

**When Do We Take the Horse Out to the Back Pasture?
Firm Valuations and Liquidation Decisions in Chapter 11**

Douglas G. Baird, Edward R. Morrison & Randal C. Picker²

Timing is everything. The bankruptcy judge does not want to shut down an operating business too soon. Such a decision destroys going concerns, puts people out of work, and jeopardizes other businesses. On the other hand, the bankruptcy judge does not want to wait too long either. The judge tries to avoid two kinds of mistakes. The first is the firm that would have flourished had it been given one last chance. The second is the firm that continues operations as it bleeds cash. It ends up administratively insolvent and is converted to Chapter 7 only after the lawyers discover that the firm no longer has enough to pay their bills.

In the academy, the question of how we identify the proper time to make an up-or-down, once-and-for-all decision has been the subject of study for a number of years. Recently, these insights have already made their way into legal scholarship, examining everything from contract law to rulemaking by the E.P.A.¹ They will no doubt soon enter the domain of bankruptcy, and it is only a

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¹ See AVINASH DIXIT & ROBERT PINDYCK, *INVESTMENT UNDER UNCERTAINTY* (Princeton 1994). These have begun to make their way into legal analysis. For application to the decision whether to settle or litigate a claim, see, e.g., Bradford Cornell, *The Incentive to Sue: An Option-Pricing Approach*, 19 J. Leg. Stud. 173 (1990); Peter H. Huang, *A New Options Theory for Risk Multipliers of Attorney's Fees in Federal Civil Rights Litigation*, 73 N.Y.U. L. Rev. 1943 (1998). Incentives to breach under different contract damages regimes have also been studied using

matter of time before expert witnesses start using this jargon, the jargon of “real options,” in the courtroom. In this paper, we provide a brief introduction to real options and then we go on to explore how this technology is likely to be used in bankruptcy cases.²

We stress two themes. First, real option theory offers an important qualification to the traditional analysis that says that the shutdown decision should turn on comparing the value of the firm if liquidated against the discounted present value of the earnings the firm is likely to generate over time. In assessing the wisdom of continuing the firm at any moment in time, we need to take into account the possibility that new information will come along that gives us a better sense of the firm’s prospects and makes us more confident about whether shutting the firm down is in fact the right thing to do. This possibility

real options. Alexander J. Triantis & George G. Triantis, *Timing Problems in Contract Breach Decisions*, 41 J.L. & Econ. 163 (1998) (showing that that an expectations damages regime creates a real option to breach that the parties will tend to exercise earlier than is socially optimal). The timing of environmental regulation can be studied in the same way. See, e.g., DIXIT & PINDYCK, *supra*, at 405-18 (1994) (exploring the optimal timing of environmental regulations to control pollutants and the incentives of firms to comply with the Clean Air Act Amendments of 1990).

The bankruptcy literature itself has focused on the way in which financial options provide alternatives to auctions that protect junior claims and interests while adhering to the absolute priority rule. See, e.g., Lucian Bebchuk, *A New Approach to Corporate Reorganizations*, 101 Harv. L. Rev. 775 (1988). Options can also allow managers to retain their ownership interests even when there are liquidity constraints. See Philippe Aghion, Oliver Hart, & John Moore, *The Economics of Bankruptcy Reform*, 8 J. L. Econ. & Org. 523 (1992). They can also minimize the rents that the sale of the company leaves in the hands of the buyer. See Francesca Cornelli & Leonardo Felli, *How to Sell a (Bankrupt) Company* (SSRN Working Paper March 2000).

² For a more detailed exploration of these issues, see Douglas G. Baird & Edward R. Morrison, *Bankruptcy Decisionmaking*, 17 J. Law & Econ. Org. ... (2001).

itself must be incorporated into the net present value calculation. The real options approach to valuation shows that some firms should be kept intact *even though the expected earnings of the firm over time are less than the cash that can be realized from the piecemeal sale of its assets today*. A real options approach provides a new weapon to counter expert valuations from trigger-happy creditors bringing lift-stay motions.

We also look beyond the role that real options can play in a battle between dueling experts and try to connect real options with the decisions bankruptcy judges actually make. Bankruptcy judges, unlike academics, live in the real world. They do not rely on abstract theory, but rather on hard evidence introduced in open court. A methodology using stochastic calculus is not (and should not be) their starting place.

In Part I, we set out the problem and unpack the intuition that drives much of the analysis using real options. Part II discusses real options and why they need to be taken into account in doing any valuation in Chapter 11. We conclude in Part III with a discussion of how real options are likely to play out in bankruptcy court. They are not likely to supplant the techniques that bankruptcy judges use today to make shutdown decisions—decisions that by and large seem to serve us well. They may, however, suggest ways in which these might be tweaked at the margin. We may be able to further reduce the number of times we shutdown a firm too late or too soon.

