Does Patience Pay? Empirical Testing of the Option to Delay Accepting a Tender Offer in the U.S. Banking Sector[1]

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We examine the empirical predictions of a real option-pricing model using a large sample of data on mergers and acquisitions in the U.S. banking sector. We provide estimates for the option value that the target bank has in waiting for a higher bid instead of accepting an initial tender offer. We find empirical support for a model that estimates the value of an option to wait in accepting an initial tender offer. Market prices reflect a premium for the option to wait to accept an offer that has a mean value of almost 12.5% for a sample of 424 mergers and acquisitions between 1997 and 2005 in the U.S. banking industry. Regression analysis reveals that the option price is related to both the price to book market and the free cash flow of target banks. We conclude that it is certainly in the shareholders best interest if subsequent offers are awaited.

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I. Introduction

Numerous empirical studies, including Moeller, Schlingemann and Stultz (2004), and Fuller, Netter and Stegemoller (2002) have found that acquiring companies tend to overpay for acquisitions. One possible explanation of the empirical results is that managers of bidding firms may suffer from hubris (see Roll (1986)). Another explanation is the free cash flow hypothesis. Jensen (1986) argues that empire-building managements would rather make an acquisition than increase payout to shareholders. Such managerial overconfidence during takeovers is confirmed in more recent papers by Heaton (2002) and Malmendier and Tate (2005).

Other theories expect takeover attempts to be value destroying, such as Jensen’s (1986) agency cost theory and the theory of managerial entrenchment established by Shleifer and Vishny (1989). Jensen’s theory is related to excess free cash flows in a company, as for example in the oil business in the 1970s. Whenever there are less investment opportunities than available free cash, often this excess capital is used for takeovers, which leads to value-reducing diversification decisions. Shleifer and Vishny’s theory implies empire building by managers. Here, takeover transactions are pursued to improve the management’s position by increasing the managers’ value to the shareholders, without actually enhancing the value to the shareholders themselves (Weston, Mitchell & Mulherin, 2004).

There is a also an extensive literature on the management resistance to takeover, including Baron (1983), and Schwert (2000). The management of the target firm in an acquisition may turn down a tender offer for a number of reasons: It wants to retain control of the company;

the offer may not reflect the true value of the firm; or the offer may reflect the true value but management might be waiting for a better offer. The idea that management does not accept a tender offer and recommends shareholders to reject the offer, in anticipation of a better offer, is also reflected in the management being aware of the value that the option to delay accepting a tender offer has. Schwert (2000) highlights that if the goal of the target firm from taking a hostile stance to takeover is to bargain for a better offer, this can lead to a higher premium paid to target shareholders. Hard bargaining in pursuit of a higher premium potentially leads to a lower success rate. By understanding which factors, if any, have the highest explanatory power in determining the value premium for the option to delay accepting the offer, can have important implications for management's strategy in deciding to prolong the takeover bid. Just how effective is this strategy to the target company, and what is the value of this strategy to the target company's shareholders, are 2 of the important issues which the real option valuation model is able to answer.

In this paper we answer these questions by bringing together these two strands of the literature on the tendency for managers of the acquiring firm to overpay for an acquisition and the target management's resistance to takeover. There is a large literature in corporate finance that studies the information and value effects of mergers. There has also been extensive testing of option-pricing models for financial assets; however, virtually to our knowledge no research has been conducted on the empirical applications of option-based valuations models for tender offers. We value this amount by using a real option methodology to empirically value the option to delay accepting a tender offer. These results have important implications for the management of both target and bidder banks in their decisions for merger and acquisition behavior.

This research is the first to examine the empirical prediction of a real option pricing model using a large sample of data of 424 mergers and acquisitions between 1997 and 2005 in the U.S. banking industry. We argue that if firm managers suffer from empire building and hubris, they are likely to put in a higher second offer for the acquisition if the tender offer is rejected. This gives the target firm a valuable option to wait in accepting a tender offer.

Our empirical results show that market prices reflect a premium for the option to wait to accept an offer that has a mean value of almost 12.5% for a sample of 424 mergers and acquisitions between 1997 and 2005 in the U.S. banking industry. The synergy value to the acquiring bank is therefore estimated at am eighth of the market capitalization of the target bank. Regression analysis reveals that the option price is related to the free cash flows of the targets among others. We conclude that it is certainly in the shareholders best interest if subsequent offers are awaited; hence patience on behalf of target banks pays.

The remainder of the paper is organized as follows: In Section II we present the methodology and data. We define the option that will be valued by specifying the parameters needed for valuing a real option, outline the option valuation methodology adopted and present the sample selection. Section III discusses the empirical results. Conclusions are presented in Section IV.

II. Methodology and Data

II.1 The Option to Delay Accepting a Tender Offer

When a tender offer is presented at time t to the shareholders of a company, they receive an offer price P_t to sell their shares currently worth S_t to the acquirer, resulting in a gain of P_t - S_t. The shareholders may accept this offer immediately or wait with their offer of acceptance until a date T. This final date is usually specified by the acquirer but may also be determined by the applicable legislation concerning mergers and acquisitions. The shareholders in the target company therefore have the option to sell their shares now for the gain specified above or wait until date T is reached and sell their shares later for S_T.

