconsistent probabilistic assessments. Going back to the Ellsberg example, in the "blue ball wins" condition, the decision maker's assessment of Urn B would focus solely on her worst case scenario (i.e., that it contains 100 red balls and 0 blue balls). For this person, Urn A would clearly dominate. In the "red ball wins" condition, the stakes of the gamble are reversed, and so with them is the worst case; here, the decision maker would focus on the polar opposite assessment (i.e., that it contains 100 blue balls and 0 red balls), and Urn A persists as the dominant choice. Note that both the SEU and MEU decision makers assign prior probability distributions to different outcomes, assessing the expected utility of a candidate's choice under those priors. Unlike her SEU counterpart, however, the MEU decision maker selects priors that are themselves potentially inconsistent, predicated in part on the underlying stakes of the gamble.[38]

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[36] *See* SAVAGE, *supra* note 28, at 73-76.

[37] The MEU approach has been developed in various forms. S.L. HURLEY, NATURAL REASONS: PERSONALITY AND POLITY 371-82 (1992); Itzhak Gilboa & David Schmeidler, *Maxmin Expected Utility with a Non-Unique Prior*, 18 J. MATHEMATICAL ECON. 141, 142-43 (1989) (differentiating the authors' vision of MEU from other models). For a review, see generally Gilboa et al., *supra* note 33.

Although it is the most focal, MEU is but one of many competing ways that have been suggested to formalize the concept of ambiguity aversion. CASS R. SUNSTEIN, WORST-CASE SCENARIOS (2007) (discussing the "Catastrophic Harm Precautionary Principle," which operates in part on a distinction between risk and uncertainty); *see also* Peter Klibanoff et al., *A Smooth Model of Decision Making Under Ambiguity*, 73 ECONOMETRICA 1849, 1852 (2005) (offering "a clarifying perspective on ambiguity and ambiguity attitude"); Peter Klibanoff et al., *Recursive Smooth Ambiguity Preferences* 1 (Fondazione Collegio Carlo Alberto, Working Paper No. 17, 2008), *available at* http://www.carloalberto.org/files/no.17.pdf (distinguishing between "ambiguity" and "ambiguity attitude"). *See generally* Machina, supra note 32. To some extent, no clear victor has emerged from this debate.

[38] Although MEU preferences were axiomatized by Gilboa and Schmeidler within

In some settings, ambiguity aversion can elicit behavior that resembles either (1) severe risk aversion, or (2) the presence of "cataclysmic" forms of risk.[39] Ambiguity avoiders, all else constant, shy away from environments that entail appreciable unpredictability. They discount upside relative to downside variations. They are willing to purchase insurance at substantial premia over actuarial cost. Many of these predictions hold for risk-averse individuals too, at least for the right degree of risk aversion or magnitude of underlying risk. Nevertheless, ambiguity aversion is not only a distinct theoretical concept, but it can sometimes manifest itself in ways that are both distinguishable and independent from risk aversion.[40]

Experimental evidence of ambiguity aversion suggests that it is most likely to manifest in settings where the underlying random process is new or poorly understood. Once subjects gain greater familiarity and confidence with their environment (effectively building an experiential "data set" on which to base their priors) ambiguity aversion tends to dissipate.[41] Risk aversion, in contrast, should not. Moreover, in a number of documented cases, the correlation between risk attitudes and ambiguity attitudes appears notably low, and ambiguity aversion alone (controlling for risk aversion) appears responsible for substantial premia that experimental subjects have been willing to pay to avoid uncertainty independent of risk—in the neighborhood of 10% to 20% of expected value.[42] Similar qualitative effects can be detected even in experimental market settings among experienced, sophisticated traders.[43]

Outside of the laboratory, ambiguity aversion has begun to play a prominent role in empirical work, particularly within the behavioral finance literature on the limits of arbitrage.[44] Ambiguity aversion, for example, is

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economics, in at least a conceptual sense, this approach also traces roots back to John Rawls. Gilboa & Schmeidler, *supra* note 37; *see* JOHN RAWLS, A THEORY OF JUSTICE 152-154 (1971); *see also* HURLEY, *supra* note 37, at 374 (discussing "Rawlsian resistance to the equiprobability assumption"); Stephen M. Gardiner, *A Core Precautionary Principle*, 14 J. POL. PHIL. 33, 45-49 (2006) (similarly discussing Rawlsian theory).

[39]*See, e.g.*, Eric L. Talley, *Cataclysmic Liability Risk Among Big Four Auditors*, 106 COLUM. L. REV. 1641, 1644 (2006).

[40]*See* Camerer & Weber, *supra* note 17, at 357.

[41]*Id.* at 326.

[42]*Id.* at 340-41.

[43]*See, e.g.*, Colin F. Camerer, *Do Biases in Probability Judgment Matter in Markets? Experimental Evidence*, 77 AM. ECON. REV. 981, 985, 995 (1987); Camerer & Weber, *supra* note 17, at 356-57. The magnitudes of such effects tend to decrease as subjects become more familiar with the random attributes of the underlying environment. Colin Camerer & Howard Kunreuther, *Experimental Markets for Insurance*, 2 J. RISK & UNCERTAINTY 265, 285-86 (1989); *see* Fox & Tversky, *supra* note 27, at 602 (stating that investors "may exhibit ambiguity aversion" when considering investment choices independently).

[44]*See generally* Nicholas Barberis & Richard Thaler, *A Survey of Behavioral Finance*, *in*

thought to be a prime driver (perhaps one of many) of the "equity premium" puzzle—the observed stylized fact that average buy-and-hold returns in equity investments during the last 150 years have been so high as to defy justification as a plausible artifact of risk aversion.[45] The observed premium, however, is more consistent with the presence of both risk and ambiguity aversion (in particular, investors' fear that their specified beliefs about asset pricing relationships are wrong), which can cause investors to demand larger expected returns.[46] In addition, ambiguity aversion may help explain why some investors fail to diversify their investments in general,[47] and in particular, the observed bias in both individual and institutional investors' portfolios towards "home field" issuers (i.e., companies traded on domestic markets and/or headquartered near investor's domicile).[48]

More recently, financial economists have begun to amass evidence that market volatility may also be systematically related to ambiguity aversion. Consider, for example the Chicago Board Options Exchange's (CBOE) volatility index "VIX," which captures average volatility inferred from a collection of put and call option markets. VIX is popularly known as the "fear index" and is described by the business press as a reflection of investors' sense of unease due to the uncertainty present in the market.[49] The value of VIX has generally fluctuated between 8% and 20% during the four years prior to the summer of 2007. As Figure 1 below suggests, VIX grew particularly erratically beginning in the third quarter of 2007. Since September 2008, it skyrocketed to over 90% before settling back down somewhat.

THE HANDBOOK OF ECONOMICS AND FINANCE: VOLUME 1B FINANCIAL MARKETS AND ASSET PRICING 1053 (George M. Constantinides et al. eds., 2003).

[45]Rajnish Mehra & Edward C. Prescott, *The Equity Premium in Retrospect*, *in* THE HANDBOOK OF ECONOMICS AND FINANCE, *supra* note 44, at 892-96.

[46]*See, e.g.*, Pascal J. Maenhout, *Robust Portfolio Rules and Asset Pricing*, 17 REV. FIN. STUD. 951, 952-53 (2004).

[47]*Id.* at 976-77; *see also* Sujoy Mukerji & Jean-Marc Tallon, *Ambiguity Aversion and Incompleteness of Financial Markets*, 68 REV. ECON. STUD. 883, 898 (2001) ("[S]tandard theory argues that diversification would . . . reduce the inconvenience of [] risk [but] [a]mbiguity aversion can actually exacerbate [this] tension.").

[48]*See, e.g.*, Shlomo Benartzi, *Excessive Extrapolation and the Allocation of 401(k) Accounts to Company Stock*, 56 J. FIN. 1747, 1761 (2001) (discussing "familiarity bias"); Kenneth R. French & James M. Poterba, *Investor Diversification and International Equity Markets*, 81 AM. ECON. REV. 222, 225 (1991) (describing how investors "impute extra 'risk' to foreign markets"); Gur Huberman, *Familiarity Breeds Investment*, 14 REV. FIN. STUD. 659, 659 (2001) (stating that "by and large," investors keep their money in their home country).

[49]*See* Tom Lauricella & Aaron Lucchetti, *Dow Slides Again, Down 514.45; S&P at a 5-Year Low; What's Behind the Surge in the VIX?*, WALL ST. J., Oct. 23, 2008, at C1.

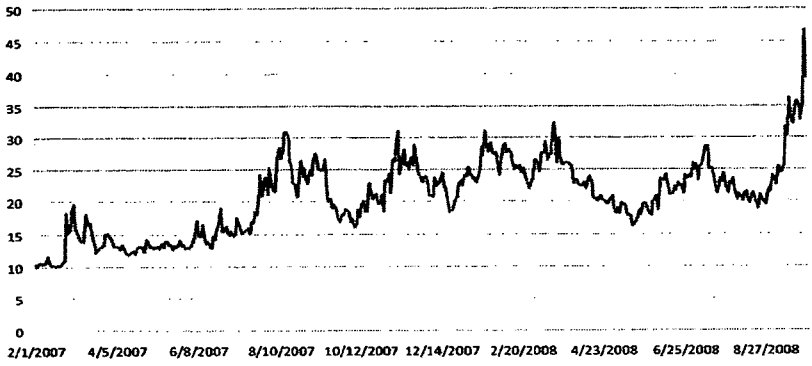

Figure 1. VIX Close, Feb. 2007-Oct. 2008

Classical finance theory suggests that it should matter little whether volatility comes from upward market movements, downward market movements, or gyrations around a stationary point for determining the realized value of the VIX. But a number of recent studies have demonstrated that VIX manifests an asymmetric response to market movements, growing disproportionately large when markets are falling.[50] Such observations are not generally predicted by standard expected utility theory, but would be a logical consequence of ambiguity aversion.[51]

Although ambiguity aversion has not colonized legal scholarship to the same extent that it has behavioral economics and finance, many have seized upon the concept to understand or criticize legal doctrines within numerous fields, including environmental law,[52] administrative law,[53]

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[50] *E.g.*, Ann Marie Hibbert et al., *A Behavioral Explanation for the Negative Symmetric Return-Volatility Relation*, 32 J. BANKING & FIN. 2254, 2255 (2008); Cheekiat Low, *The Fear and Exuberance from Implied Volatility of S&P 100 Index Options*, 77 J. BUS. 527, 543-44 (2004) (concluding that VIX is the "best aggregate index of [the] fear or sentiment of sophisticated" investors).

[51] Relatedly, a number of financial economists have begun to use VIX (or a transformation of it) as a basis for capturing market uncertainty. *See* Tim Bollerslev et al., *Expected Stock Returns and Variance Risk Premia* 16 (Duke Dep't Econ. Research Paper No. 5, 2008), *available at* http://ssrn.com/abstract=948309 ("[r]ely[ing] on the readily available squared VIX index as [the] measure for the risk-neutral expected variance."); Itamar Drechsler & Amir Yaron, What's Vol Got to Do With It 1 (Dec. 2008) (unpublished working paper, 2008) (on file with the Am. Fin. Ass'n) (concluding that "the variance premium is intimately linked to [economic] uncertainty" and helps to predict investment activity.

[52] *See generally* SUNSTEIN, *supra* note 37.

[53] *See, e.g.*, VERMEULE, *supra* note 16, at 183 (suggesting that judges defer to administrative agencies rather than "fill in the gaps" of ambiguous statutory language).

criminal law,[54] and torts.[55] Contract law scholars also have taken on the topic within specific settings, predominantly focusing on the reticence that contracting parties frequently have towards experimenting with terms that diverge from widely accepted default rules or familiar terms.[56] Ambiguity aversion has garnered somewhat less attention among contracts scholars operating within other domains, including conditions/excuse doctrine.[57] Yet some theoretical contributions in contract theory have demonstrated that ambiguity aversion (or prospective ambiguity aversion) can be a cause for contractual "incompleteness": i.e., parties may fail to specify contractual allocations in contingencies where uncertainty is especially pronounced.[58] In those contingencies, the argument goes, ambiguity aversion can swamp other gains from trade. This consequence of ambiguity aversion holds particular relevance for my inquiry, since within law, the doctrines of express and

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[54]*See, e.g.*, Uzi Segal & Alex Stein, *Ambiguity Aversion and the Criminal Process*, 81 NOTRE DAME L. REV. 1495, 1549 (2006) (stating that the frequency of plea bargains is in part attributable to a criminal defendant's ambiguity aversion vis-à-vis jury trials).

[55]*See, e.g.*, Joshua C. Teitelbaum, *A Unilateral Accident Model Under Ambiguity*, 36 J. LEGAL STUD. 431, 464 (2007) (describing how a tortfeasor's attitude towards risk impacts accident models).

[56]*See* Omri Ben-Shahar & John A. E. Pottow, *On the Stickiness of Default Rules*, 33 FLA. ST. U. L. REV. 651, 651-53 (2006) (deviating from default rules and other norms may discourage counterparts from entering an agreement); Russel Korobkin, *Intertia and Preference in Contract Negotiation: The Psychological Power of Default Rules and Form Terms*, 51 VAND. L. REV. 1583, 1586 (1998) (explaining the "status quo bias" that affects contract negotiations).

[57]Although most of the literature here has focused on risk versus uncertainty—for example, Richard A. Posner & Andrew M. Rosenfield, *Impossibility and Related Doctrines in Contract Law: An Economic Analysis*, 6 J. LEGAL STUD. 83, 87-88 (1977)—two exceptions warrant specific mention. First, Schwartz notes in passing that ambiguity aversion may induce the parties to void/exit a contract. Alan Schwartz & Robert E. Scott, *Contract Theory and the Limits of Contract Law*, 113 YALE L.J. 541, 607 n.139 (2003). However, Schwartz then concludes that "filling gaps with state-created rules or standards would not advance the parties' objectives." *Id.* While this conclusion might be true, it would depend on the nature of the gap-filling rule. A gap-filler that simply reflects the contingent preferences of the parties would seemingly advance their objectives.

Triantis considers the doctrine of commercial impracticability's role as a gap filler. Triantis, *supra* note 24, at 451-52. His analysis draws on the then-emerging literature on risk versus uncertainty. *Id.* at 459 n.24. Triantis is ultimately skeptical of implied conditions as a means for gap filling, concluding that market forces and evolutionary learning are better mechanisms for addressing poor uncertainty management. *Id.* at 453.

At its core, Triantis' argument concerns how best to set a default rule, as opposed to whether a court should enforce *express* conditions (such as MAC/MAE provisions). *Id.* at 452. On the question of the optimal default rule, much of his argument appears to rest on faith that market forces and arbitrage will effectively "de-bias" decision makers or dissipate the effects of cognitive error. *Id.* at 468-74. As noted above, recent contributions in behavioral finance have called this faith into question (at least as a universal proposition).