I. The Shutdown Decision in Chapter 11

Merry-Go-Round was one of the most successful retailers of teen fashions during the 1980s.³ After the retirement of its founder and a succession of poor acquisitions, however, the firm encountered serious financial trouble in the 1990s. Merry-Go-Round defaulted on one of its loan agreements and soon found itself in Chapter 11. Even then, Merry-Go-Round still possessed a well-recognized brand name, employed thousands, and had more than \$100 million in cash. But less than a year later, the money was gone, as was most everything else. The only asset of any value to the general creditors was a cause of action against the management consultants who had advised the firm during the bankruptcy.

Keeping Merry-Go-Round for a full year may have been a worthwhile gamble. The fashion industry is such that much of the sales come towards the end of the year and commitments must be made in the first part. The complete collapse of the business may have been unexpected. Moreover, the relevant decisionmakers seem to have been given bad advice. (The trustee in the subsequent Chapter 7 case sued the management consultants that had advised the firm in Chapter 11 and obtained a settlement for more than \$100 million.) Nevertheless, when so much money is lost, one is naturally led to ask whether we waited too long.

Consider another recent case. Iridium, the first full-service wireless global communications network, began operations in late 1997 after more than a decade in planning. You could call anyone else anywhere in the world no matter where you were. The system worked through a constellation of 66 satellites in low-earth orbit. The harbinger of a new era in telecommunications, the service went through some growing pains, but Iridium seemed on track. In 1998, a spare

Iridium satellite joined the Wright 1903 *Flyer*, *Apollo 11*, and the *Spirit of St. Louis* at the Smithsonian Institution. In early 1999, Iridium was able to raise an additional \$250 million in equity funding. Only six months later, however, Iridium filed for Chapter 11. Six months later one of the parties asked the judge to shutdown the network, sell off the ground-based assets, and order each of the satellites to fire their thrusters and burn up in the earth's atmosphere.

How does a judge think about such a request? If the judge grants the motion and the satellites are destroyed, an investment of many billions of dollars is irretrievably lost. On the other hand, the business has fundamental problems. The system failed miserably in the market place. A satellite system must be designed years in advance, and the Iridium system was designed before the Internet. It can handle only voice, not data. The phones are the size of and weighed as much as bricks. They do not work indoors. The demand for this service is just not that great. They are terrific if you are climbing Mt. Everest or spying for the C.I.A. in a remote part of the world, but not that many people do this. The rest of us can just use ordinary cell phones. Morale at company headquarters is low. Those who are still sticking with the firm are nicknamed "Iridiot" in the popular press and elsewhere. It costs \$1 million a day to keep the network running. Every day the judge delays shutting the firm down reduces the value of the estate by \$1 million. How long should the judge wait? Presumably, it should not be until the all the assets of the estate are gone, but how do we know when to stop?

In most cases, the bankruptcy judge is confronted with a lift-stay motion brought by an undersecured creditor. In such cases, the Bankruptcy Code directs the court to determine whether the collateral is "necessary to an effective

³ See Justin Martin, *The Man Who Boogied Away a Billion Building a Clothing Empire*, *Forbes* (Dec. 23, 1996).

reorganization.”⁴ When the secured creditor has a security interest on most all the debtor’s assets, the question becomes whether there is a “reasonable possibility of a successful reorganization within a reasonable period of time.”⁵

In many cases, it is easy to conclude that there is not a reasonable possibility of a successful reorganization. The greater part of Chapter 11 filings involve small firms,⁶ and in such cases making the shutdown decision is usually straightforward. We have a ski shop in early spring and it has fallen on hard times. It occupies a space in a shopping mall and sells brand-name goods. The seller does little advertising and most of its customers come from visitors to the mall. The premises are leased, the furnishings are generic and the inventory can be readily bought and sold in a wholesale market. The firm has been using money owed the I.R.S. to keep the most persistent trade creditors at bay, and there is no sign that it will soon turn around and become cash-flow positive. Bankruptcy judges grant lift stay motions in such circumstances, and granting these motions, of course, is tantamount to shutting the firm down.⁷

Of the most interest are the cases that are more complicated than that of the unsuccessful retailer, but less exotic than Iridium. In these cases, the bankruptcy

⁴ 11 U.S.C. §362(d)(2).

⁵ See *United Savings Association v. Timbers of Inwood Forest Associates*, 484 U.S. 365, 376 (1988).

⁶ More than half the firms in Chapter 11 have assets of less than \$500,000 and more than two third have assets of less than \$1 million. See Elizabeth Warren & Jay Lawrence Westbrook, *Financial Characteristics of Businesses in Bankruptcy*, 73 Am. Bankr. L.J. 499, 529 (1999) (giving figures of 58% and 71% respectively).