In general, shareholders would accept the offer straight away if P_t - S_t is higher than the present value of receiving $P_t - S_T$ at time T, discounting at the risk-free rate. However, by receiving the offer P_t which elapses at time T, shareholders are presented with an American call option to wait for a higher, second, third or a final offer P_2, P_3, or P_T , which is larger than P_t and therefore represents a gain of P_T - $S_T > P_t - S_T$ or an incremental gain of $P_t - P_T$. By waiting for such an offer, the shareholders run the risk that the acquirer withdraws his bid and they receive nothing or receive a lower offer with $P_T < P_t$. Accordingly, the option to wait that is valued here has the possible payoffs of

$$\max[\, PV(P_T - S_T) \,;\, P_t - S_T)].$$

II.2 Option Value Determinants

Current Value of the Underlying Asset (V)

The value of the underlying asset is the gain the shareholders make by accepting a tender offer and selling their shares at a premium over the market value of the shares before the announcement was made. It is therefore dependent on the difference between the final offer P_T and the target companies share price S_t , before any bid was received. This implies that $V = P_T - S_t$.

Stock price volatility (σ^2)

The price volatility of the target companies share price is a crucial element in the real option model. In our framework the stock price variance can be estimated directly, t is therefore analogous to determining the variance when valuing a regular financial option on a stock[2].

Exercise price (X)

The exercise price in the real option model is the investment that must be made in order to acquire the underlying asset. In this case if the target shareholders accept the second offer they cannot receive the premium from the first offer so by tendering their shares for a gain of V they lose $P_t - S_t$. It is important to note that X is not equal to S, because if the bid is withdrawn ($P_T = 0$) and in the case that $P_T < P_t$, the shareholders would actually lose a part of the gain they would have made if they had accepted the offer of $P_t - S_t$. The price that has to be paid to exercise the option is therefore given as $X = P_t - S_t$.

[2] Davis (1998), Luehrman (1998) and Damodaran (1999) point out that the variance is the most difficult part to determine in real option valuation when it cannot be observed directly, and estimation is possible but difficult and imprecise. Alternatively, Fabozzi (2005) uses a backward approach by comparing similar options with known option values to find the implied volatility.

Time to expiration (T)

The time to maturity of an American call option is the date until which the option's holder has the right to acquire the underlying asset. For valuing the option to wait, time T can be determined by a multiple of variables, such as the acquirer setting a deadline or legislation specifying a time until which the takeover process has to be completed. It is even possible that the option cannot expire in the case when a tender offered has been declared unconditional after a certain threshold and the acquisition of shares has been exceeded. For consistency we determine the time, T, by the date when the transaction is successfully completed; or in the case when the offer is withdrawn, at the time when the transaction is aborted.

Discount rates (r)

As is standard in the real option pricing literature risk neutral valuation is adopted, see Fernández (2002)[3]. To be able to apply risk-neutral valuation, discount rates equal to the respective risk-free rates over the life of the option must be chosen. In general, the higher the interest rate, the larger the call option value, because higher interest rates reduce the present value of the strike price. The risk-free rate is chosen so that it corresponds to the length of the life of the option.

Dividend payout (δ)

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[3] Standard financial options are priced using the risk-free rate, resting on risk-neutral valuation made possible by a no-arbitrage argument since the underlying asset is traded and so the payoff of the option can be replicated. In many cases it is possible to use risk-neutral valuation even though the underlying asset is not traded, Constantinides (1978) and Harrison and Kreps, (1979); otherwise determining an appropriate discount rate is difficult, imprecise and very time-consuming.

The presence of discrete dividends or a continuous dividend yield on the underlying stock price decreases the value of the option and in some cases makes it optimal to exercise the option early (Hull, 2002). Dividends represent a cash-outflow of the underlying asset that cannot be captured anymore by the holder of the option and the value of the option decreases. In real option analysis the dividend yield is usually labeled the cost of delay but the effect remains the same.

II.2 Option Valuation Methodology

II.2.1 Simulating vs. Approximating Stochastic Processes

When there is no analytical solution for valuing an option, or if an analytic solution can not be applied, there are two other main approaches for valuation. Either direct simulation of the stochastic processes determining the evolution of the price of the underlying asset, or, by approximating the stochastic processes by partial differential equations. Monte Carlo simulation and lattice methods belong to the first category whereas methods of numerical integration and explicit or implicit finite difference schemes belong to the second category.

Since the option to be analyzed here is American, Monte Carlo simulation should not be used (Trigeorgis, 1996). In our framework it is more appropriate to employ a finite-difference method or a lattice approach. Geske and Shastri (1985) provide a detailed comparison of the approaches. They compare explicit and implicit finite difference methods, three types of binomial methods and the analytic Black-Scholes method for computing the values of American call and put options with and without dividends. They compare the methods along two dimensions. The method’s precision is measured by looking at the convergence of the approximation errors and stability. Efficiency of the method is measured by computing the costs associated with employing the methods. The results by Geske and Shastri (1985) indicate that the binomial approach, the implicit finite difference and the log transformed explicit finite difference method give the best results.

