Very Preliminary

DOES CAPITAL HURT THE VALUE OF THE BANK?

by

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ABSTRACT

We develop a theoretical model to examine the effect of equity capital on the value of the bank in an acquisition context. Focusing on the two components of the purchase price paid in an acquisition, the model shows that the marked-to-market value of the target bank is directly affected by the target bank's equity capital, whereas goodwill is only indirectly affected. The predictions of the analysis are that the purchase price and goodwill are increasing in the target bank's equity capital. When we confront the prediction with the data on bank acquisitions, we find strong support. Moreover, we find that the marked-to-market value of the target bank is also increasing in the target's equity capital, and the difference between the acquisition price and the target bank's equity capital is not adversely affected by the target bank's equity capital. Bank capital has a positive effect on the bank's value, controlling for size and a host of other factors.

DOES CAPITAL HURT THE VALUE OF THE BANK?

The banker sitting next to me was lamenting the profitable lending opportunities being passed up by capital-constrained banks, when I broke in to ask: "Then, why don't they raise more capital?". "They can't," he said. "It's too expensive. Their stock is selling for only 50 percent of book value". "Book values have nothing to do with the cost of equity capital," I replied. "That's just the market's way of saying: We gave those guys a dollar and they managed to turn it into 50 cents." … In a capital market left to its own devices, then, it's hard to see anything about demand securities so special as to rule out application of the M&M proposition to the banking industry. Merton Miller (1995).

1. INTRODUCTION

The center stage in bank regulation is occupied by discussions of bank capital, and a voluminous literature has emerged on bank capital, both from the standpoint of its role in regulation (e.g. Bhattacharya, Boot and Thakor (1997), Dangl and Lehar (2004), Decamps, Rochet and Roger (2004), Hellman, Murdoch and Stiglitz (2001), Morrison and White (2005), and Repullo (2004)) and from the perspective of how bank capital interacts with the manner in which banks provide a host of intermediation services even apart from the effects of regulation (e.g. Diamond and Rajan (2000), and Thakor (1996)). While it is generally accepted that bank capital serves to restore prudent risk-taking incentives among banks that may be distorted by deposit insurance, it is also widely asserted that bank capital could have a host of potentially adverse (unintended) consequences, ranging from diminished liquidity creation (e.g. Diamond and Rajan (2000)) to even excessive risk taking (e.g. Besanko and Kanatas (1996)); one could broadly think of the "costs" of bank equity capital as the aggregation of the costs arising from these adverse consequences. Indeed, it now seems commonplace to assume that higher levels of capital impose an increasing cost on the bank, even though they may generate positive social externalities such as reduced bank failure and contagion risks, and it is not uncommon to find banking theory papers that simply assume an exogenous cost associated with equity capital (e.g. Allen, Carletti and Marquez (2006), and Thakor (1996)). But what is the nature of this cost and what is its magnitude? This is the question we address in this paper.

Whether bank equity capital has a special cost is unclear. Miller (1995) addressed this issue and seemed to dismiss the notion of such a special cost, even after allowing for the possibility of agency and informational frictions, and admitted only that the transactions costs of raising equity could be significant enough to deter small banks from raising equity. Miller's commentary notwithstanding, the contemporary tradition of assuming that bank equity has a special cost continues apparently unabated.

If bank equity capital does carry a special cost that the bank absorbs, then it must show up somewhere in the value of the bank and it should be measurable. But existing theories provide little guidance about where exactly to look and how to measure this cost. If one talks to bankers about this, their intuition for why equity capital is costly for banks is pretty straightforward: the cost of (insured) deposits is a lot lower than the cost of equity capital for the bank, so any increase in capital, holding the size of the bank's asset portfolio fixed, represents a replacement of deposits with more costly equity and hurts the value of the bank. This intuition, however, is *not* correct, as the following illustration shows. Consider two banks, A and B, each with a $100 loan portfolio, an unlevered equity cost of capital of 10% and a cost of deposits of 5%. There are no taxes. Let bank A be financed with $10 in equity and $90 in deposits, and bank B be financed with $20 in equity and $80 in deposits. Assume that each bank earns 10% per year on its loans, and this is also the appropriate risk-adjusted discount rate for the loan cash flows. Assuming perpetual cash flows, straightforward calculations show that the levered costs of equity capital for banks A and B are 55% and 30% respectively, and assuming that the market is aware of all of the parameters here, the market values of equity for banks A and B are $10 and $20 respectively.[1] Thus, the NPV to the bank's shareholders, measured as market value of equity minus book value of equity (invested capital) is $10 - $10 = $0 for bank A and $20 - $20 = 0 for B. The different levels of equity capital in the two banks make no difference to the shareholders. Details of these calculations as well as the examples that follow are in the Appendix.