⁷ As we discuss below, saying that this type of firm is not one that can or should reorganize in Chapter 11 is not to say that it does not belong there.

judge has to confront what it means to say that there is a “reasonable possibility” of a successful reorganization. Even discovering how bankruptcy judges go about making this decision under current law is not easy. Identifying the date of shutdown (or the date the firm leaves Chapter 11 intact as a going concern) cannot be linked with a formal event in the history of the Chapter 11 case, such as the confirmation of the plan of reorganization, closing of the case, or conversion to Chapter 7. The assets of the business may be sold as a going concern quickly, but fighting among creditors may keep the case in Chapter 11 for months (or even years) longer. Moreover, the case may end with a dismissal after the outstanding disputes are resolved. What by the standard benchmarks seems a long-drawn out affair that ends in liquidation is in fact a quick and successful reorganization. Far from being shutdown, the firm is thriving and its customers, suppliers, and workers are happy and may have barely noticed that the firm was ever in bankruptcy.

Similarly, what seems a long, but successful reorganization may, on examination, be something quite different. A plan might be confirmed in which the entity that leaves Chapter 11 is a much smaller firm that bears almost no relation to the firm that entered bankruptcy. If we ask only whether an intact firm emerged from the reorganization, even the Chapter 11 of Eastern Airlines would have to be counted a success. Finally, in many cases, there is no formal shutdown decision as such. The bankruptcy judge may have credibly communicated that she would grant a motion to convert if a particular condition were not met. The debtor’s failure to meet the condition may bring about a voluntary motion to dismiss. Often the shadow that the judge casts by virtue of her reputation for shutting down firms may be as important as the shutdown decision itself.

Chapter 11 may be a useful vehicle for sorting out the problems of firms in financial distress even when they cannot survive as going concerns.

But we can get a sense of what is at stake by considering the following hypothetical case. A small town has been a culinary desert for decades. The residents, however, have substantial incomes and extensive survey data suggests that a first-class restaurant will be well-received. Entrepreneur organizes a group of investors and persuades a celebrity chef in a major city to move to the small town with a hand-picked team. An old town house is remodeled. A wine cellar is stocked, and the china and flatware are purchased. An extensive publicity campaign is built around this celebrity chef and his distinctive culinary style. The cost of relocating the chef and remodeling the house exceed estimates. The restaurant gains a loyal following, but revenues are less than expected and costs higher. The restaurant barely meets its operating expenses. It defaults on its loans to major creditors and enters Chapter 11.

How should we think about this problem if no one is willing to buy the assets outright? We might propose keeping the restaurant and the chef, but redesigning the menu, lowering the prices, and increasing the number of tables. But if we decide to close the restaurant, the celebrity chef and his staff will move back to the big city. It will take time and money to bring them back or recruit others if we want to run the same experiment again. And we still must decide how to sell off the assets that are left. We could wait for a buyer that wanted to continue to use the assets as a restaurant. A new buyer might open a different kind of restaurant, one that specializes in steak, lobster, and Caesar salad. Alternatively, we could entertain offers from those that want to convert the townhouse back into a private residence or to a real estate developer that wants only the parcel of land.

As this case illustrates, the assets of a firm can be put to many different uses. Each decision forecloses, to a greater or lesser extent, an alternative use of the assets. The basic decision, however, is whether to keep this restaurant running with this chef in place. The longer we wait, the more we shall know

about the restaurant's chances of succeeding. But waiting is costly. At what point can we conclude that there is not a "reasonable possibility" of a successful reorganization? We would suggest that one cannot answer this question merely by asking how likely it is that the restaurant will eventually leave bankruptcy as an operating business. One has to know in addition the extent of the upside if there is a successful reorganization, how long it will take to become more certain about ultimate success, and what is to be gained or lost if we wait before shutting the firm down. Even if the restaurant is more likely than not to fail, it may make sense to keep it open a while longer if the benefits in the event of success are high and the costs of waiting to see if it will be successful are small. We can see that incorporating the temporal element into the analysis is a sensible gloss on the idea that the reorganization is a "reasonable possibility" by making an analogy to a mundane problem that shares the same dynamic.

Let us say that you are a die-hard comparison shopper and want to buy a new television. There are a lot of stores in town and they all charge different prices. How many stores do you visit before you stop and buy the television? Once you stop searching, you give up the possibility of getting the television at a lower price. But if you keep on searching, you incur the costs of going to the next store. You can always go back to where you found the lowest price, but going to a new store is a hassle.

At what point is the possibility of getting a better deal sufficiently small that you stop searching? How many stores do you visit before you buy? At the first store you visit, you are lucky and you find the television you want on sale for \$500, less than you expected to pay even after going to a number of stores. The price you expect at the next store is significantly greater than \$500. You may continue to search nevertheless. The chance of finding the television you want for less than \$500 might be small, but the cost to you from continuing the search is small too. It is only the cost of going to another store. You can always return to

the first store and buy the television for \$500. Once you find the television on sale for \$500, you care only about (1) the cost of going to another store; and (2) the chance that the price at the other store will be less than \$500. Most stores may charge much more, but the distribution of prices above \$500 doesn't matter because you will never have to pay more than \$500. The price you find at the first store truncates the bad part of the distribution. You make a trade-off: The chance of buying a television for less versus the hassle of going to another store. At some point, you reach a point of diminishing returns. The chance that you will find a better price is not worth the extra aggravation.