[58]*See, e.g.*, Sujoy Mukerji, *Ambiguity Aversion and Incompleteness of Contractual Form*, 88 AM. ECON. REV. 1207, 1207 (1998) ("Casual empiricism suggests that a real-world contract is very often *incomplete* in the sense that it may not include any instruction for some possible event.").

implied conditions represent a core mechanism with which a court can "un-complete" a contract. How and when this mechanism is activated is the question to which I now turn.

III. A NUMERICAL EXAMPLE

In order to make my arguments more concrete, this section develops and analyzes a simple numerical example to illustrate how contract design may attempt to allocate both risk and uncertainty. The goal here is not to offer a complete account of contracting with uncertainty, but rather to use the example to expose some simple (and potentially testable) intuitions about (1) how ambiguity and aversion thereto may plausibly be reflected in contractual terms, and (2) how ambiguity-averse parties may be willing (at least in certain circumstances) to make the contract's very enforceability contingent on the "ambient" amount of uncertainty they face.

A. *Framework*

Consider Bianca, a potential buyer, and Sam, a potential seller, who are negotiating a potential sales contract for a specified asset (say, a small bakery that Sam has inherited from his grandmother). The business asset is indivisible, and thus if a sale occurs, Bianca receives full control of the business (though the parties can decide to divide its cash flows in a manner described below). Should Bianca purchase the business, its future value under her stewardship is not certain: it could be a relative "success" (if, say, there is a sudden spike in donut demand), in which case it will have monetary value of $500. Alternatively, it could be a relative "failure," and have monetary value of $100. I presume that even Bianca does not know at the time of contracting what the value of her stewardship will be, but at the time of her decision to perform or breach, she will privately observe it. If Bianca does not purchase the business (or if her performance is later excused, or if she breaches), she can continue under the status quo ante and obtain an outside payoff of $125.[59]

In contrast to Bianca, Sam has little business acumen, and under his stewardship the business will simply be liquidated for $50 (with certainty). However, outside of his negotiations with Bianca, Sam has an option of selling the business to a willing third party, who has offered him $140 for it

[59]Note that because Bianca's outside payoff exceeds the value of the business to her in the event of a "failure," it will be efficient for Bianca not to perform in such a context.

free and clear.[60] Passing up this outside offer is costly for Sam; he can only keep the outside bidder in play for a limited amount of time, and if he waits too long the outside bid will evaporate.[61]

The contract between Sam and Bianca will have three chief functions—first, it may transfer control over the business asset to Bianca; second, it allows for Sam and Bianca to allocate risk; and finally, it allows for Sam and Bianca to allocate uncertainty (to the extent that they wish to).

B. *Risk Preferences*

To distinguish the effects of risk versus those of uncertainty, it will be instructive to allow for Sam and Bianca to be risk averse, so that each would strictly prefer a certain dollar payment over any risky asset with the same actuarial value. Such preferences, common within the law and economics literature, can be represented by an increasing, concave utility function for each party, which I will denote $u_S(y)$ and $u_B(y)$, respectively, where y denotes the party's wealth. Figure 2 below demonstrates this now familiar framework for Bianca, imagining that she owned the asset (and all cash flows) outright. In the figure, Bianca's utility function is pictured by the function $u(y)$. In the Figure (as well the ensuing example), I will suppose that Sam's and Bianca's preferences both take the well known form of risk aversion, where $u(y) = \ln(y)$ and where ln denotes the natural logarithm.[62]

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[60]Note that this formulation assumes away the possibility of "common values" between Bianca and Sam. I do so for the sake of simplicity. Including the possibility of common values does not generally cause ambiguity aversion to dissipate, and can in some instances exacerbate it. *Cf.* Theodore L. Turocy, *Auction Choice for Ambiguity-Averse Sellers Facing Strategic Uncertainty*, 62 GAMES & ECON. BEHAV. 155 (2008).

[61]Just how quickly this outside opportunity evaporates after Sam and Bianca contract with one another is taken up below.

[62]This functional form is sometimes referred to as *constant relative risk aversion* (CRRA). It is a special case of a more general class of functions with the form $u(y) = (y^1 \rho - 1)/(1 - \rho)$, where ρ is a constant representing the degree of risk aversion. Note that when $\rho = 0$, the utility function is linear, corresponding to risk neutrality. When $\rho = 1$, in contrast, this function collapses to $u(y) = \ln(y)$, as discussed in the text.

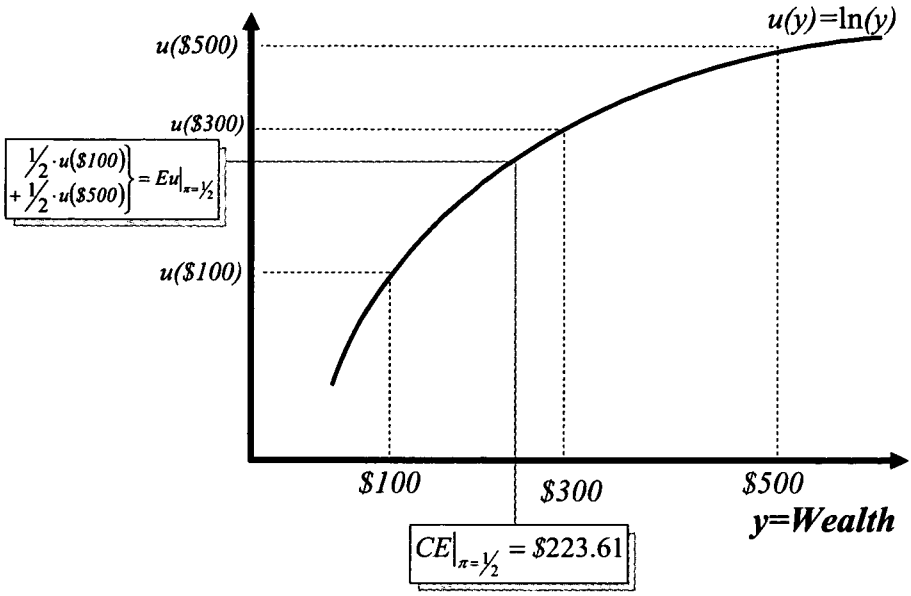

Figure 2. Expected Utility Framework

Note that while Bianca's utility increases in wealth, it does so at a decreasing rate—the *sine qua non* of risk aversion. The payoff Bianca derives (in utility terms) from the low outcome ($100) is pictured on the vertical axis at u ($100). Similarly, her utility payoff from the high outcome ($500) is pictured on the vertical axis at u ($500). If we suppose a successful outcome occurs with a probability of 50% (a supposition I will return to below), then Bianca's expected utility is simply the midpoint of these two utilities, and is denoted on the vertical axis[63] as $Eu|_{\pi=1/2}$.

One can also work backwards within this diagram, asking hypothetically how large of a fixed and certain monetary payment would make Bianca indifferent between the money and the risky cash flows from the business. In the diagram above, this "certainty equivalent" of the gamble to Bianca is approximately $223.61. In other words, Bianca's aversion to risk alone would lead her to value the business at $72.39 less than its actuarial value ($300 = $ ½ · (500+100)). This difference is sometimes called the

[63]More generally, for asymmetric probabilities other than ½, this would be the probability-weighted average of her respective payoffs.

"risk premium" that Bianca would associate with holding all the risk (though in this case, since Bianca is the prospective buyer, it might be more accurately called a "risk discount").

C. *Risk/Uncertainty*

In order to illustrate the chief claims in this article, our running example must also have a way to think about uncertainty as distinct from risk. Thus, suppose that the probability that the business is ultimately a success (or π) is not known with precision, but instead is confined within some range centered at 50%. Specifically, suppose the probability of success could be anywhere between 50% - c on the low end or 50% + c on the high end (as pictured in the figure below), where c captures the degree of ambiguity surrounding that probability. The larger the value of c, the less precision one has in bounding the "true" probability of success, though its plausible interval is always centered at 50%. Conversely, when c is very low (or zero), the probability of a high value collapses completely to the case of pure risk, at 50%.

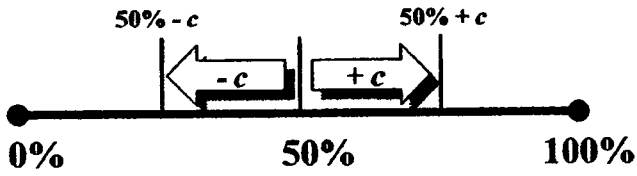

Figure 3. Interval of Prior Probabilities

Significantly, other than knowing c (which defines the range of plausible prior probabilities), neither Sam nor Bianca has any additional information about the actual probability of success. It is this lack of information about prior probabilities that gives rise to a central concern in the ambiguity aversion literature.

To the extent that Sam or Bianca cares about ambiguity, their contract may attempt to account for or accommodate those preferences. Thus, the following subsections will track two possible scenarios (and then ultimately combine them). In the first, I will consider the case of pure risk, where c is effectively 0%. This scenario corresponds to the analog of the proverbial Ellsbergian urn with a known fraction of blue and red balls. In the second scenario, I will consider what happens when c is strictly positive. This scenario corresponds with the uncertain urn.

D. *Contracting Under Risk*

Consider first how the parties would negotiate possible terms of a sales contract in an environment with risk but no ambiguity (i.e., where $c = 0$). Among other things, the contract will determine whether the asset is transferred to Bianca and how much she pays for it, as well as whether she will breach. Because only Bianca observes her true valuation of the asset, the contract will not be able to specify a price that hinges on that value. However, the parties can negotiate terms that turn on whether Bianca shows up to close the deal or instead breaches. Accordingly, suppose that they agree to a contract price (denoted P) in the event that Bianca performs, but also include a cancellation fee, or liquidated damages amount (denoted D), if Bianca breaches.

What is the nature of the contract they will produce (if any)? The answer to this question can depend on many factors, including the bargaining protocols used by the parties. In what follows, I will not attempt to limit analysis to a specific bargaining protocol, but instead will simply posit that the parties' contract will maximize the sum of their expected utilities at the time of contracting, subject to the condition that neither party can expect to be made worse off than her outside option by contracting (i.e., it is weakly Pareto improving). If a contract satisfies this property, I will refer to it as an "optimal contract."

As it turns out, our example yields a unique optimal contract, which calls for a contract price of \$500/2 = \$250 and cancellation fee of (\$125 - \$50)/2 = \$37.50 in the event of breach by Bianca. Brief inspection reveals that these terms literally divide the cash flows (and thus economic risks) in half. If the store turns out to be worth \$500, Bianca will not breach, and the parties will split the \$500 surplus. If it turns out to be of low value, however, she will breach (efficiently), and will pay \$37.50 to Sam. In this case, the net result is that they both end up with \$87.50. This splitting of risks should not be surprising, given that there are two sources of gain from contracting. First, there may be direct allocational efficiency gains from trade when Bianca controls the business in the event its value is high, and breaches (efficiently) when its value is low.[64] Second, there are also gains from risk allocation if Sam and Bianca co-insure one another against upside and downside risk. The optimal contract, in effect, seizes both sources of

[64]It might first appear that breach by Bianca is inefficient when the value of the business is low, since it would still be worth \$100 under Bianca's stewardship, and Sam can only operate it at a profit of \$50. Nevertheless, this decision is efficient because by breaching, Bianca can capture her \$125 outside option in addition to the payoff received by Sam.

efficiency gain. The resulting expected payoff has a certainty equivalent of $147.90 for each party, which clearly exceeds the payoffs that Sam and Bianca would achieve through their *ex ante* outside options ($140 and $125, respectively). Thus, the optimal risk-sharing contract described above is also Pareto efficient.

Before moving on to thinking about uncertainty, it is perhaps worthwhile to take note of three features of Sam and Bianca's contract in the case of pure risk. First, note that the liquidated damages amount, $37.50, need not reflect the usually conceived expectation damages that courts might apply. In particular, the optimal contract would not entitle Sam to a full action for the price (of $250), nor would it entitle Bianca to walk from the deal. This potential divergence from the usual contractual remedies is well known in the literature on contractual risk allocation.[65] Because of the benefits of co-insurance, they can do better than having Bianca fully ensure Sam against a breach (which is what an action for the price would entail). In essence, by agreeing to this lower quantum of damages, Sam receives a larger price from Bianca up front, and both are better off.

Second, note that the equal sharing of risks between Bianca and Sam emanates from the fact that they are assumed to be equally risk averse. If the parties were to have different risk preferences, they might settle on different values for the price and cancellation fee, with one party effectively underwriting insurance for the other, according to their relative degrees of risk aversion.[66]

Finally, note that even though the contract clearly envisions that Bianca will breach in the low profitability state, it does not allow her simply to walk away without paying anything to Sam (that is, the cancellation fee/liquidated damages amount is strictly positive). Indeed, a nontrivial source of gains from trade in this example is the efficient allocation of risk *ex ante*; as such, part of the benefit from contracting comes from the damages payment Bianca makes to Sam.[67] Allowing her to abandon her contractual duties without paying damages would undermine this benefit.

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[65] *E.g.*, A. Mitchell Polinsky, *Risk Sharing Through Breach of Contract Remedies*, 12 J. LEGAL STUD. 427, 427 (1983); Steven Shavell, *Acquisition and Disclosure of Information Prior to Sale*, 25 RAND J.ECON. 20, 34-35 (1994).

[66] *See, e.g.*, Polinsky, *supra* note 65, at 436 (promoting the "liquidated damages [contractual] remedy," which accounts for the parties' risk aversion by setting damages before a breach occurs). In addition, if one were to increase the extent to which Sam and Bianca are risk averse, the total gains from the proposed transaction would decline.

[67] *See, e.g.*, *id.*

E. *Contracting Under Uncertainty*

Now consider what might happen if the parties found themselves in a context of uncertainty instead of pure risk. If, for example, $c = 30\%$, then the plausible value of π could range anywhere between 20% and 80% (but otherwise little else is known about it). What sort of contracting behavior can we expect? The environment of uncertainty requires us to enrich our running example in two respects. First, we must posit how decision makers form subjective beliefs or conjectures about their environment. Second, we must posit how (if at all) the parties' deep preferences treat uncertainty/ambiguity in a different way than risk.

1. Ambiguity Neutrality

Let us first consider how one might analyze the Sam-Bianca contract in a situation where the parties are risk averse but ambiguity neutral. Within the Savage framework, one cannot proceed without first positing how Sam and Bianca assign values (or probabilistic assessments) to the underlying probability value distributions.

It is important to note that there are no general constraints within the Savage framework on how parties form priors. Other than the true probability, π must range between $50\% - c$ and $50\% + c$. Nevertheless, for at least intuitive reasons, many economists, statisticians, and philosophers have (by turn) been attracted to one candidate (at least for uncertainty-neutral decision makers): a prior belief assigning equal probability to each possible value of π—i.e., a "uniform" distribution on π over its plausible range. The intuition of equating uninformed with uniform priors is sometimes referred to as the "Principle of Insufficient Reason." It is in essence a conjecture, and it is not completely free from criticism.[68] However, it draws support from intuition, from experimental evidence,[69] and (somewhat selectively) from theory.[70] I therefore embrace it provisionally—at least for the purpose of illustration—though my arguments would work with a wide range of alternative prior distributions as well.