However, each method is especially suitable for valuing a particular type of option. Geske and Shastri (1985) recommend the binomial method for options where no (discrete) cash-outflow in the underlying asset is present and argue that it is still reasonably accurate when assuming a continuous cash-outflow (dividend yield or "cost of delay"). The explicit finite difference method has some stability problems but when transformed logarithmically is more efficient than the implicit finite difference method[4]. Their results furthermore imply that finite-difference schemes can be equivalent to a dynamic-programming-type process such as used in a lattice approach.

Following their approach, we value the option to wait using the lattice approach. A lattice approach is as precise as using a finite-difference technique but is more pragmatic since it does not involve specifying the partial differential equations to describe the stochastic process of the underlying asset.

II.2.2 Lattice Approaches

The binomial lattice approach for option valuation was first presented by Cox, Ross and Rubinstein (1979). Risk-neutral valuation is used in all lattice approaches, whether binomial

[4] See Geske and Shastri (1985). Researchers computing a smaller number of option values may prefer the binomial approximation, while practitioners in the business of computing a larger number of option values will generally find that the finite difference approximations are more efficient.

or trinomial, with the option value being determined as the discounted value of the expected option payoff. Lattice approaches determine the value of the option by constructing a multinomial tree showing all possible states of the price of the underlying asset over time. These values are obtained by using transition probabilities that determine the magnitude of the state variable at each point in time. Those time points have to be selected so that the tree converges in a manner that is accurate, stable and efficient (Trigeorgis, 1996).

In principle, accuracy and stability can be obtained by increasing the time points until maturity while efficiency can be obtained by reducing the steps. Therefore, a balance has to be chosen between obtaining accurate results and saving computing time. Convergence is necessary since each step in the tree actually can be seen as a model of its own. Hence, the sequence of probabilities must converge to a limiting probability measure (Bingham and Kiesel, 2004).

Starting at the end of the multinomial tree, corresponding to the expiration of the option, the value of the option is calculated according to whether its expected payoff is positive or 0. Using the possible option values, the values one period before expiration can be calculated. Successively all possible option values over time are calculated in a backward manner until the starting point of the binomial tree is reached and the current option value is calculated.

All lattice approaches work according to this basic structure but many changes have been proposed to incorporate multiple options, discrete cash-outflows, improve computational accuracy or incorporate more than one state variable. For instance, Hull and White (1988) propose a control variate approach to be used with lattice approaches in order to improve computational efficiency. The control variate approach reduces variance by reducing the dimensions needed in the calculation and therefore reduces estimation errors by about 50%. It requires the existence of a similar option whose value is already known, such as, for example, a European option with exactly the same parameters. Although it provides a significant improvement over standard binomial models the control variate technique cannot be used in our framework since no similar option exists.

Another extension of the lattice approach by Cox, Ross and Rubinstein (1979) is presented by Boyle (1988) who develops a method for valuing American options where two state variables need to be considered. This method also cannot be applied here as there is only one underlying asset and hence only one state variable. As mentioned by Geske and Shastri (1985) methods for incorporating discrete cash-outflows can be disregarded as they make the calculation far less efficient but only improve the results marginally. Therefore a continuous dividend yield will be used for valuing the option to wait. The lattice approach that seems most suitable for valuing the option to wait with the parameters specified above is the one developed by Trigeorgis (1996), which will be outlined in the next section.

II.2.3 Calculation

The algorithm used to value the option to wait is based on the log-transformed binomial model presented by Trigeorgis (1996). The value of V is assumed to follow the diffusion Wiener process given by

$$\frac{dV}{V} = \alpha dt + \sigma dz \, . \tag{1}$$

In this equation, α is the instantaneous expected return on V, σ is the instantaneous standard deviation and z is a standard Wiener process. For a small time interval this implies that the natural logarithm of *V* follows an arithmetic Brownian motion in continuous time or a Markov random walk in discrete time.[5] Assuming risk-neutrality and thereby implying that $\alpha = r$ means increments in *lnV* are independently, identically and normally distributed.

By expressing time in units of variance (in the form of $\sigma^2 T/N$) increments in *lnV* become normally distributed, having a mean of $\mu(\sigma^2 T/N)$ and a variance of $\sigma^2 T/N$, where the drift parameter μ is defined as $r/\sigma^2-0.5$. We also include the dividend yield which reduced the drift parameter by dividend rate *d*. To be used in a multinomial valuation model, this continuous diffusion process must be approximated by a discrete process. This is done by dividing the time to maturity into *N* subintervals of equal length.

Calculations are made for the subintervals, N, equal to 50, 100, 250, 500 and 1,000 subintervals. Within these discrete subintervals the value of the underlying asset follows a Markov random walk, increasing by an amount $\Delta lnV = H$ with probability *P* and decreasing by an amount $\Delta lnV = -H$ with probability 1-*P*. This implies that the discrete process measures the value of the underlying asset *V* as *lnV* expressed in units of length *H*, and measures time in units of variance *k*. This discrete process has a mean, $2PH - H$, and a variance, $H^2 - (2PH-H)^2$.