A bankruptcy judge faces the same sort of calculus. From this follows an important implication. The decision to shutdown the firm, like the decision to buy a new television, is irreversible. Once you buy the television at a given price, you lose the chance to buy one at a lower price. Once you shut the firm down, you lose the ability to enjoy its revenue stream if things turn out to be better than they appeared at first blush. To be sure, after a while you know enough to make the call one way or the other. After going to enough stores, you are not likely to find a better price. After you have gathered enough information about the firm, you know whether it is going to make it or not. But in both cases, the crucial questions center around the cost of continuing the search and the chance of finding good news if we do.

This comparison shows that the way we commonly ask the question about whether to shut down the firm is wrongly conceived. We often ask, "Is the firm worth more alive than dead?" But by framing the question this way, we are missing a large part of the problem. Go back to the television example. Let us say you decide to keep searching and the price is always higher than the lowest price you have found. You do not care how much higher it is. You aren't going to buy a television there. You go back and buy at the store with the lowest price. Similarly, once we know the firm can be liquidated for a fixed amount, we want

to know only whether it is worth waiting to find out if the firm's value as a going concern is greater than this amount. We do not care if the firm proves to be worth less than its liquidation value. Being able to liquidate the firm at any moment truncates the downside. It provides us with a safety net.

A variation on *Iridium* provides an illustration of this idea. Recall that Iridium's satellites were designed before the dot.com revolution to handle voice, not data. Before deciding to order the destruction of the satellites, the bankruptcy judge might be asked to consider the possibility that someone might develop a data-compression technology and, by reprogramming Iridium's software, provide 2-way data communication anywhere in the world. Even if the debtor was not able to develop such a technology, the debtor might want time to find a buyer of the system willing to invest in exploring such possibilities.

Even this course requires a nontrivial commitment of financial resources. The FCC license requires any buyer to show it had the resources needed (some \$10 million) to orchestrate the destruction of the satellites if the buyer's efforts to turn around the company and the system has to be shut down. (The satellites occupy a well-trafficked orbit and unused satellites become navigation hazards.) Nevertheless, the potential benefit of this different approach needs to be reflected in estimating the value of Iridium. If we continue searching for televisions and cannot find any that are cheaper, we still can go back and buy the television at a store with a low price. In the case of Iridium, if we postpone the decision to shut down the network, we do not give up the ability to shut the firm down forever. We incur only the costs associated with a delay. The chances of finding a better price on the television or an effective data-compression technology may be small, delaying the decision (either to buy the television or close the firm) is appropriate as long as the costs of waiting are sufficiently low and the rewards from success sufficiently high.

Put at this level of abstraction, the idea is straightforward. But bankruptcy decisionmaking in practice cannot be reduced to a discrete question as simple as deciding to go to another store. All the conditions surrounding the decision are subject to change in random and unpredictable ways. Even understanding conceptually how to take account of the temporal element appeared for a long-time to present insurmountable technical difficulties. Real option theory gives us a formal way to make such uncertainties tractable and can tell us how the uncertainties that do exist should affect the shutdown decision. It turns out that the amount of uncertainty itself powerfully affects how long the bankruptcy judge should wait before making a decision, but in a way that is not otherwise obvious.

II. The Technology of Real Options

Real options deal with decisions about how particular assets are used, while financial options deal with rights to the earnings that a particular asset generates. The two, however, are conceptually quite similar. Let us assume that I have the option to buy a share of stock for \$100 any time between now and next July 1. The stock is currently trading for \$150. How much is the option worth? We would not say that the option is worth \$50, the difference between the price today and the strike price for my option. We have to take into account the possibility that the value of the stock can rise or fall between now and next July 1. What is crucial here is that the downside losses are truncated. If the stock ultimately trades for less than \$100, my stock option is worthless. But it does not matter how much lower than \$100 it goes. If I am out of the money come July 1, I am indifferent to how much out of the money I am. But there is no analogous limit on the upside. However much the stock price rises, I will be able to enjoy the difference between it and \$100.

For a long time, people understood that this dynamic was at work with respect to financial options, but had no way to price any particular stock option.

But two economists—Franco Modigliani and Merton Miller—discovered how the value of a firm is reflected in its capital structure.⁸ Their insights allowed two of their protégés—Fisher Black and Myron Scholes—to devise a technique for pricing stock options.⁹ The Black-Scholes option pricing formula has revolutionized securities markets. Commodity and options traders use it all over the world. Trillions of dollars of securities are traded in reliance upon this formula, not because traders are sentimental or overly academic, but because it works. With the possible exception of quantum electrodynamics, no advance in knowledge in the last century has been as carefully tested or as completely validated.