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[68] *See* Hans-Werner Sinn, *A Rehabilitation of the Principle of Insufficient Reason*, 94 Q.J. ECON. 493, 504-05 (1980) (reviewing the criticism and offering a normative attempt at rehabilitation).

[69] *E.g.*, SUNSTEIN, *supra* note 37, at 166-67.

[70] *See* MORRIS H. DEGROOT, OPTIMAL STATISTICAL DECISIONS 198-99 (1970) (advocating uniform uninformed priors assumption, describing a proper and improper uniform prior's statistical properties, and identifying other monikers for the assumption).

If Sam and Bianca are both ambiguity neutral, then the Principle of Insufficient Reason provides the last piece of the puzzle for locking in predictions about their contracting behavior: it immediately follows that the expected probability of the high value state would simply be the midpoint between 50% - c and 50% + c—or 50%, just as in the pure risk state. Consequently, all aspects of the optimal contracting problem and resulting payoffs discussed in the previous section remain unchanged. Bianca receives a right to the asset, paying a price P = \$250, but has the option of breaching and paying D = \$37.50. Each party receives a payoff in certainty equivalent terms of \$147.90, just as before.

2. Ambiguity Aversion

Things do change, however, if at least one of the parties is ambiguity averse. Consider what might happen if one of the bargaining parties (say, our buyer Bianca) harbored MEU preferences. In this case, for each possible contract that Bianca might agree to, she would assign prior probabilities of success that generate the minimal conceivable utility payoff that the contract could yield for her, equating that value to her perceived expected utility under the contract. She will then bargain for contractual terms (if any) that maximize this minimal utility. Within this example, Bianca's perceived payoff would generally attach the most pessimistic probability, or 50% - c, to a successful outcome.[71]

Just as before, Bianca and Sam's contract (if any) will determine (1) whether Bianca receives the right to control the asset; and (2) what the price and damages payment will be. Now, however, it will do so with reference to the sum of Bianca's maxmin expected utility. The effect of this substitution will tend to comport with one's intuition; that is, the large weight that Bianca puts on the worst case scenario implies that Sam may find it optimal to give Bianca "downside protection," in the form of a moderated cancellation fee, should Bianca breach. In exchange for this downside protection, Sam may take a larger portion of the upside benefit if the asset turns out to be high value, in the form of a higher price. This makes sense, since Bianca—as an ambiguity-averse party—cares less about upside payoffs.

Note, of course, that the prospect of giving Bianca some downside protection is potentially costly to Sam, since he is a risk averse party, but this

[71]Note that this statement would not hold for a contract that (counterintuitively) awarded Bianca *more* money when the project is unsuccessful than when it is successful. For such hypothetical terms, her MEU preferences would utilize a "worst case" prior of 50% + c. Given Sam's risk aversion, however, none of the counterintuitive contracts is a reasonable contender in this example.

protection may be necessary simply to get Bianca to participate in the contract (so long as Bianca is willing to pay enough for it).

Table 1. Optimal Contract Terms; Ambiguity Neutrality vs. Buyer-Side Ambiguity Aversion

	Ambiguity Aversion			
	Neither is A.A.		Buyer is A.A	
c	Price	Damages	Price	Damages
0%	$250.00	$37.50	$250.00	$37.50
5%	$250.00	$37.50	$263.16	$33.33
10%	$250.00	$37.50	$277.78	$29.55
15%	$250.00	$37.50	$294.12	$26.09
20%	$250.00	$37.50	$307.50	$21.12
25%	$250.00	$37.50	$318.55	$14.60
30%	$250.00	$37.50	Autarky	Autarky
35%	$250.00	$37.50	Autarky	Autarky
40%	$250.00	$37.50	Autarky	Autarky
45%	$250.00	$37.50	Autarky	Autarky
50%	$250.00	$37.50	Autarky	Autarky

Table 1 illustrates the terms of an optimal contract between Bianca and Sam for various values of uncertainty, comparing the cases of (1) symmetric ambiguity neutrality, with (2) buyer-side ambiguity aversion. Note that as ambiguity rises (*c* goes up), the terms of the optimal contract for risk-averse parties do not vary (since uncertainty is increasing symmetrically around ½). On the other hand, when Bianca is ambiguity averse, the terms of the contract change in the manner suggested above. That is, the parties agree to a higher price but a more moderated termination fee, with Sam implicitly underwriting "uncertainty insurance" for Bianca. However, once *c* grows sufficiently large (approximately 28% in this example), the optimal contract becomes no contract at all. In other words, once ambiguity grows sufficiently pronounced, Sam requires such a large price premium that Bianca is no longer willing to provide it. At this point, autarky is strictly preferable to trade.

Table 2 below extends this thought experiment to consider other permutations of ambiguity aversion between the parties. When only Sam is ambiguity averse (third panel), the dynamics are qualitatively similar (though directionally reversed). As ambiguity increases, Bianca provides downside protection to Sam in the form of successively higher cancellation fees, but she simultaneously extracts a lower price. As with the case of buyer-side ambiguity aversion, once the value of *c* grows sufficiently large (around 23% in this case), Bianca is no longer willing to provide downside protection, and once again autarky is strictly preferable to trade.

Table 2. Optimal Contractual Terms
for Various Permutations of Ambiguity Aversion

	Ambiguity Aversion							
	Neither is A.A.		Only Buyer is A.A		Only Seller is A.A.		Both are A.A.	
c	Price	Damages	Price	Damages	Price	Damages	Price	Damages
0%	$250.00	$37.50	$250.00	$37.50	$250.00	$37.50	$250.00	$37.50
5%	$250.00	$37.50	$263.16	$33.33	$236.84	$41.67	$250.00	$37.50
10%	$250.00	$37.50	$277.78	$29.55	$233.75	$49.48	$262.85	$41.99
15%	$250.00	$37.50	$294.12	$26.09	$229.89	$57.19	Autarky	Autarky
20%	$250.00	$37.50	$307.50	$21.12	$223.88	$58.73	Autarky	Autarky
25%	$250.00	$37.50	$318.55	$14.60	Autarky	Autarky	Autarky	Autarky
30%	$250.00	$37.50	Autarky	Autarky	Autarky	Autarky	Autarky	Autarky
35%	$250.00	$37.50	Autarky	Autarky	Autarky	Autarky	Autarky	Autarky
40%	$250.00	$37.50	Autarky	Autarky	Autarky	Autarky	Autarky	Autarky
45%	$250.00	$37.50	Autarky	Autarky	Autarky	Autarky	Autarky	Autarky
50%	$250.00	$37.50	Autarky	Autarky	Autarky	Autarky	Autarky	Autarky

In the case where both parties are ambiguity averse, a similar effect takes hold. Note that in this case, price and damages move in the same direction. Indeed, because both parties are ambiguity averse, they are both generally reticent to provide downside protection to each other. But because Sam's outside option (*ex ante*) is more attractive than Bianca's, she may have to offer him better terms across the board to keep him in the deal. And thus, at least initially, both the price and cancellation fee increase with the parameter *c*. Nevertheless, just as in the previous permutations, uncertainty can reach a threshold at which autarky becomes strictly preferred to trade. In fact, due to the two-sided effects of ambiguity aversion, the autarky threshold is even closer than the other cases.

3. Hybrid Environments and Contingent Autarky

The analysis thus far has largely been confined to contractual environments where the ambient degree of uncertainty is fixed and known during negotiation. When uncertainty is sufficiently low, ambiguity-averse parties may choose to contract, using the terms of the deal to allocate ambiguity as well as risk. When uncertainty is high, however, parties may simply choose not to contract. Limited to these two comparisons, there is not much of an interesting story to be told for contractual conditions, MAC/MAE clauses, or other forms of contract excuses. Such interventions become more interesting in "hybrid" situations when the parties do not know

ex ante whether conditions will remain within the realm of known risks, or instead could evolve in uncertain directions.

In our running example, suppose that at the time of contracting, Bianca and Sam think they are plausibly executing their contract in an environment of pure risk (or $c = 0\%$); however, they recognize that with some probability (call it q), the environment is (or could become) typified by uncertainty so large as to deplete any gains from trade (e.g., $c = 50\%$). Suppose further that they will learn more about ambient uncertainty shortly after executing their deal (and before Sam loses his alternative buyers). How might their contracting behavior respond to such a circumstance?

One possibility, of course, is that Bianca and Sam will simply wait for the uncertainty to resolve itself, and then contract (or not). Indeed, in some circumstances such a response would probably be perfectly sensible.[72] At the same time, however, waiting may not always be prudent or convenient. In many corporate deals, for example, a number of processes must pre-date closing, such as regulatory and tax clearance, shareholder approval, due diligence, and other forms of miscellaneous planning. Many of these processes can delay the closing of a deal for months and can often take as long as one year. Waiting for the resolution of uncertainty may leave little time to reconvene at the bargaining table, structure the deal, accelerate these processes, and close. In contexts where the *ex ante* likelihood of uncertainty is low, waiting can be prohibitively costly.

Consequently, there may be some situations where ambiguity-averse parties prefer to contract straight away, but to make their contract contingent on the non-occurrence of significant uncertainty post-execution—at least for some period of time before the parties lose the ability to seek viable outside options. Suppose, then, that Sam and Bianca included an express condition in their contract that made enforceability contingent on later information revealing that they have stayed within the realm of risk ($c = 0\%$). If in contrast, it is discovered that conditions have evolved towards uncertainty ($c = 50\%$), the contract calls for autarky.

As it turns out, a contract that specifically treated migration into an environment as an express condition would fare much better than either categorical contracting or categorical autarky. Figure 4 below illustrates this point graphically for the case where the buyer (Bianca) has MEU

[72]The current unavailability of credit, even for senior secured debt and for historically safe borrowers, may itself be an artifact of uncertainty in the credit markets. *See* Gretchen Morgenson, *Darkness and Light at GE Capital*, N.Y. TIMES, Dec. 7, 2008, at BU 1 (describing how tight credit has affected GE's business model).

preferences.[73] In the Figure, the solid line represents the total welfare (in certainty equivalents) that the optimal uncertainty-contingent contract would yield for the parties. The dotted line represents the welfare that a non-contingent (but otherwise optimal) contract would yield.[74] Except for the case where the *ex ante* likelihood of uncertain conditions is zero, a contract with an uncertainty condition would yield strictly larger expected gains than would the non-contingent contract. Furthermore, these gains generally increase monotonically as the *ex ante* likelihood of uncertainty q increases, up to (just under) 60%. When *ex ante* likelihood of ambiguity crosses this threshold, moreover, autarky dominates the non-contingent contract. Here, the *only* viable contract structure between the parties is ambiguity-contingent.

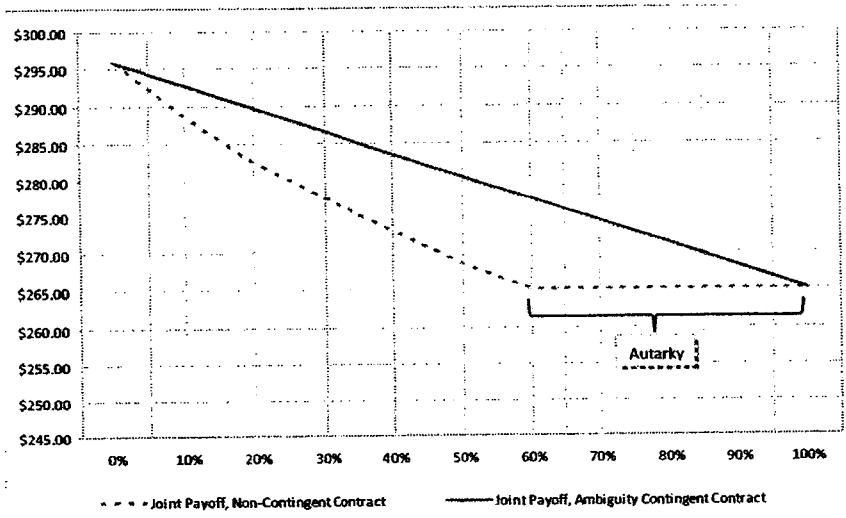

Figure 4. Gains from Ambiguity-Contingent Contract

[73]Other permutations of buyer- and seller-side ambiguity aversion are qualitatively similar.

[74]In other words, such a contract would prescribe an allocation based on the expected *ex ante* likelihood (q) of being in the maximally uncertain state versus the purely risky one. Given the value of q, this would translate into an *ex ante* set of prior beliefs ranging along the interval from (50% - q/2) to (50% + q/2).

F. *Intuitions and Corollaries*

Despite its simplicity, the above example suggests a few core intuitions that likely extend to more general environments. In particular, it suggests that in the presence of ambiguity aversion, there are distinct gains that the parties perceive from fashioning terms of their contract in a manner that accounts for prospective uncertainty surrounding the deal. An encapsulation of these intuitions for contract drafting, interpretation, and enforcement might go something as follows:

> If the surplus available through contracting remains within the domain of well-understood risks, then contracts (and the judicial enforcement of them) should be relatively insensitive to ambiguity aversion. On the other hand, if (1) conditions may plausibly transition into a domain of uncertainty, and (2) either party is ambiguity averse, then contract terms (and the judicial enforcement thereof) should explicitly account for the possibility of uncertainty. In severe cases of realized ambiguity, it may be optimal for contractual duties to be excused altogether.

Although ambiguity aversion does not categorically prescribe contract avoidance in the face of uncertainty, it at least pushes in that direction (with varying degrees of strength). Consequently, if contracting parties are ambiguity averse, those preferences should be reflected in the terms of their deals (such as MAC/MAE provisions). This observation, in turn, provides a testable implication of ambiguity aversion in contractual settings: as the prospects for uncertainty increase, the breadth and scope of express conditions within the contract should expand as well. I shall return to this prediction below in Part IV.

Before moving on, however, it may be worth pausing to consider how *courts* (as opposed to the parties) might attempt to make use of the arguments above. Indeed, even if the parties themselves have the intent to condition their duties on the absence of uncertainty, that intent is irrelevant if judicial actors are impervious to that fact. To be sure, judges frequently may not have the expertise to divine either when uncertainty is present or whether the parties genuinely care about it. There may be, however, some interpretive rules of thumb that courts can embrace when undertaking this task. I offer a few of them below.

The first corollary concerns how aggressive a stance courts should take a priori in determining ambiguity to be a significant issue. As noted above, the value of ambiguity-contingent contracts (or default rules) lies in their ability to address situations where prospective uncertainty is tangibly

present in a contractual setting. Such factors may be difficult for adjudicators to observe directly in garden variety contact disputes. In the absence of direct observation, however, it is probably sensible for courts to start with a presumption that ambiguity is not a substantial problem. First, the very fact the parties executed a contract may itself reveal their belief that the danger of ambiguity with respect to contractual gains was low. This inference likely grows to the extent that the parties failed to include an express contractual provision—such as a MAC/MAE term—signaling a desire to alter or excuse performance in uncertain environments.[75] Further still, to the extent that the parties interact in arenas where they have considerable expertise and familiarity, the effects of ambiguity are likely to be of second order importance. Finally, even if one is confident that the contractual surplus has become compromised by ambiguity, the parties' options outside contracting may be similarly compromised. Allowing a party to void the deal may do more harm than good. As a practical matter, then, absent a clear indication otherwise, it probably makes sense for courts to have a presumption against conditioning contractual duties on realized uncertainty.

