

## I. INTRODUCTION

Determining the value of property or assets is fundamental to law. Without the establishment of value, the issues surrounding the division of assets are ambiguous.<sup>1</sup> Some examples where the establishment of value is critical for practical applications are in the areas of probate, family law, partnership and bankruptcy law. In each of these areas, the law specifies how a particular division of the assets is to be conducted.<sup>2</sup> Probate law deals how the assets from an estate are to be distributed. Family law specifies how those from a dissolved marriage are divided, while partnership law how the assets from a dissolved partnership are parceled. In bankruptcy law, the question of the apportionment of assets of a debtor to creditors is analyzed. Yet, in all these areas we must have some measure of value or worth of the disputed assets for the process of dividing or apportionment to commence. In other words, the establishment of value is a necessary, though not sufficient condition, for a successful resolution of conflicting claims to property or assets. Without the establishment of value not only would disputants be arguing over their fair share of the assets, but over the actual worth of these as well.

This note is meant to address the problem of the establishment of worth or value of assets when one or the other parties does not want to sell the asset and therefore, allow the market to establish a price. More specifically, let me motivate the problem with the use of an example. Suppose that two parties are in the process of a divorce and there is a dispute over the value of an indivisible asset owned by the two individuals, for example, a home.<sup>3</sup> Furthermore, one of them wants to retain ownership while the other wants to receive her share of the equity.<sup>4</sup> This renders the solution of placing the asset on the market to determine its value cumbersome since there is no intent to sell it to a third party. Another reason why it may not be practical for either party to use the market to establish price is that

in conflictual situations value generally has to be determined fairly quickly to resolve the dispute and market offers occur over time.

The objective is to find a fair and optimal manner to establish the market value under these constraints. A minimal requirement of any procedure is that *ex ante* both parties should perceive that they are better off after the transaction is completed than before they proceeded, i.e., it should result in a Pareto-improving allocation. Furthermore, the social cost of negotiating or transacting should be kept to a minimum. Ideally, both parties would be able to use the procedure without the need for court intervention or arbitration.

I propose the following simple solution again illustrated with the use of an example. Let us suppose that the value of a house is to be determined so that the share of the equity of one of the parties can be distributed to them. How do we assess the value of the home? A common procedure is for each party to hire an appraiser and then to choose the average of the two values or if there is a large discrepancy in values between the first estimates to appoint a third appraiser as the arbiter.<sup>5</sup> Another method used in practice is for only one appraiser to be chosen (supposedly agreed to by both parties in the dispute) with both parties agreeing to the established value as final. These two methods are flawed for several reasons. First, the average of the two values or that chosen independently by a single appraiser is not necessarily the market value as perceived by one or both of the parties. Therefore, generally one or both will feel that the established value made them worse-off than had the true value been determined by some other procedure. Furthermore, one or the other party may be distrustful of the appraiser chosen by the other feeling that the estimated value assessed by the other's appraiser is biased against them.

Let me illustrate this point by providing a numerical example. Suppose that spouse A wants to remain in a jointly-owned home and wants to purchase spouse B's share. Spouse

A obviously has an incentive to hire an appraiser who assesses a low value to the asset, e.g., \$200,000. In contrast, spouse B wants the house valued highly since she is entitled to some share of the equity, say for example, one half. Spouse B hires an appraiser who values it at \$1 million dollars. If we take the average of \$600,000 as the final settlement this value need not be in any way related to the true market value. For example, the market value may in fact be \$500,000 if the house could actually be put on the market and sold over a period of time. Therefore, in this case the party receiving a proportion of the \$100,000 differential would be better off, while the other party paying the portion of this amount is worse off. How can we remedy the situation so that the true market value is assessed without any party having an incentive to employ a biased appraiser?

The solution is as follows. Each party hires their own appraiser with the condition that the person who hires the appraiser who provides the lower estimate has the obligation to sell the house to the other party for this value if the other party so chooses to exercise this option. Furthermore, the person who hires the appraiser that provides the higher estimate has the obligation to buy the house at this price if the other party chooses to exercise the option to sell it. More specifically, suppose party A's appraiser (the party who does not want to sell the property) values the house at \$200,000, while party B's estimates its worth to be \$1 million dollars. The procedure would be that Party A writes an option contract that gives party B the option to purchase (a "call") the house for \$200,000 while Party B writes an option that gives Party A the option to sell (purchase a put) Party B the house for \$1 million. By writing these contracts into the procedure we are able to eliminate any incentive either party has to misinform the other of the true market price since one or the other party could either buy or sell the house to the other for a profit and would therefore, be better off without the asset.

For example, if Party B claims the house is worth \$1,000,000, yet it is only worth \$500,000 then Party A can exercise her option to sell him the house for this amount and reap the differential profit of \$500,000. Similarly, if Party A claims it is worth only \$200,000, then Party B can exercise the option to buy it for this amount and turn around and sell it in the market for its true value of 500,000 and reap \$300,000 in profit. The only situation where neither party has any profit opportunity and therefore, the house will not be sold but kept by the party who wants to remain with it, is when each hires an appraiser who values the asset at its true value of \$500,000. At this point the option (either put or call) is worth nothing and therefore will not be exercised. So long as the true value is not being assessed by one or the other party the option is in the money and will be exercised leaving one of the parties aggrieved.

This mechanism is similar to the buy-sell or Texas Shootout clauses in many business contracts used to exit joint ownerships. Brooks, Landeo and Spier (2010) have recently explored this clause in contracts and find that asymmetric information is an impediment to their use. In fact it is part of the much wider literature on mechanisms for dividing assets amongst parties that includes work by Crawford (1977, 1980), Cramton, Gibbons and Klemperer (1987), McAfee (1992) amongst others. In fact, McAfee (1992) has shown that buy-sell clauses can lead to inefficient dissolution of assets. More recently, De Frutos and Kittsteiner (2008) show that the ex ante selection of the individual who submits a proposal to buy or sell in a Texas Shootout can result in an efficient outcome. This paper addresses this latter aspect by the use of options.