In recent years, economists and others have adapted this technique to decisions involving, not financial instruments, but rather the actual use of assets.¹⁰ Hence the name “real options.” Simplified somewhat, the formal methodology takes the following shape.¹¹ To make the shutdown decision, the decisionmaker estimates the firm’s future earnings and the uncertainty

⁸ See Franco Modigliani & Merton H. Miller, *The Cost of Capital, Corporation Finance, and the Theory of Investment*, 48 *Am. Econ. Rev.* 261-297 (1958); Merton H. Miller, *The Modigliani-Miller Propositions After Thirty Years*, 2 *J. Econ. Perspectives* 99-120 (Fall 1988). The work of Modigliani and Miller is the bedrock of modern finance.

⁹ See Fisher Black & Myron Scholes, *The Valuation of Option Contracts and a Test of Market Efficiency*, 27 *Journal of Finance* 399 (1972); Fisher Black & Myron Scholes, *The Pricing of Options and Corporate Liabilities*, 81 *Journal of Political Economy* 637 (1973). The work of Black and Scholes was refined further by Robert Merton. See Robert C. Merton, *Theory of Rational Option Pricing*, 4 *Bell Journal of Economics and Management Science* 141 (1973).

¹⁰ Unlike financial options, real options reflect a decision about how assets are used, not merely how they are owned.

¹¹ A formal exposition (with proofs) is in an appendix to Baird & Morrison, *supra* note 2.

associated with those earnings. She begins in the traditional place and estimates the future earnings of the firm, which we can call \hat{E}_t , and builds her estimate on that. She uses the information given her to estimate the way this value is likely to change and the degree of uncertainty associated with her estimate. The following equation models the process in the general case, one in which the earnings of the firm change at each moment in time.

$$d\hat{E}_t = \alpha \hat{E}_t dt + \sigma \hat{E}_t dW_t$$

This representation of the process has been given the fancy name of geometric Brownian motion with drift. But the core idea is simple. We can understand this process and the way it tracks the value of a troubled firm's earnings by imagining a blindfolded man walking in particular direction. We are on a large open field and we are standing on a long straight line. One of us is blindfolded and is asked to walk along that line. We want to predict how much that person changes the distance between her and the straight line at each moment in time.

The answer depends upon two things. First, we need to know how much the person is likely to deviate from a straight line unconsciously. (People do this because they favor one leg over another.) This effect is analogous to the first term, the rate of *drift* α . It tells us the path we expect this person to follow. Second, we need to know how likely each step is to depart from this predicted path. A clumsy person paying less attention might make bigger departures from this path at every step than someone who was careful and whose steps were more measured. We can have two people with the same predicted path, but one may be more likely to stray from it in one direction or another. This effect is captured in the second term: the amount of variance, the random error the person makes with each footstep, is given by σ .

We can then use this process to determine the value of the shutdown option. The process has two components. The first tells us how we expect earnings to change over time. If the firm is recovering from economic distress, however, we would expect the earnings to improve over time. The predicted rate of growth of earnings is μ . The higher μ , the more valuable the firm as a going concern and the more valuable the shutdown option.

Also crucial is the second component, σ , which measures the volatility (or variance) of future earnings. During any period, the condition of the firm may turn out to be better or worse than we expect. Not only does the condition of the firm affect earnings for that period, but for future periods as well. We base our predictions of earnings at $t=2$ on earnings at $t=1$. Similarly, we base our predictions of earnings at $t=3$ on earnings at $t=2$. If earnings were high at $t=2$, we expect them to be high at $t=3$; if earnings were low at $t=2$, we expect the same at $t=3$. Thus, to estimate future earnings, we need to know how much better or worse earnings might depart from what we predict.

Although σ has no independent effect on the expected value of the future stream of earnings of the firm as a going concern, it does affect the value of being able to postpone the liquidation decision. As the volatility of firm earnings increases, the potential gain from waiting increases. If we can still sell off the assets of the firm after shutdown for a fixed amount at any point in time, the increase in downside exposure from higher volatility is merely the lower earnings we receive before we shut the firm down, not the amount realized in the piecemeal sale. These low earnings in bad states do indeed become even lower as the variance increases. But the possibility of very low earnings for one period (after which the decisionmaker shuts down the firm and sells off the assets) is more than offset by the possibility of high earnings in *all* future periods when things turn out better than we expected.

The decisionmaker needs to know how much can be realized by selling the assets; she also needs to know the current income the firm is generating. But option pricing forces us to focus on two additional elements: (1) the average growth (?) of this earnings stream over time; and (2) the variance of earnings (?) within any period of time. These characteristics of firm earnings pin down the value of the decisionmaker's option to liquidate.

Both characteristics of the firm—? and ?—will depend on industry- and firm-specific factors. When profitability of firms in a particular industry grows slowly and is fairly predictable (? and ? are relatively low), the value of the shutdown option is small. The decisionmaker does not raise the value of the firm by deferring the shutdown decision to a future date. The relevant information is at hand and the possibility that earnings will unexpectedly rise is low. Hence, we are better off if the decisionmaker exercises the shutdown option sooner rather than later. The chances of surviving as a going concern are not high, but this alone is not what compels the conclusion that there is not a “reasonable possibility” of a successful reorganization. Continuing the reorganization effort is not reasonable because things are not likely to change and even if they did change for the better, they are not likely to change enough to justify the wait.