[5] A Markov random walk is a special type of a discrete-time Markov chain and describes a process which changes states at discrete time steps and where the probability of the next stage only depends on the current state, disregarding the past states (see Bingham and Kiesel, 2004).

For reasons of consistency, mean and variance of the continuous and the discrete diffusion Wiener process must be equal. Therefore, the probability of an increase H in V for one k, P must equal $0.5(1+ \mu k/H)$ and H must equal $[k+(\mu k)^2]^{-0.5}$ conditional on H being larger than μk, where k is defined as $\sigma^2 T/N$.

To be applicable in our framework, the option parameters specified in Section III must be transformed to achieve consistency between the continuous diffusion and the discrete time processes outlined above. As the previous paragraph described, these intermediate variables are defined as k (time step), μ (drift), H (state step), and P (probability).

The next step consists of calculating the terminal boundary values at the last day of the option's life. Hence, for each state i at $j = T$ the following formula is used to calculate $V_{(i)}$:

$$V_{(i)} = e^{V_{(0,0)} + i*H} \quad . \tag{2}$$

The option payoff at node $(i\ ;\ T)$ is equal to the difference between $V_{(i,T)}$ and the corresponding strike price $X_{(i,T)}$, which is defined as:

$$X_{(0,0)}\left[1+\left(tr * k / \sigma^2\right)\right] . \tag{3}$$

The final step consists of a backward iterative process which is used to calculate the option's value at the announcement day of the bid. Starting at the terminal values at $j = T$ the values of the option for the preceding node $j = T$-1 are calculated using the information for two states i present at $j = T$. This implies that according to P, the value of the option at nodes with $j = N$ is equal to the higher of the two values at the two possible states, at $j = N$ discounted for one period at the risk-free rate, equal to equation (4) or the payoff from early exercise:

$$R_{(i,j-1)} = e^{-rk/\sigma^2}\left[PR_{(i+1,j)} + (1-P)R_{(i-1,j)}\right]. \qquad (4)$$

II.3 Data

II.3.1 Sample Selection

Our primary data set consists of a large number of transactions for mergers and acquisitions in the U.S. banking industry over the period 1997 to 2005 retrieved from Thompson Financial's SDC Platinum. A merger occurs when an acquiring bank and a target bank agree to combine under legal procedures in the countries in which the merger participants are incorporated. Generally, mergers are friendly and require the approval of both management teams and management boards before stockholders vote. In contrast, inter-firm tender offers are generally of unfriendly nature, as the target management is by-passed by asking the stockholders to sell their stock or voting rights. Both kinds of transactions can be referred to as takeovers or acquisitions, which will be the terms that are used in the following.

In order to obtain any evidence on the value of an option to delay a tender offer it is necessary that we are meticulous in constructing the sample so that other influences can be controlled. The original data of mergers and acquisitions was reduced to a sample of 424 deals in the U.S. banking sector, which fulfilled the following 8 necessary conditions:

1. The deal type was a merger or acquisition.
2. Target and acquiring were both US based.
3. Target and acquirer belong to the banking sector with respective SIC codes: 6000, 6081, 6029, 6082, 6021, 6712 and 6022.
4. Target and acquirer were both publicly listed companies.
5. The sub-deal type must have been one or more of the following: contested bid, hostile bid, initially hostile bid became recommended bid, public takeover, recommended bid, initially recommended bid became hostile and/or unsolicited bid.
6. The deal status must have either been completed or withdrawn.
7. To avoid the issue of using equity as a signaling effect, we focus on cash transactions only [6].
8. The final stake the acquirer has in the target after completion of the transaction must be more than 50.1% to include only transactions where a change in control takes place.

II.3.2 Variables

Besides a synopsis and the general information gathered on the targets and acquiring banks, the announcement and closing dates of the deals were obtained in order to calculate the time to maturity. Furthermore, the initial offer and the final offer were compared to the target stock price one day prior to the announcement date. Also, the dividend yield one day prior to the announcement date was applied to avoid any announcement effects on the dividend yield.

[6] Travlos (1987) points out that those firms with poor returns generally pay for acquisitions with equity.

Additional data, necessary to determine the option value, e.g. dividend yield and risk free rates, was extracted from Thompson Financial's Datastream. We employ the one month US interbank rate. For all rates, averages over the respective period from the announcement until the conclusion of the deal were calculated. For the regression analyses that were conducted in order to test factors that could potentially influence the option premium, all variables used were key item variables extracted from Thompson Financial's Datastream. These were Cash Flow per Share, Market Capitalisation, Common Equity and Debt to Equity, Book Value per Share and Price to Book Value Ratios respectively.