Although this reasoning argues in the direction of judicial conservatism, it may only be a weak form of conservatism. There is a potential epistemic circularity between the parties' contractual choices on the one hand and their revealed judicial expectations on the other. Suppose at the time of contracting that a buyer and seller anticipated that the danger of prospective ambiguity within the contract was large. The parties might nonetheless execute the contract with few express provisions accounting for prospective ambiguity, anticipating that a court would subsequently accommodate them should such contingencies materialize. In this circumstance, a court would be mistaken were it to conclude that the parties' prior contractual conduct evinces their indifference towards ambiguity. On the other hand, this circularity problem is not completely fatal. If even modest transaction costs attend the execution of a contract, at least those parties for whom prospective ambiguity is overwhelmingly likely to gain little over autarky would not likely enter a contract. Thus, the court can probably rule out at least those circumstances where uncertainty is extremely likely (although perhaps only those cases) simply because the parties bothered to execute a contract.[76] All told, this reasoning appears to counsel for a form of weak conservatism:[77]

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[75]For a similar point, see Triantis, *supra* note 24, at 464, 466, who explains that "an omitted risk . . . is in a sense contemplated and managed at a broader level."

[76]Note that the absence of an express condition, in contrast, probably has an even weaker inferential value for courts as an interpretive guide. Indeed, conditionally contracting some set of rationalizable conjectures about the background rule could almost always justify the omission of an

> Corollary 1: Weak Conservatism Principle. *Courts should be conservative about finding ambiguity to be a substantial factor within a contract, and in the absence of other evidence should adopt a presumption that the danger of ambiguity is negligible.*

In a related fashion, ambiguity aversion delivers predictions about the dynamic nature of conditions within an optimal contract. In particular, as contracting parties become more familiar with a particular domain of unpredictability, they are likely to begin treating it less like uncertainty and more like pure risk. Consequently, as their comfort with and knowledge about various contingencies mature, they are less likely to condition performance on the non-occurrence of those contingencies. Accordingly, courts should grow more reticent about granting relief upon the occurrence of a contingency that has become more familiar to the contracting parties. This reasoning gives rise to a second corollary:

> Corollary 2: Familiarity Principle. *As parties become more (less) familiar with the characteristics of an unpredictable contingency, they will begin to treat it more (less) as a form of risk than of uncertainty. Consequently, courts should be most receptive when excusing claims predicated on the occurrence of an event whose characteristics are relatively unfamiliar to either party.*

A third principle stems from the fact that judicial actors must rely (at least in part) on the parties themselves to provide information about whether an important ambiguity contingency has arisen after contract execution. One obvious danger with affording parties such an opportunity is that they will use it strategically, as a pretext for undoing value-enhancing risk allocation decisions that have not gone in their favor. In the example from above, for instance, it is more credible for Sam or Bianca to seek avoidance when it is still unknown to either party whether the business will be a success or failure.

Perhaps a stronger reason to favor early over late asserters is that the other party's outside options are likely to wane or become more uncertain as the time past execution increases. Soon after committing to a contract,

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express condition (precedent or subsequent) in the contract.

[77]The weak conservatism principle is in many ways similar to a nuanced form of the (so-called) "precautionary principle" in environmental policy. *E.g.*, SUNSTEIN, *supra* note 37, at 119 (using the term "Catastrophic Harm Precautionary Principle"); Gardiner, *supra* note 38, at 36 (outlining the basic components of the precautionary principle).

alternative counterparties can lose interest, move on to other things, or otherwise become less accommodating. In the above example, recall that the parties learned about the existence of ambiguity at a point where both had the ability to salvage their outside options. The longer one waits, the less this is likely to be the case, and the attractiveness of allowing excuse shrinks. Consequently, there are good reasons to favor those who make early assertions of excuse rather than those who wait until a late stage of the game. This reasoning is reflected in a third corollary:

> Corollary 3: Early Bird Principle. *Courts should be most receptive to excuse claims asserted before significant uncertainty has been resolved. Excuses asserted long after the executory stage, in contrast, should be treated with skepticism.*

A final corollary concerns the process by which ambiguity associated with a contract surplus might emerge. In the example explored above, ambiguity emerged exogenously, independent of the actions of either party. In some situations outside of that explored here, however, the ambiguity-creating event may have been within the control of the party now seeking excuse. In such circumstances, courts should be loathe to allow for excuse, given that the parties undoubtedly would have wanted to deter such conduct. In more familiar Calabresian terms, one might refer to this reasoning as the "low cost ambiguity avoider" principle:[78]

> Corollary 4: Low Cost Ambiguity Avoider Principle. *Courts should be reluctant to grant an excuse if that party could have taken reasonable steps to avoid or reduce ambiguity, but failed to take such steps.*

IV. EVIDENCE AND APPLICATIONS

Although the foregoing discussion has proposed a plausible story about how ambiguity aversion can "matter" for contractarian objectives, the practical significance of that story has remained unattended. It remains unclear whether ambiguity aversion is an appreciable factor in contractual

[78]Gilson and Schwartz as well as Posner and Rosenfield suggest a similar interpretive criterion as well. Gilson & Schwartz, *supra* note 19, at 355-56 ("When a buyer attempts to exit by invoking a MAC clause, the court should ask whether the event was within the seller's ability to affect."); Posner & Rosenfield, *supra* note 57, at 98 ("[C]ontract discharge should not be allowed when the event rendering performance uneconomical was reasonably preventable by either party.").

settings, or instead is largely irrelevant or peripheral. If the latter, then we would neither expect contracting parties to expend much effort accounting for it, nor would we wish courts to alter their behavior in a likewise fashion. Addressing this question is important, especially in light of the nature of the contracts that motivate this article (acquisition agreements among sophisticated parties).

The enhanced attention that ambiguity aversion has garnered recently in the behavioral finance literature provides at least suggestive evidence that uncertainty constitutes an important limit to arbitrage in markets with sophisticated participants.[79] But it is only anecdotal and circumstantial evidence that ambiguity aversion matters for the type of contract design issues envisioned here. In this section, I consider how one might go about testing more directly for the relevance of ambient uncertainty in the design of express contract terms—specifically MAC/MAE clauses. Finding preliminary evidence consistent with the ambiguity aversion account, I then briefly consider practical applications of the approach in specific legal settings.

A. *MAC/MAE Provisions: An Empirical Test*

Perhaps the best place to examine the claims made above empirically is in the very application that motivated this article: the design and interpretation of MAC/MAE provisions in corporate acquisitions. To do so, I will make use of a unique data set of 528 recent MAC/MAE provisions from mergers and acquisitions deals executed between July 2007 and July 2008. A preliminary analysis of these provisions suggests that their structures respond to ambiguity in a manner consistent with the predictions above. In other words, the extent of ambient uncertainty appears to "matter" in predicting the reach and breadth of a MAC/MAE provision.

At the onset, it is important to realize that there are many plausible reasons parties might craft MAC/MAE provisions in practice, many of which need not be related to ambiguity aversion. As noted in the introduction, for example, Gilson and Schwartz posit that the key rationale for a MAC/MAE term is to address seller-side moral hazard; that is, a seller may be in a position to make "synergy-specific" investments in enhancing the value of the deal before closing.[80] A MAC/MAE clause, they argue, gives

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[79] *See supra* notes 46-51 and accompanying text.

[80] Gilson & Schwartz, *supra* note 19, at 357.

the target an efficient incentive to make those investments when it otherwise would be underdeterred.[81] (I will return to this thesis below.)

There may also be other plausible rationales behind MAC/MAE terms. A number of practitioners interviewed for this study, for example, suggested that, in addition to concerns about uncertainty, one of the key reasons for a MAC/MAE provision is to provide a backdrop for possible deal restructuring should market conditions change. A handful (albeit fewer) of practitioners also maintained that such provisions can provide a helpful backstop against problems of adverse selection, permitting the buyer some added room to exit a deal if it begins to appear that the seller has misrepresented its current condition, future prospects, or some other material fact.

Significantly, ambiguity aversion may not only be consistent with these alternative motivations for MAC/MAEs, but it may even complement them. This seems particularly likely for the latter two rationales for MAC/MAEs described above. Indeed, even if a principal reason for a MAC/MAE provision is to provide a template for renegotiation, that rationale may be perfectly consistent with ambiguity aversion once one considers why a restructured deal is desirable to begin with. In the numerical example above, for instance, uncertainty justified autarky in "extreme" cases; but for more moderate levels of uncertainty, closing the deal likely remains efficient, albeit on restructured terms that are responsive to new information about ambiguity.[82] Viewed in this sense, information about ambiguity itself may provide part of the rationale for restructuring, and the credible triggering of the MAC can provide a backdrop against which the parties attempt to seize those gains. Similarly, the presence of asymmetric information by a seller may plausibly exacerbate problems with ambiguity aversion. If a buyer knows a seller has significant private information but is unsure about how that information is distributed across seller "types," then she may discount the value of trade significantly.[83]

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[81] *Id.* at 332.

[82] *See supra* tbl.2, p. 780.

[83] *See* Schwartz & Scott, *supra* note 57, at 606 n.139. The joint occurrence of private information and ambiguity aversion, moreover, may intersect meaningfully with the role of MAE/MACs in facilitating restructuring. If transaction costs from restructuring are high (due, say, to asymmetric information), then the background allocation of entitlements can affect bargaining. Here, the existence of a MAC (even one whose legal effect is unpredictable) may catalyze bargaining. *See, e.g.*, Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027, 1053 (1995) (stating that the "information-forcing character of liability rules" has an "efficiency-enhancing effect"); Albert Choi & George Triantis, *Completing Contracts in the Shadow of Costly Verification*, 37 J. LEGAL STUD. 503, 526 (2008) (concluding that "a costly but noisy signal can play an important role in incentive provision[s]").

Ambiguity aversion may also be consistent with Gilson and Schwartz's moral hazard story, but if so, to a more attenuated degree.[84] In theory, both phenomena may simultaneously motivate the adoption of MAC/MAEs. And in fact, if there is uncertainty around how best to motivate a seller to maintain value in the company before closing, then moral hazard concerns may also amplify payoff ambiguity; on the other hand, there may also be reasons to believe that the two accounts are not fully parsimonious. For example, in cases of severe prospective exogenous uncertainty surrounding the gains from trade, ambiguity aversion suggests that the incidence and breadth of MAC/MAE provisions should rise. In those same environments, in contrast, the deal-preserving specific investments envisioned by Gilson and Schwartz may grow less relatively important (akin to planting flowers in one's garden notwithstanding an approaching Category 5 hurricane).[85] In the Gilson and Schwartz framework, the breadth of a MAC/MAE provision should grow in circumstances where the target's moral hazard problem is most severe: they posit that high technology targets are likely to be a prime example of such a circumstance.

The raw data I utilize comes from Nixon Peabody LLP's annual analysis of MAC clauses, the summary statistics of which are published each November.[86] Nixon Peabody has been producing this survey for seven years,[87] and since 2005 its methodology has become sufficiently consistent to be usable in empirical investigations. As illustrated in the left panel of Table 3,[88] the data consists largely of a set of binary variables describing the MAC/MAE terms of each deal. In the 2007-08 report, there were thirteen distinct categories of MAC/MAE clauses, including terms that deal with the target's financial condition, the seller's or buyer's ability to close the deal, benefits contemplated by the agreement, either party's ability to continue to operate business immediately after closing, and general prospects of the target. In addition to these MAC/MAE categories, the data also reflects the existence and scope of exceptions (or "carve outs") to the MAC/MAE.

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[84]Indeed, the sole focus of Gilson and Schwartz's analysis is specific investments, and thus both buyer and seller are presumed to be risk- and uncertainty-neutral. Moreover, Gilson and Schwartz do not allow for alternative contract terms (such as earn outs or cancellation fees) to allocate risk between the parties—in their theoretical approach (and the predictions it spawns), the allocation is accomplished solely through deal price and the MAC. Gilson & Schwartz, *supra* note 19, at 339.

[85]*See also* Mukerji, *supra* note 58, at 1222-23 (making a similar point that incentives may be less important for affecting the worst-case scenario outcomes).

[86]NIXON PEABODY LLP, SEVENTH ANNUAL MAC SURVEY (2008), *available at* http://www.nixonpeabody.com/publications_detail3.asp?ID=2488.

[87]*See id.* at 2.

[88]*See infra* tbls.3, 5, pp. 807-10.

Carve outs create categorical nullifications of MAC/MAEs, specifying domains over which a material adverse event cannot occur.[89] They therefore are a limiting factor on the scope and reach of a MAC/MAE provision. In the 2007-08 report, there were thirty-one such exceptions, including a change in trading price or trading volume of company's stock, changes in interest or exchange rates, war, terrorism, acts of God, political volatility, legal change, bankruptcy, and national and international calamities.[90] As is typical, virtually all of the MAC/MAE provisions were on the buyer side, perhaps an implicit nod to the observation that corporate law frequently mandates an asymmetric seller-side option to exit, via the *Revlon* doctrine and the statutory requirement of shareholder approval.[91]

There are a number of advantages to the Nixon Peabody sample over other existing MAC/MAE databases.[92] First, although it covers only a fraction of deals announced each year, the Nixon Peabody data still samples a relatively large swath of cash mergers, stock mergers, asset sales, equity sales, and tender offers (skewed somewhat towards larger cash and stock deals). In addition, the data set also contains all combinations of public and

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[89]The *Hexion* case, for example, involved a relatively general MAC/MAE pertaining to the "financial condition, business, or results of operations" of Huntsman; but its carve outs excluded among other things any "changes in general economic or financial market conditions" that did not have a "disproportionate effect on the Company." Hexion Specialty Chems., Inc. v. Huntsman Corp., 965 A.2d 715, 736 (Del. Ch. 2008).

[90]*See* NIXON PEABODY LLP, *supra* note 86, at 7-11. Significantly, the absence of a MAC/MAE provision does not necessarily imply the absence of exceptions. The handful of deals that lacked a MAC nevertheless had specific exceptions written into them. Thus, the variable "nomac" enters as a miscellaneous variable in this coding scheme.

[91]*See* DEL. CODE ANN. tit. 8, §§ 251(c), 271(a) (2001) (stating the terms of shareholder approval with respect to mergers, sales, leases and exchanges of assets); Revlon, Inc. v. MacAndrews & Forbes Holdings, Inc. 506 A.2d 173, 184 (Del 1986). In some cases, buyers also have to obtain shareholder approval, but such constraints are often relatively simple to avoid through triangular mergers and asset sales. In stock deals, publicly traded buyers may have to seek shareholder approval to dilute current voting shares by 20% or more. *See* NYSE, Inc., Listed Company Manual § 312.03(c) (2007), *available at* http://nysemanual.nyse.com/lcm/. Even that requirement, however, can be waived in extreme cases if a delay would seriously jeopardize the company's viability. *Id.* § 312.05; *cf. In re* Bear Stearns Litig., 870 N.Y.S.2d 709, 723, 731 (Sup. Ct. 2008) (dismissing a shareholder complaint against a target who sold lock-up block to an acquirer amounting to a 39.5% dilution, and declaring that the court "will not second guess" the board's decision).