If collateral is not depreciating in nominal dollars, modern bankruptcy judges are likely to focus on whether the debtor is satisfying postpetition obligations, not on the uncertainty associated with the firm's income stream. They will not let a debtor go too long in the red postpetition, but they will allow the case to proceed months or even years if the debtor is at least breaking even. The case can remain in Chapter 11 as long as the debtor has some argument that it will be able to support a plan in the near future and no adverse event gives a secured creditor or other interested party an affirmative reason to protest. A real options perspective, however, suggests that this is a mistake. When the assets can generate more in an alternative use, however, we should conclude that a

reasonable possibility of a successful reorganization exists and continue the firm only if uncertainty about future earnings is high enough. In other words, existing practice treats uncertainty in future earnings as a factor that militates in favor of liquidating the firm rather than keeping it intact. Other things being equal, uncertainty cuts in the opposite direction.

Lower variance has no effect on expected earnings, but the value of the option drops as the variance decreases. Armed with this information alone, a decisionmaker might well be able to make the shutdown decision once she had only modest and readily accessible knowledge about the firm. Imagine a pizza parlor occupies a highly desirable storefront. It has been in business for several years, and, unlike the other stores near it or the other pizza parlors in the neighborhood, it cannot pay back its creditors. Indeed, it is barely meeting its ongoing operating expenses. Nothing in the environment is about to change. Because it is unlikely that firm revenues (and profit) will increase in the future, the decisionmaker should shut down the firm assets sooner rather than later.

The hard cases arise when the volatility of firm profit is high. Volatility may exist at the outset because of conditions that are firm specific. The firm needs to make significant changes in its operations, perhaps because of mismanagement in the past. Similarly, mismanagement may make it hard for anyone to have a grasp on the firm's prospects. During the first few months of the postpetition period, earnings will be highly uncertain, but the volatility may decline over time. Long-term volatility, the climate in which the shutdown decision matters the most, can arise when there is wide-variation among similar firms in the same industry. From the perspective of the decisionmaker, the variance of earnings σ^2 is quite high in these firms, even though the expected growth rate μ may be high or low. Greater uncertainty by itself increases the value of the liquidation option. If the firm is generating a positive cash flow and the shutdown value of the assets is stable, delaying the shutdown decision merely postpones the time at which we

realize the value of the firm's assets when sold off piecemeal. This cost is worth bearing when there is a possibility that the future income in every period may turn out to be large.¹²

We can get some sense of how real options may affect the way we think about the shutdown decision by returning to the television-shopping example. Tell me in which of the following two worlds you be more likely to keep on searching. In one world, prices are pretty close together. You go to a couple of stores, and the prices are all within a few dollars of each other. In the second world, you find that the prices are dramatically different from each other. In which case does it make more sense to continue shopping? It makes more sense in the second case. The more the prices vary, the more you stand to gain from continuing your search. High variance leads you to want to postpone making your decision because it is more likely you will find a much lower price at the next store. The shutdown decision in Chapter 11 is much the same. We have two firms. Everything about them is the same except we are a lot less sure about how much one is going to earn over time than another. To make it concrete, let us assume that the first firm is a pizza parlor that relies on foot traffic. The second is

¹² Although we characterize σ as a measure of the volatility, uncertainty, or "riskiness" of firm profits, we use these terms informally. Technically, σ is only a measure of the standard deviation of profits, i.e., the spread of outcomes around the expected (average) profit level. Thus, σ should not be confused with the standard measure of "riskiness", beta (β), which measures the sensitivity of an asset to market movements. If an investor holds the market portfolio and is considering another investment, β measures how that investment affects the riskiness of the entire portfolio, i.e., the extent to which it increases the variance of the investor's portfolio. In contrast, σ merely measures the extent to which firm profits will deviate from the expected (average) level of profits. While an increase in σ will increase the variance of profits, it may reduce the variance of the investor's portfolio (if firm profits are negatively correlated with the market rate of return). For more discussion of the relationship between σ and β , see

the fancy restaurant we talked about earlier. It doesn't have a neon sign. It relies on word of mouth. It could become hot and trendy. It all depends on what the in-crowd does.

The pizza parlor has very predictable earnings. It is never going to do much better or much worse than it is doing now. A fancy restaurant could be much more successful or much worse. The pizza parlor is like the television world in which prices are close together. If the pizza parlor can't make a go of things now, in all likelihood it never will. We can't justify waiting on the ground that there is little downside. What matters is whether there is an upside worth waiting for. Think again about shopping for the television. We are much more likely to go to an additional store in a world in which there was a big chance that the prices could be high or low. Instead of saying that we aren't going to lose much if we wait to shutdown the pizza parlor, we should ask how much we gain by waiting. Return to the fancy restaurant. Unlike the pizza parlor, there is a possible upside. The existence of this upside is a necessary condition to putting off the decision.