One might wonder if it matters that we have made the assumption that the unlevered equity cost of capital for the bank is assumed to be the same as the yield on loans. It does not. To see this, assume that the loan yield is 15% for both banks and all other data are unchanged. The market values of equity are now $60 and $70 for banks A and B respectively, and the NPVs for the shareholders are $50 in both cases. Again, the different levels of equity capital in the two banks make no difference to the banks' shareholders.

[1] We are using the standard formula for the relationship between the levered equity cost of capital and the unlevered cost.

We can think of this example as well as the previous one in the context of the bank being sold in an acquisition transaction. If we assume that loans sold on a stand-alone basis (as opposed to being part of the whole bank which is sold) will fetch only a 10% yield, then the "marked-to-market" value of the bank's equity (marked-to-market values of stand-alone assets sold piecemeal minus marked-to-market values of liabilities) coincides with its book value in each case. We can then interpret the NPV to the bank's shareholders as the goodwill in an acquisition transaction in which the bank is purchased.

This is all standard M&M stuff, of course. But it does make one simple yet important point. One cannot simply take the fact that bank equity has a cost of capital greater than the cost of deposits (as it does in the above illustration) and use it to assert that higher levels of capital hurt the bank or its shareholders because capital replaces cheaper deposits.

How then do we think about capital being "costly" to the bank, apart from the transactions cost of raising capital? There are many possibilities. We consider two here to illustrate. One is that a bank with more capital accepts liabilities that are not as attractively priced or makes loans that are simply not as profitable on a risk-adjusted basis as those made a bank with less capital. That is, capital may impair the *stand-alone* value of the bank's asset portfolio or its liability portfolio. This could be a manifestation of an agency problem between bank managers and shareholders: a manager who is less willing to subject himself to capital-market discipline may pay lower dividends in order to accumulate capital that diminishes the probability of having to raise capital in the future, and such a manager also makes poorer loans. That is, capital can hurt the value of the bank by acting as a protective cushion for lazy or incompetent managers. The other possibility, not necessarily mutually exclusive with the first, is that bank capital adversely affects the value of the bank's asset-liability portfolio, without adversely impacting either the stand-alone asset value or liability value. In other words, equity capital may hamper the *interaction* of assets and liabilities in terms of the value created for the bank. This could happen, for example, if the liquidity provided by deposits relative to equity permitted the bank to do something on the asset side - - say by offering more loan commitments or structuring relationship loans differently - - that generated special value (e.g. Kashyap, Rajan and Stein (2002)). We illustrate these ideas below by combining these two possibilities.

Consider banks A and B, both as targets in acquisitions. Suppose that if bank A sold its loans on a stand-alone basis, they would fetch an 11% yield, but the yield is still 15% if the loans are a part of the ongoing bank. If bank B sells its loans on a stand-alone basis, they fetch a yield of 11%, but the yield is 14% if the loans are part of the ongoing bank. All other data are unchanged. We can see now that the marked-to-market value of the bank's equity is $20 for bank A and $30 for bank B, and the market values of equity is $60 for each bank, assuming that the market is aware of all the parameters mentioned above. The NPV for the shareholders is $50 for bank A and $40 for bank B.[2] The goodwill recorded in an acquisition transaction using the purchase method of accounting would be $40 if bank A is purchased and $30 if bank B is purchased.[3] Thus, although both banks receive the same purchase price for their equity, both the NPV to the bank's shareholders and the goodwill recorded in the transaction (a measure of the synergy/growth value of the bank) are lower for bank B than for bank A. Higher capital in this case imposes a "cost."

This illustration brings out a couple of key points. First, even controlling for the bank's asset size, one cannot just look at the market value of the bank is equity or its acquisition price to determine if capital hurts the bank's value.[4] Second, one needs to examine the individual components of the bank's value (e.g. the marked-to-market value of the bank's equity, the market value or acquisition price, and goodwill, the difference between the two) to determine the *nature* of the cost imposed by bank capital.

To address our main question, we therefore need an approach that allows us to: (i) examine the *incremental* value-creation impact of bank capital, possibly using an approach that overcomes difficulties with accounting distortions in book values to assess the incremental value of bank capital; (ii) examine how bank capital affects the separate components of the value of the bank; and (iii) overcome the possible effect of asymmetric information on the market value of the bank that could distort the measurement of the incremental value impact of bank capital.