In the analysis presented below, I retained the modest number of seller-side MAC/MAE provisions, as they tended to attend stock deals. Excluding them does not appreciably change the results, however.

[92]Both Gilson and Schwartz and Antonio Macias collected and coded MAC provisions from public target acquisitions from before 2005. Gilson & Schwartz, *supra* note 19, at 351-53; Antonio J. Macias, Risk Allocation and Flexibility in Acquisitions: The Economic Impact of Material-Adverse-Change (MACs) Clauses 2 (Apr. 17, 2009) (unpublished manuscript), *available at* http://ssrn.com/abstract=1108792.

private targets and acquirers. A third advantage to the data set is that it was created by practicing lawyers, and thus both its classificatory scheme and actual coding are more likely to reflect the judgment of practitioners who negotiate these instruments. But perhaps most significantly, the time period available for study here is particularly interesting because it covers MAC/MAE provisions that were executed commencing in early summer of 2007, before the sudden meltdown of the private equity wave, through midsummer of 2008. This is a time span in which significantly greater uncertainty entered financial markets.

A downside of the Nixon Peabody data is that it is largely limited to the deal value and the MAC/MAE characteristics of the transactions. There are no additional coded attributes related to the deal,[93] firm-level controls, or market controls. Such information is obviously helpful if one is interested in how such variables predict the existence and structure of MAC/MAE terms within the overall deal. In order to consider the effects of market conditions and firm-specific attributes, I merged the Nixon Peabody sample with deals recorded in the Thompson's SDC Platinum M&A database. SDC is an extremely broad database that contains not only information about the structure of each deal (its financing, structure, etc.) but also firm-specific characteristics of both the buying and selling firms. (It does not, however, include an analysis of MAC terms.) In areas where the SDC data was incomplete or appeared unreliable, I supplemented the data when possible with hand-collected information through press reports and SEC filings.

Table 3 describes the cross sectional attributes of the data set, and how it measures the various terms of both MAC/MAE provisions and exceptions of the original 528 deals, as well as the 452 records with a successful name-date match in the SDC data set. The third panel of the table also displays the MAC/MAE characteristics for the 247 matched deals involving public targets. It is the public sellers for which the largest amount of information is available.

Because I am interested in understanding how various factors (including a measure of ambient market uncertainty) affect the structure of an agreement, it is necessary to have a strategy for evaluating (or "scoring") the terms of a deal. The bottom panels of Table 3 consider a number of

[93]Typical acquisition agreements contain a litany of terms beyond the MAC/MAE and pricing terms. Examples of such terms include cancellation fees, "bring down" clauses, no-shop and go-shop clauses, earn outs, asset lockups, topping fees, and voting trust agreements. Although the SDC database, *infra* tbl.5, pp. 809-10, covers some of these other provisions, its coverage was too erratic to be helpful for this study. In future efforts, I hope to augment this spotty SDC data through hand collection.

plausible scoring algorithms for the Nixon-Peabody data. Each score captures a measure of the extent of MAC/MAE coverage or carve out coverage or both. The MERatio, MEPerc, and MERelCov algorithms are particularly worth noting, as they attempt to capture both MAC/MAE terms and carve outs. In each, a larger number of MAC/MAE provisions increases the overall score, while a large number of exceptions decreases it. Because these scoring functions are atheoretic, I have no reason to believe that one is better than another. For brevity and concreteness, however, I will focus below on MEPerc, which measures the total number of MAC/MAE provisions relative to the total number of provisions (MAC/MAEs plus exceptions). MEPerc is a convenient scoring rule, as it is bounded theoretically below by zero and above by (approximately) one, thereby facilitating the interpretation of coefficients.[94]

For those interested in how the Hexion-Huntsman deal compares, the last column of Table 3 presents the coding for that transaction (which is one of the 528 deals captured in the data set). Consistent with popular zeitgeist,[95] the Huntsman MAC/MAE provision does appear limited in the number of affirmative MAC/MAE provisions granted to the buyer, and its scores generally reflect this characterization. At the same time, however, the difference between the Huntsman deal and the remaining sampled population falls well short of extreme. Under each scoring rule, for example, Hexion-Huntsman falls within a standard deviation of the mean (and it is barely distinguishable from other public targets).[96]

In addition to firm-level characteristics, I matched the deals with external market data relating to factors that could influence the attractiveness of the transaction, through the time value of money, risk environment, and ambient uncertainty. To reflect an economy-wide benchmark for time value, I included measures of the risk-free rate of return. The actual cost of capital that firms face, however, is above the risk-free rate, due to the undiversifiable risk that investors may bear. I therefore also included a number of risk

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[94]It also appears to be distributed approximately normally within the sample, which suggests that the ordinary/generalized least squares estimation is an appropriate approach. As a robustness check, in unreported regressions I have estimated all the specifications reported below with the other two comprehensive scores (MRatio and MECoverage). Both cases produce qualitatively similar results.

There are undoubtedly countless approaches for scoring these contractual provisions. The scoring approaches offered here represent a first (but almost certainly not a final) stab at the issue.

[95]*See supra* notes 4-15 and accompanying text (describing the *Hexion* decision and news commentary surrounding the deal).

[96]Of course, some of the attributes of the deal that made it appear seller-friendly concerned non-MAC/MAE provisions. *See* DealBook, *supra* note 13 (analyzing how the deal "leaves little room for Hexion to escape [the] transaction").

adjustment factors, including (1) the industry-wide β for the target's industry group;[97] (2) the market risk premium, defined as the difference between the return on the risk-free rate and the return on a value-weighted market portfolio; and (3) the cross product of the market risk premium and industry-wide β. Because the deals in the data set are generally negotiated during a period of weeks leading up to the announcement date, both the risk-free rate and the market risk premium are computed using the lagged two-week means for each predating the announcement date.

Finding a good proxy for uncertainty (as separate from time value and risk) is more challenging. There is not, to my knowledge, a consensus measure that captures the extent or degree of market uncertainty. Nevertheless, one candidate measure of uncertainty that has been quickly growing in popularity during the last few years is the CBOE's volatility index "VIX," which reflects average implied volatility implied from a collection of put and call option markets. VIX is often known as the "fear index," and is described by the business press as a reflection of investors' sense of unease due to the uncertainty present in the market.[98] The value of VIX generally rises as expected volatility in the market rises.[99] As noted above,[100] whether expected volatility comes from upward market movements, downward market movements, or gyrations around a stationary point should not matter—at least in theory—for the value of the VIX index. However, a number of studies have demonstrated that VIX is systematically larger when markets are falling than when they are rising, an observation that is not generally predicted by standard expected utility theory.[101] Such observations are, however, consistent with various accounts of prospect theory (including ambiguity aversion). Relatedly, a number of financial economists have begun to use VIX (or a derivative of it) as a basis for measuring uncertainty.[102] As with the market risk premium, to allow for the

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[97]The risk metric β comes from the Capital Asset Pricing Model (CAPM) and reflects the risk that a specific financial asset (such as a stock) has relative to a market portfolio. A low value of β (below 1.0) reflects low risk relative to the market, while a high value (above 1.0) reflects greater risk. *See* MARK GRINBLATT & SHERIDAN TITMAN, FINANCIAL MARKETS AND CORPORATE STRATEGY 151-54 (2002) (introducing CAPM and briefly explaining its practical application).

[98]*See* Lauricella & Lucchetti, *supra* note 49, at C1.

[99]*Id.*

[100]*See supra* notes 50-51 (explaining why the value of the VIX index shifts).

[101]*E.g.*, Hibbert et al., *supra* note 50, at 2256; Low, *supra* note 50, at 544 ("I find that this metric of risk perception tends to increase when downside volatility increases more than upside volatility.").

[102]*E.g.*, Bollerslev et al., *supra* note 51, at 16; Drechsler & Yaron, *supra* note 51, at 1. VIX may not reflect solely ambiguity and may have risk perceptions embedded within it as well. Thus, some caution is warranted in interpreting the extent to which VIX appears to predict deal structure.

time to negotiate a deal, I recorded the lagged two-week means of VIX closing values leading up to each deal's announcement date.

As a preliminary matter, Gilson and Schwartz posit that their moral hazard story is most salient in areas where unobservable investments by targets in "deal synergies" are important.[103] In particular, high technology industries represent an area that is susceptible to this phenomenon, and thus we should expect more MAC/MAE coverage related to investment-specific risk.[104] Table 4 compares high technology to other firms, along various measures of MAC/MAE and exclusion breadth. High tech deals appear, on the whole, to be quite comparable to other firms in the number of MAC/MAE provisions they include, yet they have nearly 1.3 more carve outs. In terms of the scoring algorithms described above, the additional number of carve outs is reflected in slightly narrower overall MAC/MAE breadth, though this difference is statistically significant in only one of the three measures (MERelCov). As an initial matter, MAC/MAE provisions in high technology deals appear to be mildly narrower than those in other deals, which runs contrary to the Gilson and Schwartz account (albeit weakly).

Table 4. Comparison of High Tech to Non-High Tech Targets in Matched Sample

	Non High Tech Target	High Tech Target	Difference
Total # of MAC/MAEs	2.749333 [1.320789]	2.753247 [1.065683]	-0.003914 [0.16030062]
Total # of Eclusions	8.357333 [4.453598]	9.636364 [4.454179]	-1.279031 [0.5572227]*
MERatio	0.4637165 [0.5913538]	0.3940101 [0.5503312]	0.0687064 0.0731455
MEPerc	0.2600616 [0.1556253]	0.2331057 [0.141436]	0.0269559 [0.0191827]
MERelCov	-0.0404803 [0.1553072]	-0.0814132 [0.1635743]	0.0409329 [0.0196097]*
Number of Targets	375	77	

N=452; standard error in brackets; *significant at 5%; **significant at 1%

At the same time, one must be cautious about making inferences about high tech deals generally (or the moral hazard argument specifically) without

Consequently, I have also included a number of conventional measures of risk (and given that VIX is not conventionally viewed as one of them). In addition, I have also rerun the analysis (with consistent results) using alternative derivatives of VIX.

[103] Gilson & Schwartz, *supra* note 19, at 357.

[104] *Id.* at 354-55.

attempting to control for other variables of interest. Many factors (including ambiguity and uncertainty) may also play a unique role in industries like technology, where a significant component of firm value comes from intangible rather than tangible assets.[105] Attempting to correct for this unobserved variable bias requires—at the very least—the inclusion of additional controls, a task to which I attend below.

Two aspects of each deal are broadly observable in the data: (1) the total deal value, and (2) the MAC/MAE scores. It is important to keep in mind that just as with the numerical example from Part III, price and non-price terms are determined simultaneously, as a by-product of negotiation. Consequently, it would be inappropriate to include deal price or premium as a right hand side variable in predicting the intensity of a MAC/MAE provision. Nor, for that matter, would it be desirable simply to ignore the information on deal value, since shocks that affect price would likely also affect non-price terms and vice versa. Thus, my empirical strategy in what follows is to estimate price and MAC/MAE score regressions jointly, using a seemingly unrelated regressions approach.[106]

Table 5[107] contains selected results from the full collection of matched deals involving both public and private acquirers and targets. Each panel of the table reflects jointly estimated coefficients for (1) the deal value (logged), and (2) the score associated with the MAC/MAE terms (captured by MEPerc). There is limited data coverage of firm-specific control variables for private companies beyond the basic deal terms, a fact reflected by the relatively modest number of controls and goodness for the regressions in the table. Nevertheless, at least for the larger specifications, both the price and non-price estimations generate coefficients that are jointly significant at the 0.01 level or better.

Recall from the earlier analysis of ambiguity aversion in Part II that uncertainty will have an ambiguous effect on price, but a positive predicted effect on the attractiveness (and thus breadth) of a MAC. Interpreting VIX

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[105]Even Gilson and Schwartz themselves subdivide among high tech deals. Given that my primary question of inquiry is whether there is evidence of ambiguity aversion in deals, rerunning the entirety of Gilson & Scwhartz's results for a later time period here is only of secondary interest.

[106]*See* Arnold Zellner, *An Efficient Method of Estimating Seemingly Unrelated Regression Equations and Tests for Aggregation Bias*, 57 J. AM. STAT. ASS'N 348, 349-52 (1962) (establishing an estimation procedure that uses "seemingly unrelated regression equations").

[107]*See infra* tbl.5, pp. 809-10. The alert reader will note that simultaneous estimation of both the price and the MAC/MAE specifications is not necessary if one uses the same controls in each. *See infra* pp. 809-10. If one uses different right hand side variables between two expressions, however, SUR is appropriate. In unreported regressions (available from author), I have checked the robustness of these results to non-symmetric specifications, and for which a SUR specification provides a clearer efficiency advantage. The results appear robust.

as a measure of uncertainty, this prediction appears to be born out. Specifically, VIX has a consistently positive and statistically significant predictive effect on the MAC/MAE score. Although the practical significance of the coefficient's size may appear small on first blush, corrected for their respective ranges, a 1.0 standard deviation increase in VIX would predict an approximate 0.35 standard deviation increase in the MAC/MAE score. This corresponds to an appreciable (though not overpowering) degree of economic significance. In comparison, VIX has a statistically insignificant predictive effect on logged deal value (trivially consistent with the predictions of ambiguity aversion).

In contrast to the estimated VIX coefficients, more conventional risk measures—and particularly β—appear to play a much different predictive role. Higher values of β predict a lower deal value (albeit with sporadic statistical significance), and virtually no effect on MAC/MAE structure. One plausible interpretation of this finding is that fluctuations in risk tend to be reflected in price terms (if at all), while fluctuations in uncertainty tend to be reflected in non-price terms, such as MAC/MAE structure.

A few other features of these regressions are worth noting. First, strategic buyers appear on average to pay less than financial buyers and demand slightly broader MAC/MAE terms (though the latter effect is not statistically significant). In addition, the accounting value of the acquirer (one of the few financial variables broadly represented across SDC matched deals) predicts a higher deal value and no discernible effect on MACs. This possibly reflects both the fact that larger acquirers are better organizational matches for larger targets, as well as the possibility that larger acquirers are less likely to be risk averse. Acquisitions of public targets by private buyers (principally private equity deals) are more likely to have both higher deal values and narrower MAC/MAEs relative to any other public-private dyad.[108]

Finally, after controlling for other factors, there appear to be few differences in MAC/MAE when the target is a high technology firm. In fact, in this set of regressions, a high tech target appears to predict a lower

[108]If reduced investor diversification within private buyers is a proxy for greater organizational risk and ambiguity aversion, this effect seems inconsistent with both a risk- and uncertainty-based account of MAC/MAE provisions. On the other hand, financing of these deals is still often syndicated more broadly, and the acquirers may immediately realize significant and immediate upside benefits (e.g., elimination of agency costs, deregistration, etc.). Moreover, since incumbent management frequently works with private equity investors, the attributes of the firm may already be familiar to the acquirer, dampening the effects of ambiguity aversion. It bears noting that most of the deals in this dyad reflect cash acquisitions, and thus the pressure to close quickly may reduce the need for a broad MAC/MAE.