II.3.3 Descriptive Statistics

Table 1 shows the descriptive statistics for all parameters that are needed to determine the option values for the full dataset of 424 observations. The necessary stock prices are given in absolute and in standardised form. For simplicity, all absolute numbers are given in US dollars. N is the randomly chosen amount of subintervals into which the time to maturity is subdivided for the calculation model.

Insert Table 1

III Empirical Results

By applying the model to the described data set, we obtain option premiums that are realised by delaying the decision to accept a tender offer. Table 2 presents the summary statistics for the option premium of the data set, which relies on 250 nodes. Based on a total sample of 424 bank acquisitions between 1997 and 2005, we obtain an average option premium of 12.45%.

Insert Table 2

We find that this average option premium of 12.45% is stable from year to year. Although the Group of Ten (2001) finds that the amount of takeovers and the takeover values constantly increased between 1997 and 2001, this research based on various sub samples finds that the average annual option premium does not vary significantly during the period of observation. Interesting is also the comparison between mean and median values. The median is significantly lower than the mean, which suggests that outliers exist that pushes the average premium upwards.

Moreover, in 60 observations information about competing bidders was revealed. Without competition of other potential acquirers, the option premium was at 8% significantly lower than the average. Table 2 indicates that in the case that competitors entered the bidding process, the findings suggest an option premium of 18.43%, which is clearly much greater than the average premium paid. This is in line with previous studies and the winner's curse theory first established by Rock (1986). As more bidders enter the process, the higher the bids with the winner probably paying too high a price for the takeover.

The exercise price is already corrected for the time value of money due to the risk-free discount rate. Thus, a potential premium as it is determined by this research is instantly incurred when accepting the tender offer. As the option premium is of significant size, target shareholders are always better off if the decision to accept a tender offer is delayed. Even if the offer is withdrawn and the transaction is cancelled, the chance of a future takeover is very high. Our finding of an increased premium with competition in the bidding process also suggests it is highly valuable to delay the decision to accept an initial tender offer for as long as possible. The higher the probability of other bidders in the bidding process, the greater this value.

In contrast to the positive implications for target banks shareholders, acquirers must be aware of the negative impacts, in case the option to delay accepting the tender offer is exploited. Previous research implies that majority of the return to the target company's shareholders is born by the bidder. Hence for the acquirer it is of importance to finish the transaction before any competitors enter the bidding process.

III.1 Sensitivity of the Option Parameters

It is highly interesting to gauge the sensitivity of the parameters in the option model to the option premium. The option premium is a positive function of the premium offered over the stock price at time *t(X)*. The higher the initial tender offer over the stock price at time *t*, the higher the option premium to wait in accepting the offer. There is also a similar positive relation between the option premium and the final offer premium *V*. The variance of the underlying stock price has a greater positive influence on the option premium, as can be seen in Figure 1: the more volatile the stock price during the run-up to the tender offer, the higher the premium. Figure 1 also indicates that the longer the period until the target firm has until the tender offer lapses results in a significant increase in the value of the option.

Insert Figure 1

There is a positive and highly significant relationship between the premium on the tender offer, over the stock price at the time of the offer *X*, and the value of the real option. This provides us with some empirical support for a model that incorporates the option to wait in accepting a tender offer.

At time *t* the option value can be derived for the target firm in waiting to accept the tender offer. The sensitivity of the value of the option to the final offer can be calculated, so that the target firm can evaluate the additional value of waiting to accept the tender offer. To analyze in more detail which factors are more influential in determining the value of the option to wait, it is necessary to run some preliminary regressions. The results of these regressions are presented in Figure 1. It becomes apparent that the variance (Figure 3) is the largest driver in valuing the additional value of waiting to accept a tender offer from an acquiring firm.

Insert Figure 2 & 3

The second strongest driver is the value of the underlying asset. Moreover, we see that there are highly significant positive relationships between the value of the underlying asset, the variance of the stock price in the underlying period and the size of the option premium.

III.2 Endogenous Variables

To try and determine which firm specific characteristics can best explain the size of the option premium, we analysed a variety of firm factors. Both for the acquiring firm and the target firm. The additional factors which we analyse for the target banks were, size, debt/equity ratio, earnings and price to book value. We also look at the size of acquiring firm, debt to equity ratio, FCF and price to book value of the acquiring firm. Dunis and Klein (2005) also do this for financial firms; however, use a different methodology.

Several regression analyses were conducted with the option premium as the dependent variable and several endogenous variables as independent variables. For the acquirer side, these were respectively Market Capitalisation, Debt to Equity, Cash Flow per Share, and Price to Book Value. For the target side, these were respectively Market Capitalisation, Debt to Equity, Free Cash Flow per share and Price to Book Value. Summary statistics of the regressions are provided in Table 3.

Insert Table 3

Price to book value can be seen as a proxy for company size. Hence, the size of the target company significantly influences the option premium. Furthermore, a low price to book value and the contribution to a higher option premium can be seen from the acquirer perspective. If the target firm has a very low price to book value, the acquirer is more likely to want to pay a premium for acquiring a valuable asset at a low price.