We take an approach that attempts to achieve these goals. We develop a theoretical model in which the impact of bank capital on the value of the bank is examined in an acquisitions context and then take its predictions to the data on bank acquisitions. Examining acquisitions, as we do in the illustrations above, offers several advantages. First, since purchase transactions separate out goodwill from the rest of the purchase price, we are able to empirically

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[2] The NPV is again defined as the market value of equity minus the book value of equity.

[3] The goodwill number for each bank is the market value of equity minus the marked-to-market value of its equity, i.e., $60 - $20 = $40 for bank A and $60 - $30 = $30 for bank B.

[4] Even examining market value minus book value may be misleading because, unlike our example, book values may be distorted due to accounting practices.

examine the impact of bank capital separately on the portion of the bank value that represents the stand-alone values of the bank's assets and liabilities and the portion that represents the synergies between them. Second, by examining the impact of the target bank's capital on goodwill, which is arrived at by subtracting the marked-to-market value of the bank's equity from the purchase price, the effect of accounting distortions inherent in the book-value measurement of bank equity capital are minimized. Third, the impact of asymmetric information on the bank's market value is minimized by focusing on acquisitions, since there is considerable information communication between the acquirer, the target and the regulators in bank acquisitions. This is particularly important because of the possibility that asymmetric information about the bank could be cross-sectionally correlated with the bank's capital due to the signaling potential of the bank's capital structure.

To fix concepts, we begin by developing a simple theoretical model in which a bank faces both costs and benefits associated with equity capital. As in many other models, the cost is simply exogenously specified as increasing and convex in the amount of equity capital, E, the bank keeps. The benefit is both direct and indirect. The direct benefit is that higher capital reduces the probability of the bank being closed at an interim point in time. The indirect benefit is that, as a result of the direct benefit, the bank invests more in monitoring its relationship borrowers and earns higher rents. The bank's *ex ante* choice of capital balances the marginal costs and benefits of equity. We then allow the bank to possibly be acquired at an interim point in time in a competitive corporate control market. The price, P, paid by the acquirer has two components: the "marked-to-market value" of the bank's equity (E_m) and goodwill (G), i.e., $P = E_m + G$. The convention of purchase accounting in acquisitions is such that E_m is essentially the "liquidation value" of the bank's equity, i.e., it is the value if each asset and liability were sold separately in the market. Thus, G captures the acquirer's prospective assessment of the "synergy value" or "growth value" of the bank's portfolio that is not reflected in the stand-alone market values of individual assets and liabilities.

Our theory shows that the costs and benefits of equity capital decompose nicely. All of the costs and a portion of the benefits of equity capital are captured in E_m. Equity capital, E., does *not* show up anywhere in G, except indirectly through the enhancement in G arising from higher bank monitoring of its relationship loans that is endogenously induced by higher bank capital. The model has two predictions. First, as long as banks are choosing optimally, the purchase price, P, is an increasing function of the target bank's equity capital, E. Second, goodwill, G, is increasing in the equity capital, E, of the target bank. That is, the component of the value of the bank that is not directly affected by bank capital is actually increasing in bank capital due to the beneficial *indirect* effect of bank capital in eliciting greater value-enhancing bank monitoring of its relationship loans.

Of course, establishing that goodwill, G, and the purchase price, P, are increasing in the target bank's equity capital, E, does not mean that bank capital does not impair any component of the value of the bank. Since the direct costs and benefits of bank capital appear in the marked-to-market value of the equity, E_m, it could still be that E_m is adversely affected by E. However, our theory does not unambiguously predict how E affects E_m, so this issue can only be settled empirically.

We then take our theory to the data. Our empirical results strongly support the main predictions of the theory, namely that the purchase price and goodwill in an acquisition are increasing in the amount of equity capital of the target. These results obtain even after we use a host of exogenous control variables like acquirer size, acquirer stock returns, acquirer capital, acquirer risk, the banking sector's stock index, target stock returns, the size of the target relative to that of the acquirer, and the location of the target relative to the acquirer. Moreover, the effects of the target bank's capital on the purchase price and goodwill are both statistically and economically significant. We also recognize the endogeneity problem inherent in the possible simultaneous determination of target capital and goodwill. That is, it may be that riskier and more growth-oriented targets choose to keep more capital simply to absorb the higher risk and support the higher growth prospects. We find that our results survive even after accounting for this possibility.