MAC/MAE score.[109] Compared to Table 4,[110] then, the possibly distinct structure of tech deals dampen considerably when one controls for other possible factors (including market uncertainty). One possible reason for the reduced evident power of the Gilson and Schwartz story[111] is that the sample of MAC/MAE provisions they study comes from announced public acquisitions in 1993, 1995, and 2000, a period of significant market advances. The data studied here, in contrast, correspond with a period of notable market declines. Within behavioral finance, ambiguity aversion has been found to be more prevalent during market downturns than during booms—an observation that suggests the relative importance of ambiguity aversion may be counter-cyclical.[112]

The sparsity of controls in Table 5 may give some cause for concern, suggesting that it may be fruitful to repeat the above exercise with public targets only, for which more firm-specific controls are available. Table 6[113] reports on the results of this narrower—but deeper—inquiry, adding controls that include the target's pre-bid equity value (logged), the target's total assets (logged), the targets total liabilities (logged), the target's four-week return on equity, and the target's and acquirer's earnings per share.

Note that limiting the inquiry to public targets immediately reduces the usable sample size by around 50% while adding a number of control variables, a combined effect that can reduce precision of the estimated coefficients. Nevertheless, even with this reduction in usable data, the overall explanatory power of regression specifications in Table 6 jumps considerably from Table 5. Both the pricing and MAC score coefficients are jointly significant at either the 5% or the 1% levels across all specifications, and a number of financial asset and income variables have significant explanatory power.

More to the point for the instant inquiry, the estimated coefficients on VIX remain quite solid and consistent, barely changing from Table 5. In all specifications, the VIX coefficient is statistically significant at either the 5% or the 1% level. In addition, the economic magnitudes of the estimated VIX coefficients are, if anything, larger than they were in Table 5. Also consistent with the previous iteration, the key measure for transaction risk,

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[109]This finding is robust to the score used, including MERelCov, where tech deals appeared to have the strongest measurable difference.

[110]*See supra* tbl.4, p. 794.

[111]Ultimately, this remains a question that admits considerable speculation, and is the target of future research. *See generally* Gilson & Schwartz, *supra* note 19.

[112]*See* Barberis & Thaler, *supra* note 44, at 1074-75 (stating that ambiguity aversion is accentuated in moments where a decision maker feels incompetent).

[113]*See infra* tbl.6, pp. 811-12.

average target-industry β, generally tends—all else constant—to predict lower values but not the breadth of MAC/MAE provisions.

As before, private acquirers of public targets tend to pay more (controlling for target-level variables) than do public acquirers. However, there does not appear to be a statistically significant difference between public and private purchasers in their proclivity to execute broad or narrow MAC/MAE provisions.

One potential cause for both Tables 4 and 5 is that the proxy I use for ambiguity, VIX, possibly reflects both risk and ambiguity factors, thereby possibly causing me to overattribute the effects of ambiguity. Note that both the above specifications attempt to address this issue indirectly, by including other more conventional risk proxies (such as industry β and market risk premium). However, as one additional robustness check, I reran all of the analyses in Table 1 using the "variance risk premium," a transformation of VIX, which consists of the difference between VIX and the realized forward volatility realized by the reference assets. This alternative measure has been advocated in other studies for representing ambiguity.[114] Although some of the results weaken slightly in some specifications, others actually become stronger. On the whole, then, this robustness test appears to give roughly analogous results.

The inclusion of target-level financial control variables (such as assets and liabilities) in specifications [3]-[5] also appears to have explanatory power in predicting the deal value. Somewhat curiously, in specifications [3] and [4], total target liabilities appear to have a *positive* predictive effect on value. Total assets, in contrast, appear to enter negatively and with paltry statistical significance. These observations appear curious at first blush (e.g., suggesting that companies with greater debt relative to equity should command a higher price). A means for resolving this curiosity is to note that each of the first four specifications in Table 6 also include a control for the pre-announcement equity value of the target, which itself is likely endogenous to other right hand side variables and may in particular reflect public investors' assessment of the target's acquisition value. Moreover, it may be that part of the economic gains from the transaction (particularly private equity deals) come from the inability of targets to realize the tax advantages of leverage and the view (at least from the acquirer's perspective) that the target's existing debt load was overly penalized by public investors. When one drops pre-announcement equity value from the joint regressions

[114] *See supra* note 51. In the interests of space, and given their general similarity, I have not reported these robustness tests here.

(specification [5]), the total assets coefficient in the price equation becomes strongly positive, and the total liabilities coefficient becomes strongly negative,[115] as a priori intuition would suggest. Greater target-level assets pre-dict narrower MAC coverage and a smaller score, while greater liabilities predict a larger score. While this observation is likely consistent with ambiguity aversion, it is also consistent with other theories.[116]

Finally, whether a deal involves a high tech target is not terribly predictive of MAC/MAE structure. Across the specifications in Table 6, tech deals manifest effects that are mildly positive in sign but uniformly insignificant statistically.[117] Thus, the public target deals from 2007 to 2008 also do not appear (at least in the aggregate) to provide strong support for the moral hazard thesis of Gilson and Schwartz.[118] It may be that both the adverse selection and ambiguity stories have explanatory power, but that in the last year the former account has been of first order importance. If so, then the systematic relationship between uncertainty and MAC/MAE coverage may not hold over longer periods of time. Further investigation may be able to test this conjecture.[119]

All told, a preliminary empirical assessment of recent MAC/MAE structures yields evidence that is consistent with the claim that ambiguity (or the prospective anticipation of it) plays a significant role in determining deal structure.

B. *Legal Applications*

The previous sections have argued that ambiguity aversion provides both a plausible and empirically supportable account of why contracting parties might adopt express conditions of performance (such as MAC/MAEs) and how they might structure them. In light of these arguments, I

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[115]Dropping pre-announcement equity value, in contrast, does not affect the VIX coefficient at all.

[116]Including common sense: people pay more for things that are likely to be worth more, and vice versa.

[117]This lack of predictive power is even more pronounced when measured against alternative MAC/MAE scores, such as MERelCov.

[118]As another robustness check, in unreported regressions (available for author), I interacted both the VIX uncertainty measure and the various risk measures with the high tech dummy variable and reran the regressions. There, MAC scores of high tech targets appear *even more* responsive to market uncertainty than other types of firms, and no more sensitive than other firms to target level risk measurements. This finding is also consistent with ambiguity aversion even within (indeed particularly within) high tech firms in 2007-08.

[119]In future work, I plan to include the entire panel of MAC/MAE provisions from 2005 through 2008, which may allow for testing longer-term time trends.

consider below a few brief applications within "real world" cases. Ultimately, these applications are tentative, but they nonetheless help to lay out how, as a practical matter, my thesis might be fruitful for understanding actual disputes. In the following subsections, therefore, I will first return to the *Hexion v. Huntsman* decision, assessing how the opinion fares through the lens of ambiguity-averse contractarianism. I then briefly consider the same exercise in the context of *IBP v. Tyson Foods*, a well-known predecessor to *Hexion*. In both cases, I argue, the analyses offered by the Delaware Court of Chancery is consistent with an ambiguity account (as defined above), though *Hexion* more so than *IBP*.

1. *Hexion v. Huntsman*

Recall that in *Hexion*, Vice Chancellor Lamb rejected a pre-trial claim that a material adverse event had transpired, and instead required Hexion to exercise its best efforts to close the transaction.[120] How would his opinion fare through the lens of ambiguity aversion? On first blush, the prospects might not look particularly good. Given the magnitude of uncertainty that typified the market by the late spring of 2008, one might argue (with some justification) that Lamb was insensitive about how this uncertainty might have compromised the likely gains from the deal. Viewed from this perspective, Lamb may have been too quick to conclude that no MAE had transpired.

On the other hand, numerous other factors in this case likely justify its outcome, even within the framework of ambiguity aversion. As noted above, the MAC provisions combined with the other terms of the deal made for a discernibly unforgiving instrument. This narrow scope has information content about the parties' situation. Vice Chancellor Lamb's resulting response to this signal, in turn, bears some similarity to the principle of Weak Conservatism. Indeed, in the opinion Lamb specifically recognized the relatively narrow berth provided Hexion by the terms of the deal, and accordingly placed a higher burden for overcoming that presumption.[121]

In a related vein, one of the more interesting doctrinal aspects of the case involves how the court effectively treated the clause as a condition subsequent (notwithstanding the express language in the deal that strongly suggested a condition precedent).[122] In practice, this distinction is more than

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[120]Hexion Specialty Chems., Inc. v. Huntsman Corp., 965 A.2d 715, 722 (Del. Ch. 2008).

[121]*Id.* at 739-40 (placing "the burden to show the existence of an MAE squarely on Hexion").

[122]*Id.* at 757 ("Huntsman is correct that the solvency of the combined entity is *not* a

rhetorical, since it determines the (often dispositive) question of who bears the burden of proof. For conditions precedent, the non-breaching party must prove by a preponderance of the evidence that the nominated condition occurred, and only after such an occurrence would the defendant's duty be triggered.[123] In a condition subsequent, it is the (allegedly) breaching party who must prove that the nominated condition occurred, as a means for excusing his obligation.[124] As Lamb's opinion appears to make clear, absent a clear indication from the parties, the linguistic presentation of the MAE/MAC will not determine its interpretation:

> [MAC/MAEs] are strange animals, *sui generis* among their contract clause brethren. It is by no means clear to this court that the form in which a material adverse effect clause is drafted (i.e., as a representation, or warranty, or a condition to closing), absent more specific evidence regarding the intention of the parties, should be dispositive on the allocation of the burden of proof. Typically, conditions precedent are easily ascertainable objective facts, generally that a party performed some particular act or that some independent event has occurred. A material adverse effect clause does not easily fit into such a mold, and it is not at all clear that it ought to be treated the same for this purpose. Rather . . . it seems the preferable view, and the one the court adopts, that absent clear language to the contrary, the burden of proof with respect to a material adverse effect rests on the party seeking to excuse its performance under the contract.[125]

Given the degree to which M&A attorneys obsess over linguistic minutiae, Lamb's skepticism about the deterministic nature and plain meaning of language is curious (and borderline Traynoresque[126]). Nevertheless, while this part of the opinion may offend doctrinal purists, his interpretational presumption may also be consistent with the principle of Weak Conservatism.[127] As noted above, the relatively seller-friendly terms of the

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condition precedent to Hexion's obligations under the merger agreement.") (emphasis added).

[123] RESTATEMENT (SECOND) OF CONTRACTS § 225 cmt. a (1981).

[124] *Id.*

[125] *Hexion*, 965 A.2d at 739 (footnotes omitted).

[126] *See* Pac. Gas & Elec. v. G.W. Thomas Drayage & Rigging Co., 442 P.2d 641, 644-46, (Cal. 1968) (Traynor, C.J.) (reversing the application of the parol evidence rule, and holding "[i]f words had absolute and constant referents, it might be possible to discover contractual intention in the words themselves and in the manner in which they were arranged. Words, however, do not have absolute and constant referents").

[127] *See supra* Corollary 1, p. 785.

deal were a plausible signal that the parties viewed ambiguity aversion to be relatively unimportant *ex ante*.[128] Construed in this way, it economizes on judicial resources and litigation costs for the court to place the burden on the party who is claiming that the least plausible (*ex ante*) state has now come to pass. As applied here, then, it makes considerable sense to require the party seeking excuse (i.e., Hexion) to demonstrate that the uncertain contingency had occurred—the very fabric of a condition subsequent.[129]

Two other factors appear further to justify the *Hexion* outcome. First, as has been noted numerous times (including in Lamb's opinion) Hexion did not come forward to attempt to trigger the MAE/MAC clause until nearly a year after the deal's announcement.[130] Even by the standards of large corporate acquisitions, this is very late in the game. Viewed in this light, the Early Bird Principle suggests that Lamb was rightly skeptical of Hexion's position, particularly given that they came at a point where Huntsman's outside prospects were sufficiently compromised.[131] Second, Lamb reserved considerable disapprobation for the fact that while Hexion was ostensibly under a duty to use best efforts to close the merger, it instead proactively attempted to engineer an insolvency opinion in order to trigger the MAC/MAE, providing its financial advisor with self-serving (negative) projections of potential synergies, and possibly even managing its own accounting practices to render that result.[132] Given that the seeds of the alleged uncertainty about the deal were at least in part sown by Hexion's own behavior, the Least Cost Ambiguity Avoider Principle may also support the outcome.[133]

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[128]*See* DealBook, *supra* note 13, and accompanying text.

[129]Another potentially important consideration would involve identifying which party has better access to information that would verify or disprove the emergence of the uncertainty contingency, and to assign initial presumptions to force that party to come forward. In many ways, this point parallels the famous Prosser/Wigmore debate over *res ipsa loquitur* doctrine. *See* WILLIAM L. PROSSER, HANDBOOK OF THE LAW OF TORTS 302 (1941) (characterizing *res ipsa loquitor* as an "inference of negligence" that a fact-finder is "permitted but not compelled to accept"); JOHN HENRY WIGMORE, A TREATISE ON THE ANGLO-AMERICAN SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW 397 (3d ed. 1940) (stating that *res ipsa loquitor* does not "ask[] the Court to perform a process of inference"—rather, it "proves or disproves itself").

The *Hexion* case does not seem clear cut in either direction; however, it seems at least plausible that a strategic buyer (like Hexion) may have better information about the nature and predictability of synergistic gains.

[130]*See Hexion*, 965 A.2d at 723. The parties signed the agreement on July 12, 2007; the plaintiffs filed suit on June 18, 2008. *Id.*

[131]*See supra* Corollary 3, p. 786.

[132]*Hexion*, 965 A.2d at 751-54.

[133]*See supra* Corollary 4, p.786.

2. *IBP Inc. v. Tyson Foods*

The *Hexion* case is but a recent shot in a decade-long volley of MAC/MAE jurisprudence. Interestingly, no Delaware case to date has actually found a MAE to have occurred.[134] The doctrinal pedigree of these cases, while perhaps modest by comparative standards, contains a number of notable entries, perhaps none more so than *In re IBP Inc. Shareholders Litigation*,[135] which involved a 2000 merger agreement that was the by-product of an auction for control of IBP between Tyson Foods (the ultimate winner) and a management buyout group. Unlike in *Hexion*, the merger agreement contained a MAC/MAE that was notable in its breadth, containing few of the exceptions that typify many similarly situated deals.[136] Months after the deal was announced, IBP began to experience poor earnings (due to a combination of an impairment to a subsidiary and cyclical revenue downturns).[137] Tyson then sought to trigger the MAC/MAE provision to excuse performance.[138]

Using conventional contract interpretation doctrines (though applying New York law), Vice Chancellor Strine found the MAC had not been triggered, on what was self-described as a "close" call.[139] One of the more controversial aspects of Strine's opinion was that it narrowed the scope of the MAC/MAE beyond its apparently broad text, holding that "a buyer ought to have to make a strong showing to invoke a Material Adverse Effect exception to its obligation to close."[140] To make such a showing, Strine held, a buyer would have to demonstrate the occurrence of a significant event that could not have been easily foreseen at the time of contracting:

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[134]Given the nature of settlement, this is not necessarily dispositive about the non-receptivity of Delaware courts to MAC/MAE provisions. In late 2007, for instance, Kohlberg Kravis Roberts & Co. (KKR) and Goldman Sachs invoked an MAE clause to escape an $8 billion buyout of Harman International. The case did not go to litigation, but resulted in a settlement whereby the parties terminated the acquisition, replacing it with a much smaller private debt placement. Dana Cimilluca & Dennis K. Berman, *KKR, Goldman Cancel $8 Billion Harman Deal*, WALL ST. J., Sept. 22, 2007, at A3.