It can be deemed very likely that target size influence the option's value in some way or the other. In particular the notion that larger firms have a greater base of knowledge capital, greater efficiency gains from a reduction in overhead costs and hence greater overall benefits from synergy. Related to this, another interesting question would be to find out how previous takeover attempts and the percentage premium offered by the acquirer influence the value of the option.

Schwert (2000) finds that target firms with higher market-to-book ratios are more likely to be successfully taken over. This may provide evidence that the value of the option to delay accepting a tender offer is likely to be higher for target firms with high BV/MV. We do find evidence in support of Schwert (2000) for the US banking sector, since target firms with a high price to book value have lower option prices. However the result is not significant for MV/BV ratios, or as a ratio of the acquiring companies MV/BV.

The empirical results by Schwert (2000) also show that targets with lower debt-to-equity ratios are more likely to be successfully taken over. Does this mean that they also render larger premiums for the option value to delay accepting the offer? We find no evidence in support of the premium that US banks pay in attracting target banks being related to target banks with a specifically low or lower debt-to-equity ratio. There is some anecdotal evidence that targets avoid takeover by adding debt through a leveraged recapitalization, however our results do not show empirical support for higher premiums being paid for banks with low debt ratio for the US banking industry.

A likely explanation is in line with the hubris hypothesis of corporate takeovers presented by Roll (1986). The first offer represents the maximum amount the acquirer can offer to make the acquisition a profitable deal. However, most managers engage in only very few acquisition during their career, while at the same time these acquisitions have a profound impact on their career. It is not only due to the increase in power but also due to the publicity that is associated with such a deal. Therefore, the reason for a second (higher) offer might be, that the management of the acquiring company willingly overpays for personal reasons. Abandoning the deal could be perceived badly. Acquisitions are often presented as necessary for the future of the acquiring company. Not completing a deal would question the credibility of the management.

III.3 Robustness Analysis

As pointed out in the methodology section, the accuracy, stability and efficiency of the model is dependent on the amount of nodes included in the binomial lattice approach. A sensitivity analysis with different amounts of nodes was conducted to see the influence of a change on the final result of the option pricing model. Therefore, the initial amount of 125 nodes was doubled three times and the model was run with 125, 250, 500 and 1.000 nodes. Even though, Trigeorgis (1996) states that his application of the log-transformed binomial model with N = 50 nodes and came up with a result that only deviates minimally from the standard binomial model of Cox, Ross and Rubinstein (1979) with N = 500 nodes, this research starts with 125 nodes and the empirical results given in the tables above are obtained with N = 250 nodes.

When the nodes are doubled from 125 to 250, the option premium changes by more than three percent from 13.18% to 12.77%. If it is doubled again to 500 nodes, it only changes by 0.64% to 12.69%. Thus the result with N > 250 can be seen as reasonably accurate and stable. With regard to efficiency, the choice of 250 nodes also seems to be the best. When the amount of nodes is doubled from 125 to 250, the processing time is less than doubled from three to five seconds. If the amount of nodes is doubled further, the amount of processing time is more than doubled: from five to thirteen seconds for 500 nodes and to about 50 seconds for 1000 nodes.

IV Conclusions

This paper provides evidence, based on a large sample of actual mergers and acquisitions in the U.S. banking industry, that the real option pricing model for valuing the price of delaying in accepting a tender offer has descriptive value. This paper gives insight into the quantitative premium that can be obtained by target shareholders of a bank under acquisition from waiting to accept the tender offer. If the decision to delay accepting the tender offer is pursued, the average premium to the target shareholders amounts to 12.45%. The median values are lower with 5.2%, hinting towards large outliers in the data set. In any case the median values support the conclusion that target bank shareholders are better off by waiting when accepting a tender offer from a potential acquiring bank in the US banking industry.

By delaying the decision to accept the tender offer, potential new entrants on the bidding process may occur. We find highly significant evidence that the premium is much greater, if competitors enter the bidding process. This finding holds for the total data set, as well as for various annual sub-samples. Several characteristics of banks that could potentially increase or decrease the likelihood of a larger option premium have been researched by conducting regression analyses with endogenous variables. Of all the researched variables, only a target banks' price to book value and its earnings per share had a significant inverse relationship on the size of the option premium. A low price to book value means than an acquirer takes over a bank that seems to be worth more from its balance sheet for a lower price. A similar reasoning for target companies earnings to price ratios. Although these factors may be intuitively understood, both the coefficients of the estimates and the R^2 of the regressions were extremely low. This would indicate that other non- firm specific factors play a greater role on the size of the option premium and hence the value to the target bank in delaying the option to accept a tender offer. One explanation of the large value for the option premium is the hubris hypothesis of corporate takeovers presented by Roll (1986).

The implications from this research are exactly opposite for acquiring banks. The longer the takeover process takes and the more reluctant the target shareholders are to accept the tender offer, the higher the price for the transaction and the more likely bidders will enter the process. That increase in the price can diminish all potential gains from realising synergies and economies of scope. Hence, whether to delay accepting a tender offer depends on the perspective. For target shareholders, patience always pays!