We then examine how the marked-to-market value of the target bank's equity, E_m, is affected by its equity capital, E. We find that, even after controlling for all of the factors mentioned above, E_m is increasing in E. That is, the component of bank value that is directly affected by bank capital appears to be positively affected by it. Although accounting distortions related to book values can contaminate this measure, as a final check we examine whether the "NPV for shareholders", defined as the acquisition price minus the book value of the target bank's equity, is adversely affected by the target bank's book equity capital. We find that the target bank's equity capital does not have a statistically significant effect on the NPV for the target bank's shareholders.

We conclude, therefore, that bank capital seems to positively affect bank value, at least within an acquisitions context. This by no means suggests that bank capital has no cost, but it does suggest that the cost-benefit tradeoffs associated with bank capital in the cross-section of the banks we have examined are such that equity capital does not adversely affect bank values.

The rest is organized as follows. Section 2 develops the model. Section 3 contains the analysis. The empirical analysis appears in Section 4, and Section 5 concludes.

2. THE MODEL

Sequence of Events: Consider an economy with universal risk neutrality and three dates. At $t=0$, the bank starts with a fixed asset size of $\$N$ and must make two decisions: (i) the mix of deposits (D) and equity (E) to finance its loans with, and (ii) the amount of loan monitoring (m) to engage in. At $t=1$, it becomes known what fraction of the bank's loans will default at $t=2$ and what fraction will pay off. Let γ represent a random variable that represents the fraction that repays. Moreover, at $t=1$, the bank makes a second monitoring decision that involves a choice of effort $e \in \{0,1\}$. This second monitoring decision affects the value of the bank's loans at $t=2$ that are known at $t=1$ to *not* be in default. All payoffs are observed at $t=2$. At that time, borrowers repay the bank and the bank repays depositors. We assume there is complete deposit insurance, zero insurance premium and zero riskless rate.

We now describe in greater detail the bank's decisions.

The Bank's Capital and Monitoring Choices: We assume that the bank starts out with retained earnings on hand of $\$B$ that are kept as cash-asset reserves to absorb the costs of monitoring and the dissipative cost of equity (discussed below) and not invested in loans. The bank makes $\$N$ in relationship loans at $t=0$. Think of these as N relationship loans, each $\$1$. The bank takes this size as given and decides at $t=0$ how much equity capital to raise, with the rest coming from deposits. The cost of raising $\$E$ in equity is $k(E)$, where $k'>0, k''>0$, the Inada conditions $k'(0)=0,\ k'(N)=\infty$. The idea is that bank equity has a dissipative cost associated with it and the marginal cost of equity increases with the amount of equity raised. This assumption is meant to capture the ubiquitous assumption in banking models that bank equity is costly, and it is general enough to capture all of the possible ways in which equity capital could impose a cost/damage on the bank.

The bank monitors its relationship loans to enhance their value (e.g. Boot (2000), and Boot and Thakor (2000)). The monitoring is $m \in \left[0, \overline{m}\right]$, with cost $W(m)$, where $W' > 0$, $W'' > 0$ and $W(\cdot)$ satisfies the Inada conditions $W'(0) = 0$, $W'(\overline{m}) = \infty$. Bank monitoring enhances the value of the bank's relationship loans by enhancing the payoff the bank receives on each relationship loan that is repaid. This payoff is $R(m)$ per dollar of loans, so that on a \$1 relationship loan that repays, the bank collects $\left[1 + R(m)\right]$. We assume $R(0) = 0$, $R' > 0$ and $R'' < 0$. Let $f(\gamma)$ be the probability density function of γ, and let $F(\cdot)$ be the associated cumulative distribution function. Deposits are assumed to carry a zero interest rate. The bank chooses its monitoring m, taking a level of equity as given.

Then taking m as a function of E, the bank solve for its optimal capital level. We assume that the enhancement, $R(m)$, in the value of the bank's relationship loan is an "illiquid asset" in the sense that it is bank-specific and hence partially lost if the asset portfolio were liquidated and the N loans sold on a piecemeal basis, or if the bank were closed. We assume that if the loans are sold on a piecemeal basis, only a fraction α, where $0 < \alpha < 1$, of the R(m) can be captured. The relationship loan value enhancement is preserved in its entirety if the bank is acquired by another bank and maintained as an ongoing entity with $e = 1$ being chosen.

In addition to the decisions of how much capital to raise and how much to invest in monitoring m at $t = 0$, the bank also makes a second monitoring decision at $t = 1$ *after* it observes the fraction γ of its loan portfolio that will repay at $t = 2$. We assume that this monitoring effect is $e \in \{0,1\}$ with a cost $V(e)$, and $V(1) > V(0) = 0$. The effort e should be viewed "maintenance monitoring" to preserve the value of the relationship loans between $t = 1$ and $t = 2$.