[135]789 A.2d 14 (Del. Ch. 2001). Other well known entries include; S.C. Johnson & Son, Inc. v. Dowbrands, Inc., 167 F. Supp. 2d 657, 670-71 (D. Del. 2001) (considering a claim related to an MAE clause, among others); Frontier Oil Corp. v. Holly Corp., No. 20,502, 2005 WL 1039027 (Del. Ch. Apr. 29, 2005), *reprinted in* 30 DEL. J. CORP. L. 993 (2005).

[136]*IBP*, 789 A.2d at 68.

[137]*Id.* at 22-23.

[138]*Id.* at 23.

[139]*Id.* at 68 ("[T]he question of whether IBP has suffered a Material Adverse Effect remains a close one.").

[140]*IBP*, 789 A.2d at 68.

> [E]ven where a Material Adverse Effect condition is as broadly written as the one [here], that provision is best read as a back-stop protecting the acquiror from the occurrence of unknown events that substantially threaten the overall earnings potential of the target in a durationally-significant manner. A short-term hiccup in earnings should not suffice; rather the Material Adverse Effect should be material when viewed from the longer-term perspective of a reasonable acquiror.[141]

Ultimately, after admitting to considerable ambivalence about the case, Strine found that Tyson failed to make this showing.[142] The court then (again somewhat surprisingly) granted a specific performance remedy, and the deal closed a few months later (on altered terms).[143]

Viewed through the lens of ambiguity aversion, Strine's opinion in *IBP* is also somewhat of a close call. In interpreting the MAE, the court both narrowed its reach and imposed the burden of demonstrating its occurrence on Tyson. Given the evident breadth of the MAE's language, both of these moves are curious and do not seamlessly follow from the principle of Weak Conservatism. Unlike the terms of the *Hexion* deal, *IBP* involved a broad, open-ended MAE that plausibly signaled the parties' intent for the MAE trigger to be relatively sensitive.[144] By narrowing the scope of this term, the court effectively disregarded this signal.

At the same time, other parts of the opinion provide a few potential avenues for reconciliation. For example, Strine placed significant weight on the fact that Tyson's statements and actions showed that it had long been aware of the problems in one of IPB's subsidiaries.[145] In fact, most analysts and even Tyson's own financial advisor still considered the terms of the deal to be fair.[146] The fact that IBP's performance had been comparable to its track record (though barely so) suggests, consistent with the Principle of

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[141] *Id.* (footnotes omitted).

[142] *Id.* at 71.

[143] *See id.* at 84. Interestingly, Yair Listoken detected positive abnormal returns for both IBP and Tyson upon the release of Strine's opinion. Yair Jason Listokin, *The Empirical Case for Specific Performance: Evidence from the Tyson-IBP Litigation* (Working Paper, Mar. 1, 2005), *available at* http://ssrn.com/abstract=679874.

[144] *Compare* Hexion Specialty Chems., Inc. v. Huntsman Corp., 965 A.2d 715, 724 (Del. Ch. 2008) (describing the MAE clause as "narrowly tailored"), *with IBP*, 789 A.2d at 65-66 ("Although many merger contracts contain specific exclusions from MAE clauses . . . [this clause] is unqualified by such express exclusions.").

[145] *IBP*, 789 A.2d at 22 ("During the auction process, Tyson was given a great deal of information that suggested that IBP was heading into a trough in the beef business.").

[146] *Id.* at 72.

Familiarity, that the parties may not have entered a realm of uncertainty that was significant enough to be reflected in the company's performance.

V. CONCLUSION

Using MAC/MAE provisions as an animating template, this article has argued that the behavioral economics concept of "ambiguity aversion" is a helpful device for understanding contractual conditions and excuses. I have argued that if one or more parties is ambiguity averse, and if the surplus from contracting is subject to uncertainty, then the terms of the resulting agreement (as well as the law's interpretation of them) should reflect those preferences. In cases where prospective ambiguity is particularly severe, an optimal contract/interpretive scheme could allow the contract to be voided entirely, reimposing autarky.

In addition to arguing for the plausibility of this account, I have endeavored to test it empirically. Using data from acquisition agreements announced between 2007 and 2008, I found that the breadth and reach of MAE clauses appear consistently responsive to a measure of "ambient" market uncertainty during negotiations. This effect persists, moreover, when one controls for risk attributes, industry effects, acquirer characteristics, and financial control variables. Evidently, at least in the most recent crop of merger agreements, ambiguity "matters" for contract design. The way that it may matter, in turn, provides insights about recent cases that have attempted to interpret MAE clauses.

Though I have not endeavored to explore them here, the intuitions developed above may also have applications to other domains within contract law. One such domain might be the set of doctrines associated with implied conditions, such as mutual mistake. For instance, Andrew Kull reports that the most predictive element of outcome of a mistake case is whether the contract at issue was still executory or substantially performed.[147] Courts appear much more willing to void executory agreements based upon a mistake than they are to rescind fully performed agreements, regardless of whether the formal elements of mutual mistake appear present.[148] While generally considered to be a curiosity, Kull's finding is actually consistent with the Early Bird Principle noted above, in which excuse claims are more likely to be credible products of realized ambiguity (and less likely to be strategic) if made early on after execution rather than late in the game.

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[147] Andrew Kull, *Mistake, Frustration, and the Windfall Principle of Contract Remedies*, 43 HASTINGS L.J. 1, 10-11 (1991).

[148] *Id.* at 11.

Another area for extension might be in corporate law and the design of *Revlon* auctions. When a seller's shareholders are ambiguity averse, the optimal design may turn critically on the extent to which the distribution of buyer values is itself subject to ambiguity. In contexts of extreme uncertainty, a proverbial "bird in the hand" (i.e., a reliable initial bidder) may be substantially more valuable than two (or more) in the bush. Accordingly, deal lockups that are ordinarily viewed with suspicion (such as no-shops, poison pill protections, large cancellation fees, and topping fees) may be more acceptable in such contexts.[149] I leave these questions (and potentially others) for another day.

The constructive thesis offered here is meant to be neither exclusive nor dismissive of alternative accounts of express or implied conditions. To the contrary, there are undoubtedly many reasons that parties include *force majeure* provisions in their contracts, some of which are perfectly consistent with (and even complementary to) ambiguity aversion. At the same time, however, within the current financial climate, one can reasonably expect that the challenge of allocating uncertainty will increasingly come to confront courts, practitioners, and legal scholars. Developing an appreciation for such challenges, as well as the analytical tools for addressing them, is an investment whose return is significant, practically relevant, and (hopefully) unambiguous.

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[149] A recent New York case involving the Bear Stearns rescue arguably demonstrates this sort of reasoning. In it, the court dismissed a shareholder complaint stating that the Bear board impermissibly sold JP Morgan a 39.5% dilutive stake in new shares without first obtaining a shareholder vote (as would ordinarily be required under NYSE rules). *In re* Bear Stearns Litig., 870 N.Y.S.2d 709, 730 (Sup. Ct. 2008). The court invoked a little used exception to the rules and implicitly signaled a lighter touch in judging the board's actions in a time of uncertainty:

> In response to a sudden and rapidly-escalating liquidity crisis, Bear Stearns' directors acted expeditiously to consider the company's limited options. They attempted to salvage some $1.5 billion in shareholder value and averted a bankruptcy that may have returned nothing to the Bear Stearns' shareholders, while wreaking havoc on the financial markets. The Court should not, and will not, second guess their decision.

Id. at 731 (footnote omitted).

APPENDIX

Table 3. Summary Statistics of MAC/MAE Provision

Category	Variable	Description of Variable
Financial	Price	Approximate purchase price ($mil)
MAC/ MAE Terms	mbof	MAC on the business, operations, financial condition, etc.
	mselabil	MAC on Seller's ability to close the deal
	mbuyabil	MAC on Purchaser's ability to close the deal
	mexesslos	Losses over a specified threshold deemed to be a MAC
	mbencont	MAC on the benefits contemplated by the agreement
	mbuybiz	Ability of Purchaser to continue to operate business immediately after closing in substantially same manner as immediately before closing
	mtarbiz	Ability of Target to continue to operate business immediately after closing in substantially same manner as immediately before closing
	mprspects	MAC on prospects of the Company/Target
	massets	MAC on the securities or purchased assets
	menfable	MAC on the validity or enforceability of agreement
	mreasexp	Reasonable expectation of event to have a material adverse effect/change
	mnodef	MAC out with no definition of "MAE" or "MAC"
	mdispeffect	Disproportionate Effects Language
Misc	nomac	No MAC (*Note: does not guarantee absence of force majeure exclusion terms*)
Exclusion Terms	echecon	Change in economy or business in general
	echgen	Change in general conditions of the specific industry
	echsecm	Change in securities markets
	echprvol	Change in trading price or trading volume of Company's stock
	echintr	Change in interests rates
	echexch	Change in exchange rates
	ewar	Acts of war or major hostilities
	eterror	Acts of terrorism
	egod	Acts of God
	epolcond	Change in political conditions
	enatcal	National calamity
	eintlcal	International calamity directly or indirectly involving U.S.
	echlwreg	Change in laws or regulations
	echintrp	Change in interpretation of laws by courts or government entities
	echbnkr	Change in resulting from bankruptcy or actions of a bankruptcy court
	echtax	Change in applicable taxes/tax law
	eeeatt	Employee attrition
	elayoffs	Lay-offs
	echlabor	Change in Target's relationship with any labor organization/unions
	eredcust	Reduction of customers or decline in business
	ecustbr	Commencement of a proceeding in bankruptcy of a material customer
	eredrev	Adverse effect resulting in seasonal reduction in revenues
	edelaysp	Delay or cancellation of orders for service or products
	efctdscl	Developments arising from any facts that were expressly disclosed to the Parent/public
	eanntran	Effects of announcement of transaction
	eexptran	Expenses incurred in connection with transaction
	echaction	Changes caused by the taking of any action required or permitted or in any way resulting from or arising in connection with the agreement
	echgaap	Changes in GAAP
	etrgfail	Failure by the Target to meet revenue or earnings projections
	eachttar	Any action required to be taken under law or contract by which Target is bound
	elittran	Litigation resulting from any law in relation to agreement/transaction contemplated
MAC/ MAE "Score"	totmac	Total number of MAC/MAE terms
	totexc	Total number of MAC/MAE Exclusions
	MERatio	Quasi-ratio of MAC/NAE terms to exclusions = totmac/(totexc + 1)
	MEPerc	Quasi-percentage of total MAC/MAE provisions to total of all provisions = totmac / (totmac + totexc + 1)
	MCoverage	Total MACs relative to total coded = totmac / (total # MAC categories)
	ECoverage	Total exceptions relative to total coded = totexc / (total # Exclusions categories)
	MERelCov	Relative coverage of MAC/MAE terms to exceptions = MCoverage – Ecoverage

Table 3. Summary Statistics of MAC/MAE Provision (continued)

All Deals (N=528)				SDC Matches (N=452)				Pub. Tar. Matches (N=247)				*H-H*
Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	
1,460	2,960	100	27,300	1,420	2,600	100	23,000	1,960	3,160	102	23,000	*9,910*
88.26%	-	0	1	91.59%	-	0	1	95.14%	-	0	1	*1*
44.13%	-	0	1	48.45%	-	0	1	54.66%	-	0	1	*0*
23.48%	-	0	1	24.56%	-	0	1	23.48%	-	0	1	*0*
3.22%	-	0	1	3.10%	-	0	1	1.62%	-	0	1	*0*
0.95%	-	0	1	0.88%	-	0	1	0.81%	-	0	1	*0*
0.95%	-	0	1	0.44%	-	0	1	0.81%	-	0	1	*0*
0.76%	-	0	1	0.88%	-	0	1	1.62%	-	0	1	*0*
3.22%	-	0	1	2.88%	-	0	1	2.02%	-	0	1	*0*
23.11%	-	0	1	25.00%	-	0	1	24.29%	-	0	1	*0*
2.08%	-	0	1	2.65%	-	0	1	2.02%	-	0	1	*0*
15.34%	-	0	1	15.04%	-	0	1	13.36%	-	0	1	*0*
7.01%	-	0	1	5.53%	-	0	1	3.64%	-	0	1	*0*
51.14%	-	0	1	53.98%	-	0	1	64.37%	-	0	1	*1*
3.79%	-	0	1	3.54%	-	0	1	4.45%	-	0	1	*0*
75.38%	-	0	1	77.88%	-	0	1	82.19%	-	0	1	*1*
69.51%	-	0	1	72.57%	-	0	1	76.11%	-	0	1	*1*
44.89%	-	0	1	44.25%	-	0	1	47.77%	-	0	1	*1*
33.14%	-	0	1	37.61%	-	0	1	57.49%	-	0	1	*0*
15.91%	-	0	1	15.93%	-	0	1	20.24%	-	0	1	*0*
11.74%	-	0	1	10.62%	-	0	1	13.36%	-	0	1	*0*
60.04%	-	0	1	64.38%	-	0	1	70.04%	-	0	1	*1*
59.47%	-	0	1	64.60%	-	0	1	70.45%	-	0	1	*1*
24.81%	-	0	1	26.33%	-	0	1	31.98%	-	0	1	*1*
37.69%	-	0	1	40.93%	-	0	1	44.94%	-	0	1	*0*
12.31%	-	0	1	13.50%	-	0	1	11.34%	-	0	1	*0*
7.39%	-	0	1	8.19%	-	0	1	6.88%	-	0	1	*0*
62.88%	-	0	1	68.36%	-	0	1	75.30%	-	0	1	*0*
27.46%	-	0	1	31.19%	-	0	1	36.44%	-	0	1	*0*
3.22%	-	0	1	2.88%	-	0	1	2.43%	-	0	1	*0*
3.41%	-	0	1	3.10%	-	0	1	3.64%	-	0	1	*0*
12.50%	-	0	1	12.61%	-	0	1	14.57%	-	0	1	*0*
1.14%	-	0	1	1.33%	-	0	1	1.62%	-	0	1	*0*
0.76%	-	0	1	0.88%	-	0	1	0.81%	-	0	1	*0*
10.98%	-	0	1	13.05%	-	0	1	17.00%	-	0	1	*0*
0.38%	-	0	1	0.44%	-	0	1	0.40%	-	0	1	*0*
2.27%	-	0	1	4.20%	-	0	1	4.86%	-	0	1	*0*
3.22%	-	0	1	2.65%	-	0	1	2.02%	-	0	1	*0*
4.92%	-	0	1	5.31%	-	0	1	4.45%	-	0	1	*0*
63.83%	-	0	1	65.04%	-	0	1	70.04%	-	0	1	*1*
5.11%	-	0	1	5.31%	-	0	1	6.88%	-	0	1	*0*
55.87%	-	0	1	59.96%	-	0	1	65.59%	-	0	1	*0*
60.04%	-	0	1	64.82%	-	0	1	77.33%	-	0	1	*1*
35.04%	-	0	1	39.16%	-	0	1	53.44%	-	0	1	*0*
6.63%	-	0	1	7.74%	-	0	1	7.29%	-	0	1	*0*
14.96%	-	0	1	18.36%	-	0	1	28.34%	-	0	1	*0*
2.63636	1.308	0	7	2.75	1.38	0	7	2.878543	1.173	0	6	*2*
8.01894	4.711	0	19	8.57522	4.475	0	19	9.813765	4.077	0	18	*7*
0.48121	0.61	0	4	0.45101	0.585	0	4	0.350489	0.362	0	3	*0.25*
0.26397	0.164	0	0.8	0.25547	0.153	0	0.8	0.229093	0.123	0	0.75	*0.2*
0.2197	0.109	0	0.5833	0.22917	0.107	0	0.58333	0.239879	0.098	0	0.5	*0.167*
0.25868	0.152	0	0.6129	0.27662	0.144	0	0.6129	0.316573	0.132	0	0.5806	*0.226*
-0.03898	0.162	-0.53	0.731	-0.04745	0.157	-0.53	0.35752	-0.07669	0.148	-0.41	0.3522	*-0.06*