The value of the liquidation option increases with the variance of profit: the higher the variance, the higher the probability that profits will increase tomorrow. The variance of profit is decreasing; hence the value of the liquidation option is decreasing. This implies that the earnings one needs to justify delaying the liquidation decision *increases* over time. In other words, a decisionmaker should be less patient, more willing to make a once-and-for-all shutdown decision, as she learns more about the prospects of the firm (and therefore the variance of future earnings ? declines). All else being equal, the firm where the variance is greatest—perhaps cases like Iridium—are the cases in which delay makes the most sense, even though the risk is high that the firm may prove worthless as a going concern.

To summarize, a decisionmaker needs to know how much can be realized by selling the assets; she also needs to know the current income the firm is generating. But less recognized are the two additional elements that affect the value of the real option embedded in the shutdown decision: (1) the average growth of this earnings stream over time; and (2) the variance of earnings within any period of time. Current bankruptcy practice sometimes ignores these elements. Too often, we treat certainty in future earnings as a factor that militates in favor of keeping the firm intact rather than liquidating it. This is wrong. Other things being equal, certainty cuts in the opposite direction. Lower variance has no effect on expected earnings, but the value of the option drops as the variance decreases. Armed with this information alone, a decisionmaker might well be able to make the shutdown decision once she had only modest and readily accessible knowledge about the firm. The hard cases arise when the volatility of firm earnings is high.

III. Real Options Meet the Real World

Financial options have proved fantastically successful in securities markets because the numbers needed in the Black-Scholes option-pricing formula are readily available. We know the strike price for the option, we know the current value at which the stock trades, and from its past history, we know its volatility relative to the rest of the market. These numbers are not available for many real options, including the shutdown decision in bankruptcy. Hence, we should ask what benefit comes from using real options in this context. Given that we cannot plug in the numbers on a calculator the way a commodities broker can (and does), of what use are they?

(1991).

There are a number of ways in which real options can still be important in bankruptcy cases, even though they cannot be employed with certainty. First, and most practically, real option theory offers an important counter to any analysis that neglects the temporal element in decisionmaking. A creditor who wants the automatic stay lifted has not done enough if she merely presents an expert who shows that the expected earnings of the firm are less than its piecemeal liquidation value. Indeed, skillful cross-examination with pointed questions about real options can make such an expert look foolish.

The value of real options in a battle of the experts, however, should not be overstated. As in any arms-race, once both sides arm themselves the original equilibrium may not change much. Moreover, real options are a wrinkle on net-present-value calculations, not a competing methodology. Nor is it a radical break with current practice. One of the virtues of real options lies in the simple intuition that underlies it: timing is everything. The good decisionmaker knows when to decide, as well as how to decide. Real option analysis encourages the bankruptcy judge to cut through the valuation experts' fancy charts and all the jargon and ask simply, "What is it that I am going to know about this firm a month from now that I don't already know?" Real options, like most social science tools imported into legal analysis, are most useful for their ability to help us sharpen our own intuitions.

Nevertheless, when bankruptcy judges confront the question of whether to shutdown a firm, they do not seem to do anything like plugging values into a Black-Scholes equation. Their methodology instead begins with a search for red flags. They possess several shorthand rules of thumb that allow them to single out particular cases for closer scrutiny. Each judge, of course, approaches the shutdown decision differently, but it is useful to generalize and identify some of these rules of thumb. For the most part, they are sensible and effective proxies for

a real options analysis of the shutdown decision.¹³ Among the most important are the following four.

1. *The 13 O’Clock Rule.* When a clock strikes thirteen, you know both that the clock is broken now and that you have to doubt anything it has told you before. Judges take the prospect of shutting down the firm seriously (whether it is converting or dismissing the case or granting a lift stay motion, or appointing a trustee), if those running the debtor firm have made any misrepresentation to the court or have violated a court order, particularly with respect to cash collateral. Quite apart from the misdeed itself, the judge worries about others that might not yet be apparent.
2. *The Cash-flow Rule.* The judge does not regularly receive regular financials from firms in Chapter 11, but she typically will receive schedules that show how much cash has come into the business and how much has left. Cash flowing in might be artificially high because major assets have been sold. It might be low because the business is cyclical. Nevertheless, the schedules provide a quick picture of the firm, and if a firm that remains cash-flow negative for any period of time is suspect.
3. *The Three-Strikes Rule.* A debtor in bankruptcy may fail to file a schedule, miss a §341 meeting, or fail to pay a fee. The United States Trustee’s motion for dismissal will be taken seriously if it happens more than once or twice. Similarly, a debtor may pay an insurance premium late, fail to pay its postpetition taxes on time, or not meet its payroll. The tax collector or the union representing the workers may be the ones who push for the shutdown decision instead of or in addition to the United States Trustee. Even if such a firm does not evidence the negative cash-flow that would already raise a red flag for the judge, a repeated failure to meet obligations on time will trigger scrutiny. The judge infers that there are likely other problems that will keep the firm from reorganizing.
4. *The Meeting Milestones Rule.* At the status conference, the debtor will often put forward the goals that it expects to meet. It will find a buyer for the firm for a particular date. A new investor will be found. A plan