The model developed has proved to be simple enough to be intuitively understood, yet complex enough to capture all the important factors influencing an option's value. An analytic solution to the valuation problem would decrease the time needed to calculate the option's value. However, since the development of an analytic solution is far more complex and does not necessarily improve the results, the practical and theoretical benefits of switching from a lattice model to an analytical model are limited.

The real option model outlined in this paper has found empirical evidence of a large and significant premium to the target company in delaying to accept a tender offer from an acquiring bank. Using data for a sample of 424 US banks between 1997 and 2005 we find a value of 12.45% as a premium paid. The real option methodology enables us to break down the effects of time, stock market volatility on the value to the target bank of having this option. The most crucial factor is the effect of stock market volatility on the value of the premium. Patience also pays in that it may attract competitors in the bidding process, which resulted in a significant gain in value to the option value and hence to the target bank's shareholders.

For future research it would be interesting to see if hostile takeovers render a larger option premium. We have also not yet analyzed multiple bidders (white knights), and the effect of seeking additional bidders to give the option greater value. Also, the financial ratio analysis has raised additional questions. As only two ratios of the target have been revealed to be significant, it would be of importance to find also variables for the acquiring firm that can help to predict the option premium.

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Table 1: Descriptive Statistics of the US Dataset

Parameters	Description	Mean	Median	Std. Dev.	Min.	Max.
S_t	Target closing price 1 day prior to announcement	33.05	22.00	48.66	0.31	559.72
P_t	Initial price per share	40.53	26.94	61.93	0.45	738.6
P_T	Accepted price per share	40.80	26.60	63.38	0.45	744.06
V	$P_T - S_t$ in absolute values	7.74	4.70	23.59	-121.25	341.65
X	$P_t - S_t$ in absolute values	7.48	4.66	21.91	-121.25	335.75
V (stand.)	Value of underlying asset	0.298	0.216	0.480	-0.648	7.688
X (stand.)	Strike price	0.297	0.215	0.476	-0.648	7.688
Var	Variance	0.075	0.012	0.673	0.000	14.776
T	Time to maturity in days	161	157	74	0	967
r	Risk-free rate	3.99%	4.32%	1.89%	0.00%	13.32%
DivYie	Dividend yield	2.23%	1.89%	4.62%	0.00%	94.32%

Table 2: Summary Statistics for the Option Premium

	Mean	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
Total	12.45%	5.22%	18.39%	0.00%	75.79%
With Competitor	18.43%	8.81%	25.60%	0.01%	75.79%
Without Competitor	8.00%	2.74%	14.46%	0.00%	70.49%

Table 3 – Firm specific explanatory variables for the discount in accepting a tender offer immediately

A	Discount if accepting offer immediately				
Target Bank Variable	(1)	(2)	(3)	(4)	(5)
Target Total Debt %	-5.87E-05	-8.70E-05			
	6.83E-05	6.63E-05			
Target Size (Market Cap)	-1.93E-10		-1.62E-09		
	1.65E-09		1.26E-09		
Target Earnings Per Share	-0.010854			**-0.019323**	
	0.013936			0.009838**	
Target Price to Book Value	-0.023623				-0.032226
	0.017891				0.016521**
R2	0.028013	0.007704	0.007314	0.017079	0.016851
Number of observations	224	224	224	224	224

B	Discount if accepting offer immediately				
Variable	(1)	(2)	(3)	(4)	(5)
Acquirer Total Debt %	-8.36E-05	-0.000108			
	6.62E-05	6.44E-05			
Acquirer Size (Market Cap)	-7.32E-10		-8.86E-10		
	4.86E-10		4.77E-10		
Acquirer Cash Flow per Share	-0.000156			-0.000133	
	0.000184			0.000184	
Acquirer Price to Book Value	-0.009589				-0.013631
	0.011438				0.011222
R2	0.021228	0.008974	0.010926	0.001660	0.004707
Number of observations	314	314	314	314	314