## II. A FORMAL ANALYSIS

### *1.1 The Mechanism.*

Assume a common value,  $v$  for the 2 players or spouses where  $v_1 = v_2 = v$ . This can be viewed as the market price for which the house would sell if the court imposed the sale. The mechanism is the following. First, each agent reports  $v_i$ . If both agents report the same value, one of them is randomly chosen and buys the object and pays half of the value to the other. Otherwise, first the high value person moves let's assume player  $j$ . He decides whether to buy the house at the lower price the other person claims its worth. If he decides to buy, he pays half of that amount to the other,  $v_i/2$  and his payoff is  $v - v_i/2$ . If instead he decides not to buy, the other individual, player  $i$ , who reported the lower value decides whether to exercise the option of selling the house to the other person at the price they claimed it was worth,  $v_j$ . In this case he receives half of this amount,  $v_j/2$  and player  $i$  receives  $v - v_j/2$ . Finally, if no one exercises his or her option, the high bidder buys the house at the average of the two values claimed  $(v_i + v_j)/2$  and pays half of that to the other individual,  $(v_i + v_j)/4$ . The extensive form of the game is represented in Figure 1 where the payoffs are  $(u_i, u_j)$  from the outcome of the equilibrium.

Let's consider the possibilities for equilibrium.

First, consider where  $v_i < v_j$ . Then it follows that player  $i$  (the lower bidder) would be better off if he instead submitted a bid of  $\hat{v}_i$  subject to  $v_i < \hat{v}_i < v_j$ . So this amount cannot be an equilibrium. Therefore,  $v_i = v_j$  must hold in equilibrium.

Next, consider  $v_i = v_j > v$ . Then one of the 2 players would be chosen with probability  $1/2$  and proceed to buy the house. In this case,

$u_i = u_j = \frac{1}{2}v_i + \frac{1}{2}v - \frac{v_i}{2} = \frac{1}{2}v$ . If player i announced  $\hat{v}_i$  subject to  $v < \hat{v}_i < v_j$ ,

then j would exercise the option and buy the house at  $\hat{v}_i$  with  $\hat{u}_i = \frac{\hat{v}_i}{2} > \frac{v}{2}$  so this cannot

be an equilibrium.

Now let's consider the case where  $v_i = v_j < v$ . Then in this situation,

$u_i = u_j = \frac{1}{2}v$ . If j submitted  $\hat{v}_j$  subject to  $\hat{v}_j > v_i$  then j would be able to buy the house

at price  $v_i$  in equilibrium, then  $\hat{u}_j = v - \frac{v_i}{2} > \frac{v}{2}$  since  $v > v_i$ , so this cannot be an

equilibrium.

Finally, the last possibility is when  $v_i = v_j = v$ . This implies that  $u_i = u_j = \frac{v}{2}$ . If

$\hat{v}_i < v_i$ , then  $\hat{u}_i = \frac{\hat{v}_i}{2} < \frac{v}{2}$  and there is no such deviation. Whereas, if  $\hat{v}_i > v_i$  then

$\hat{u}_i = \frac{v_j}{2} = \frac{v}{2}$  and there is no such deviation. Therefore, this is the unique Nash equilibrium

pure strategy for this game.

### III. CONCLUSIONS

Many closely held businesses such as limited liability corporations and partnerships contain buy-sell provisions in their operating agreements which provide a way for owners who no longer wish to participate in the business venture to leave. Similarly, divorce proceedings presents a situation where the assets must be redistributed between the parties. One popular exit mechanism in businesses is the so-called Texas Shootout or a Russian Roulette clause "where one owner names a price and the other owner is compelled to either purchase the first owner's shares or sell his own shares at the named price." This paper

presents another alternative mechanism that leads to an efficient outcome for parties to redistribute assets based on the provisions of a set of put-call options to them. This mechanism can reduce the need for “experts” to assess the value of contested assets in court proceedings.

## REFERENCES

- Brams, S. and Taylor, A.. *Fair Division: From Cake-Cutting to Dispute Resolution*. New York: Cambridge University Press, 1996.
- Brooks, R., Landeo, C., and Spier, K. “Trigger happy or gun shy? Dissolving common-value partnerships with Texas shootouts.” *Rand Journal of Economics*, Vol. 41, No. 4, (2010) pp. 649-673.
- Carey, S.A. “Buy/Sell Provisions in Real Estate Joint Venture Agreements.” *Real Property, Probate and Trust Journal*, Vol. 36 (2005), pp. 651–709.
- Cramton, P., Gibbons, R., and Klemperer, P. “Dissolving a Partnership Efficiently.” *Econometrica*, Vol. 55 (1987), pp. 613-632.
- Crawford, V.P. “Game of Fair Division.” *Review of Economic Studies*, Vol. 44 (1977), pp. 253-247.
- “A Self-Administered Solution of the Bargaining Problem.” *Review of Economic Studies*, Vol. 47 (1980), pp. 385-392.
- de Frutos, M. and Kittsteiner, T. “Efficient Partnership Dissolution under Buy-Sell Clauses.” *The Rand Journal of Economics*, Vol. 39, No. 1 (2008), pp. 184-198.
- Koloff, G., and Cutler, L., *NJ Family Law Practice*. (13th edition), NJ Institute for Continuing Legal Education (2008).
- McAfee, R.P. “Amicable Divorce: Dissolving a Partnership with Simple Mechanisms.” *Journal of Economic Theory*, Vol. 56 (1992), pp. 266-293.

FIGURE 1