¹³ The use of such proxies (or “heuristics”) is a standard part of expert decisionmaking. See Gerd Gigerenzer, Peter M. Todd, et al., *Simple Heuristics That Make Us Smart* (Oxford 1999).

will be filed. Sometimes the milestone cannot be met because of circumstances beyond the debtor's control. Often the other major players (including the large institutional creditor and the United States Trustee) agree that an extension make sense. In these cases, the bankruptcy judge is likely to extend the deadline. But if the milestone is not met and major players oppose the debtor's effort to push it back, the bankruptcy judge again sees the failure as a red flag, a sign that the firm is not on the path to being reorganized effectively.

These red flags are all strongly information forcing. The bankruptcy judge cannot conduct her own investigations or make decisions independent of what parties bring before her in open court. Hence, she needs to act in such a way that parties have an incentive to bring information to her. These rules of thumb encourage debtors to ensure that information keeps flowing. The debtors that do have their acts together can be sorted from those that do not. The bankruptcy judge, like Sherlock Holmes, draws inferences from silence.

Recall that in Iridium, the bankruptcy judge had to decide whether to keep the network up and operating. The bankruptcy judge is not an expert with respect to the technology or the ways in which the existing satellite voice network might be converted to a data network, but the judge can draw inferences from the debtor's actions. Assume, for example, that the debtor starts the case by asserting a number of potential buyers have shown an interest in the system and need time to study the system more closely. If no buyer makes a bid when the time expires, the bankruptcy judge may draw the inference that potential buyers who have concluded that the networks prospects are too low to warrant putting up even the minimum amount the FCC requires.

These red flags do much to ensure that decisions are made at the right time. The real options approach, however, does suggest one category of firm that may remain in bankruptcy too long. Some marginal firms may be able to remain just below the radar screen of the bankruptcy judge. The bankruptcy judge relies on red flags and some firms may never have one. A debtor that cuts square corners and remains only marginally cash-flow positive can linger in Chapter 11 for a

long time. There is another way to put the same point. The screening rules that bankruptcy judges use seem to do two things effectively: (1) They allow firms with substantial going concern value to reorganize successfully the chance to do so; and (2) they ensure that firms that have no future as going concerns get weeded out. What these rules do not address are debtors whose chances of reorganizing are too small to justify the effort, but not small enough to trigger a red flag.

The prototypical case is the Chapter 11 filing of a building contractor. The firm has little value as a going concern. It rents equipment that it needs for each job and hires its workers in the same way. Much of the value of the business comes from the contacts of its owner-manager, but she can exploit these contacts outside of bankruptcy as well as in. For such firms to remain in Chapter 11 may do no great harm, but nothing about the current system forces anyone to ask whether there are benefits in the particular sufficient to justify the costs that are incurred.

Conclusion

In examining the effectiveness of Chapter 11 in preserving going concerns, the real options approach has much to commend it. But Chapter 11 is about much more than preserving going concerns, and a coherent vision of Chapter 11 must take this into account. It is important to distinguish between those cases in which the firm remains as an operating business in Chapter 11 and those in which the firm is sold or ceases to operate, but the Chapter 11 case continues. In the latter cases, there is no shutdown decision to be made. The costs and benefits of the Chapter 11 must be assessed against a different metric. What we often find is a dispute between different parties over fungible assets or the proceeds from their sale. In these cases, the appropriate benchmark may be the leisurely pace we ordinarily see in civil litigation.

For many debtors, Chapter 11 serves as a vehicle for resolving disputes (frequently between the owner-manager, the firm, and the tax collector). The question in such cases should not be whether the firm remains intact as a going concern or how long the reorganization process takes, but rather whether Chapter 11 is an appropriate forum in which to resolve the controversy. Return to the example of the retailer in the shopping mall. The case may still belong in Chapter 11. Chapter 11 is often the forum of choice for sorting out the problems of a failed business that has little value as a going concern.¹⁴ For example, apart from a secured creditor that may have already repossessed its collateral, the only other creditor in the money may be the IRS, which is owed FICA and withholding taxes. The owner-managers of the business are likely to be personally liable for these taxes. Chapter 11 provides a forum for them to negotiate a settlement. Although the case has little to do with corporate reorganizations, a bankruptcy judge is not likely to dismiss such a case until one of the parties asks her to make it. Whether such a case belongs in Chapter 11 is not one to which real option theory can provide much help.

¹⁴ See Samuel L. Bufford, *What is Right About Bankruptcy Law and Wrong About its Critics*, 72 Wash. U. L.Q. 829 (1994).