** Significant at the 5% level

Figure 1: Real option value as a function of the target bank's stock price

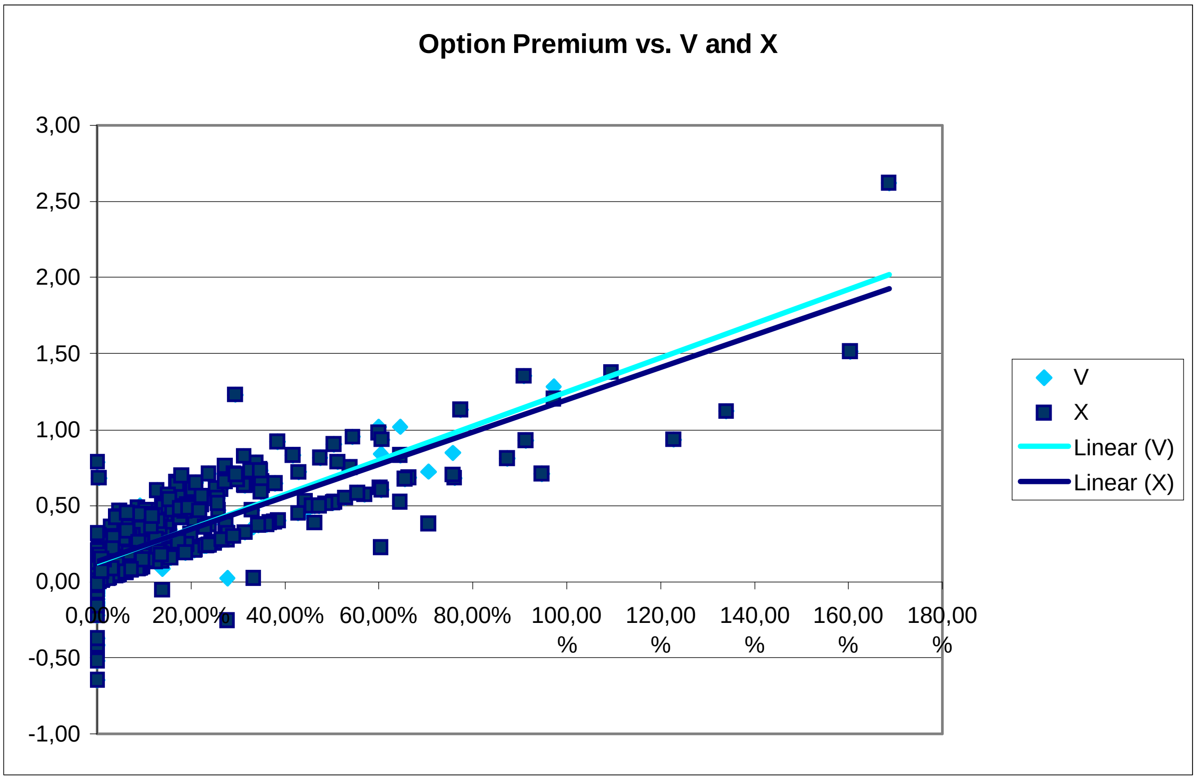

Figure 2: Real option value as a function of time

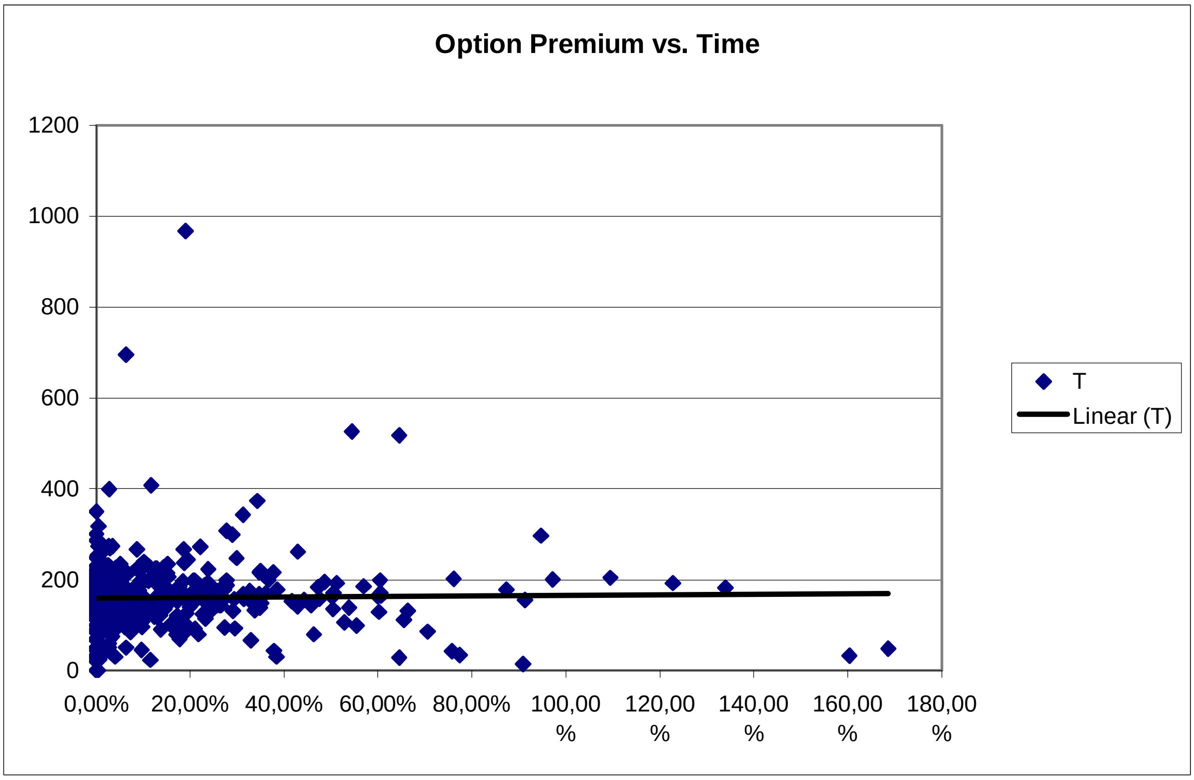

Figure 3: Real option value as a function of the target banks stock price volatility