Table 5. Simultaneous (SUR) Estimation of Value and MAC "Score" for All SDC-Matched Deals

	[1]		[2]	
Dependent Variable	***ln*(Deal Value)**	**MEPerc**	***ln*(Deal Value)**	**MEPerc**
Pre-Announcement VIX (10 day ave.)	-0.038932	0.005324	-0.036951	0.005399
	[0.020076]	[0.002166]*	[0.019964]	[0.002163]*
Pre-Ann. Mkt. Risk. Prem. (10 day ave.)	-0.712834	0.078647	-0.60955	0.090377
	[1.396309]	[0.150648]	[1.389936]	[0.150610]
Target Industry β	-0.233522	-0.036485	-0.213236	-0.013303
	[0.179521]	[0.019368]	[0.244524]	[0.026496]
(Target Ind. B) x (Mkt. Risk. Prem.)	0.107718	-0.021346	0.258521	-0.027112
	[0.530192]	[0.057202]	[0.531089]	[0.057548]
(Pre-Ann. VIX) x (Mkt. Risk. Prem.)	0.030204	-0.0021	0.016676	-0.002202
	[0.054890]	[0.005922]	[0.054828]	[0.005941]
Percentage Sought by Acquirer	0.010666	-0.000505	0.01043	-0.000472
	[0.003643]**	[0.000393]	[0.003626]**	[0.000393]
Risk Free Rate	14.829565	3.912929	16.830725	3.806878
	[18.883097]	[2.037296]	[18.794380]	[2.036518]
Acquirer is Strategic Buyer	-0.730625	0.032398	-0.722676	0.028864
	[0.209667]**	[0.022621]	[0.209756]**	[0.022729]
Target Industry: Energy			0.189304	0.028805
			[0.22211]	[0.024078]
Target Industry: Finance			-0.365233	0.030012
			[0.228603]	[0.024771]
Target Industry: High Tech			-0.196744	-0.006728
			[0.210960]	[0.022859]
Number of Bidders (Inc. Acquirer)				
ln(Acquirer's Accounting Value)				
Acquirer Private and Target Public				
Acquirer Public and Target Private				
Both Acquirer and Target are Private				
Constant	6.720385	0.148239	6.698525	0.113333
	[0.749347]**	[0.080847]	[0.776723]	[0.084164]
Observations	420	420	420	420
R^2	0.0829	0.0316	0.0956	0.0367
χ^2	37.98**	13.72	44.4**	16.01

*significant at 5%; **significant at 1%

Table 5. Simultaneous (SUR) Estimation of Value and MAC "Score" for All SDC-Matched Deals (continued)

[3]		[4]		[5]	
***ln*(Deal Value)**	**MEPerc**	***ln*(Deal Value)**	**MEPerc**	***ln*(Deal Value)**	**MEPerc**
-0.036307	0.005369	-0.020687	0.004383	-0.020044	0.004593
[0.019781]	[0.002165]*	[0.018646]	[0.002139]*	[0.018660]	[0.002133]*
-0.800415	0.092467	-0.334127	0.065382	-0.363195	0.055912
[1.377800]	[0.150807]	[1.291218]	[0.148154]	[1.291222]	[0.147580]
-0.217246	-0.012762	-0.459923	0.00002	-0.46415	-0.001375
[0.242637]	[0.026558]	[0.230119]*	[0.026404]	[0.230077]*	[0.026297]
0.258261	-0.026099	-0.043928	-0.009697	-0.004025	0.003303
[0.526736]	[0.057654]	[0.404962]	[0.056792]	[0.498174]	[0.056939]
0.025571	-0.002335	0.021787	-0.002059	0.021265	-0.002229
[0.054428]	[0.005957]	[0.050958]	[0.005847]	[0.050935]	[0.005822]
0.010421	-0.000469	0.014952	-0.000748	0.015028	-0.000723
[0.003591]*	*[0.000393]	[0.003416]**	[0.000392]	[0.003416]**	[0.000390]
19.368907	3.806773	18.262247	3.91237	18.54554	4.004662
[18.629090]	[2.039046]	[17.446902]	[2.001856]	[17.442346]	[1.993573]*
-0.757902	0.028685	-0.689116	0.016891	-0.662451	0.025578
[0.208322]*	*[0.022802]	[0.217720]**	[0.024981]	[0.221121]**	[0.025273]
0.184312	0.028465	0.373106	0.016392	0.372247	0.016112
[0.220290]	[0.024112]	[0.208001]	[0.023866]	[0.207891]	[0.023761]
-0.390937	0.029838	-0.684654	0.046565	-0.683059	0.047085
[0.226684]	[0.024812]	[0.215730]**	[0.0274753]	[0.215625]**	[0.024645]
-0.18922	-0.007359	-0.143765	-0.010774	-0.139151	-0.009271
[0.209717]	[0.022955]	[0.196623]	[0.022560]	[0.196633]	[0.022474]
-0.281363	-0.011182	-0.617751	0.014242	-0.670895	-0.003071
[0.424848]	[0.046502]	[0.406146]	[0.046601]	[0.413411]	[0.047251]
0.521098	-0.004119	0.477592	-0.0003	0.483009	0.001465
[0.182135]*	*[0.019936]	[0.171307]**	[0.019656]	[0.171399]**	[0.019590]
4.715305	0.14275	1.040902	-0.061267	0.987442	-0.078682
[1.189852]*	*[0.120235]	[0.135204]**	[0.015513]**	[0.156422]**	[0.017878]**
		-0.002985	0.012985	-0.101531	-0.019119
		[0.159545]	[0.018306]	[0.215687]	[0.024652]
		4.186715	0.164433	-0.197816	-0.064442
		[1.122193]**	[0.128760]	[0.291545]	[0.033322]
				4.29634	0.200145
				[1.133155]**	[0.129514]
420	420	420	420	420	420
0.1139	0.0369	0.2235	0.0726	0.2243	0.0808
53.96**	16.11	120.86**	32.87**	121.45**	36.9**

*significant at 5%; **significant at 1%

Table 6. Simultaneous (SUR) Estimation of Value of and MAC Score for Public Target Deals

	[1]		[2]	
Dependent Variable	***ln*(Deal Value)**	**MEPerc**	***ln*(Deal Value)**	**MEPerc**
Pre-Announcement VIX (10 day average)	-0.007348	0.00639	-0.004306	0.006576
	[0.007392]	[0.002399]**	[0.007263]	[0.002416]**
Pre-Ann. Mkt. Risk. Prem. (10 day average)	-0.0393661	0.040833	-0.490611	-0.046777
	[0.490173]	[0.159108]	[0.478858]	[0.159251]
Target Industry β (3-dig. SIC)	-0.297843	0.015937	-0.290573	0.016383
	[0.091097]**	[0.029570]	[0.088863]**	[0.029552]
(Target Ind. B) x (Mkt. Risk. Prem.)	-0.142362	-0.017327	-0.07294	-0.013071
	[0.195622]	[0.063498]	[0.191855]	[0.063804]
(Pre-Ann. VIX) x (Mkt. Risk. Prem.)	0.025826	0.00161	0.026997	0.001682
	[0.019499]	[0.006329]	[0.019018]	[0.006325]
Percentage Sought by Acquirer	0.025749	-0.000431	0.025848	-0.000425
	[0.001054]*	*[0.000342]	[0.001028]**	[0.000342]
Risk Free Rate	-8.158361	2.416646	-6.313468	2.529747
	[7.053910]	[2.289666]	[6.900195]	[2.294749]
ln(Target's Pre-Ann. Equity Value)	0.999614	-0.003621	1.001516	-0.003504
	[0.016998]**	[0.005517]	[0.016586]**	[0.005516]
Delaware Incorp. Target	-0.050902	-0.002815	-0.053055	-0.002947
	[0.052134]	[0.016922]	[0.050844]	[0.016909]
Acquirer is Strategic Buyer	-0.040453	-0.014473	0.11133	-0.005168
	[0.071836]	[0.023318]	[0.083032]	[0.027613]
Target Macro Industry: Energy	0.016795	0.049109	0.030677	0.049961
	[0.108650]	[0.035267]	[0.106033]	[0.035263]
Target Macro Industry: Finance	-0.304764	0.061099	-0.292954	0.061824
	[0.080517]**	[0.026135]*	[0.078595]**	[0.026138]*
Target Macro Industry: High Tech	-0.072042	0.012639	-0.050143	0.013981
	[0.074431]	[0.024160]	[0.072869]	[0.024233]
Acquirer is Private			0.209278	0.01283
			[0.061460]**	[0.020439]
ln(Target's Total Assets)				
ln(Target's Total Liabilities)				
ln(Acquirer's Total Accounting Value)				
ln(Target's Net Sales)				
Target's Earning Per Share				
Acquirer's Earnings Per Share				
Target's Return on Equity (1 month)				
Constant	-1.707442	0.09875	-1.820326	0.091829
	[0.314916]	[0.102220]	[0.30887]**	[0.102724]
Observations	225	225	225	225
R^2	0.9511	0.1013	0.9535	0.1029
χ^2	4374.24**	25.37*	4611.26**	25.81*

*significant at 5%; **significant at 1%

Table 6. Simultaneous (SUR) Estimation of Value of and MAC Score for Public Target Deals (continued)

[3]		[4]		[5]	
ln(Deal Value)	MEPerc	*ln*(Deal Value)	MEPerc	*ln*(Deal Value)	MEPerc
-0.005489	0.006361	-0.004664	0.00572	0.00937	0.005489
[0.006368]	[0.002366]**	[0.006733]	[0.002449]*	[0.015953]	[0.002441]*
-0.463931	0.018304	-0.544263	0.017728	-0.382318	0.013824
[0.418975]	[0.155671]	[0.431034]	[0.156760]	[1.024864]	[0.156791]
-0.16698	0.009415	-0.168035	-0.003086	0.026677	-0.005648
[0.078263]*	[0.029079]	[0.081117]*	[0.029501]	[0.192407]	[0.029436]
-0.086653	-0.025651	-0.048036	-0.017747	0.340864	-0.026158
[0.166490]	[0.061860]	[0.171838]	[0.062495]	[0.402976]	[0.061650]
0.026902	-0.000839	0.028171	-0.001349	0.012583	-0.000829
[0.016763]	[0.006228]	[0.017301]	[0.006292]	[0.040733]	[0.006232]
0.027077	-0.000375	0.026888	-0.000576	0.02287	-0.000539
[0.000947]**	[0.000352]	[0.000988]**	[0.000359]	[0.002317]**	[0.000354]
-7.64246	2.754175	-7.233766	2.930707	27.651508	2.472145
[6.023683]	[2.238115]	[6.306542]	[2.293593]	[14.764397]	[2.238763]
0.947616	-0.004515	0.93668	-0.012107		
[0.027555]**	[0.010238]	[0.030026]**	[0.010920]		
-0.068253	-0.009206	-0.074721	-0.012742	-0.090004	-0.013102
[0.044322]	[0.016468]	[0.046524]	[0.016920]	[0.110227]	[0.016863]
0.149037	0.011797	0.120491	-0.000449	-0.178862	0.003611
[0.074120]*	[0.027539]	[0.078710]	[0.028626]	[0.185757]	[0.028418]
0.01736	0.052108	0.000829	0.059705	0.173346	0.054545
[0.091934]	[0.034158]	[0.096712]	[0.035173]	[0.223447]	[0.034184]
-0.487029	0.039653	-0.498672	0.037092	-1.273127	0.047239
[0.077230]**	[0.028695]	[0.080079]**	[0.029124]	[0.181078]**	[0.027703]
-0.016672	0.030549	-0.016755	0.045817	0.014103	0.045613
[0.065743]	[0.024427]	[0.069446]	[0.025256]	[0.165166]	[0.025268]
0.154882	0.009567	0.153284	0.014613	0.252747	0.01345
[0.054199]**	[0.020138]	[0.055927]**	[0.020340]	[0.132826]	[0.020321]
-0.095702	-0.04432	-0.0659	-0.036525	1.403111	-0.055563
[0.068828]	[0.025573]	[0.072927]	[0.026522]	[0.132443]**	[0.020262]**
0.22436	0.035261	0.206366	0.030957	-0.572056	0.041190
[0.054590]**	[0.020283]	[0.057709]**	[0.020988]	[0.123695]**	[0.018924]*
0.063924	0.000287	0.077578	0.007966	0.325644	0.004678
[0.062822]	[0.023342]	[0.069061]	[0.025116]	[0.163196]*	[0.024967]
-9.00E-06	5.00E-06	-1.00E-05	5.00E-06	-2.00E-05	5.00E-06
[0.000004]*	[0.000001]**	[0.000004]*	[0.000001]**	[0.000010]*	[0.000001]**
		-0.000885	0.00291	0.039346	0.002403
		[0.0007437]	[0.002705]	[0.017425]*	[0.002666]
		-0.000011	0.000002	-0.000173	0.000005
		[0.000122]	[0.000044]	[0.000290]	[0.000044]
		-0.013482	-0.005757	-0.080347	-0.004906
		[0.009207]	[0.003348]	[0.021304]**	[0.003259]
-2.736197	0.159925	-2.797672	0.205419	-2.87495	0.209113
[0.384013]**	[0.142681]	[0.427408]**	[0.155442]	[1.015657]**	[0.155383]
220	220	208	208	209	209
0.9607	0.1783	0.9599	0.1971	0.7721	0.1919
5383.99**	47.22**	4982.56**	51.05**	708.22**	49.64**

*significant at 5%; **significant at 1%