In particular, conditional on learning at $t = 1$ that a relationship loan will pay off at $t = 2$, the bank assesses the value of a \$1 relationship loan at $t = 2$ as $1 + R(m)$ if $e = 1$ and 1 if $e = 0$.

That is, not expending "maintenance monitoring" e at $t=1$ results in a loss of the bank-specific value enhancement in relationship loans due to the initial monitoring m at $t=0$. The bank's choices of m and e are privately observable to the bank but not to the regulator, and hence cannot be contracted upon. The bank makes all its choices to maximize the expected wealth of its shareholders at $t=2$.

Regulatory Closure Policy: At $t=1$, we assume that the regulator is also able to observe γ (a proxy for the quality of the bank's loan portfolio) and decide whether to close the bank or let it continue. There is a small regulatory cost $c>0$ involved in keeping the bank open another period that is absorbed by the regulator, so the regulator will keep the bank open only if the value of its equity at $t=1$ exceeds c. The idea here is that γ determines the economic value of the bank's equity at $t=1$; if this is sufficiently low, the regulator closes the bank.

A summary of the events in the model is provided in *Figure 1*.

Figure 1: **Sequence of Events**

0	**1**	**2**
• The bank chooses its equity capital level E • The bank chooses its optimal monitoring m	• The bank and the regulator observe γ, the fraction of relationship loans that repay • The regulator decides whether to close the bank or let it continue • The bank chooses its maintenance export $e \in \{0,1\}$ • The Bank may be acquired by another bank	• Loans repay • Depositors paid off by the bank if it is able • Depositors paid off by the deposit insurers if the bank defaults

3. THE ANALYSIS

We will analyze the model using the usual backward induction approach, starting with events at $t=1$ and then moving back to $t=0$.

Events at $t=1$: We need to determine the bank's incentive to choose $e=1$. Suppose the observed fraction of relationship loans that will repay is γ. Then the bank's shareholders' expected wealth at $t=2$ is determined at $t=1$ to be:

$$\begin{cases} \gamma N\left[1+R(m)\right]-D-V(1) \text{ if } e=1 \\ \gamma N-D-V(0) \text{ if } e=0 \end{cases}$$

where we have ignored $k(E)$ and $W(m)$ because these were incurred at $t=0$ and hence sunk costs in the decision at $t=1$. B is ignored for the same reason.

We now have the following result.

Lemma 1: For a given level of equity, capital, E, the critical value of γ, call it $\hat{\gamma}$, such that the bank is indifferent between choosing $e=0$ and $e=1$ is given by:

$$\hat{\gamma}=\frac{V(1)}{R(m)N} \tag{2}$$

Proof: Note that incentive compatibility requires that at the indifference point:

$$\hat{\gamma}N\left[1+R(m)\right]-D-V(1)=\hat{\gamma}N-D-V(0)$$

Substituting $V(0)=0$, we have:

$$\hat{\lambda}NR(m)=V(1)$$

Rearranging yields the desired result. ■

From Lemma 1 we know that as long as $\gamma>\hat{\gamma}$, the bank will choose $e=1$ at $t=1$, assuming that its participation constraint is satisfied at $t=1$.[5] This leads to:

Lemma 2: Given an E and a $\hat{\gamma}$, as long as $R(m)D>V(1)$, the bank's incentive compatibility constraint ($e=1$ is preferred to $e=0$) and its participation constraint (incremental payoff to equity at $t=1$ is non-negative) are satisfied at $t=1$ if $\gamma\geq\gamma^{0}$, where

[5] It might seem obvious that with complete deposit insurance, the bank's participation constraint of a non-negative incremental equity value at $t=1$ would be trivially satisfied. However, this is not so since $V(1)$ is incurred at $t=1$ and the deposit insurer merely ensures that depositors are repaid in full at $t=2$. Thus, it is possible that $\max\left\{\hat{\gamma}N\left[1+R(m)\right]-D,0\right\}\geq 0$ for the bank and yet $\hat{\gamma}N\left[1+R(m)\right]-D-V(1)<0$.

$$\gamma^0 = \frac{V(1) + N - E}{[1 + R(m)]N} \tag{3}$$

and $\gamma^0 > \hat{\gamma}$.

Proof: Assuming for the moment that $\gamma > \hat{\gamma}$, the regulator knows that the bank will choose $e = 1$. Thus, the bank's participation constraint will be satisfied if

$$\gamma N[1 + R(m) - D - V(1)] > 0$$

which implies

$$\gamma > \frac{V(1) + D}{N[1 + R(m)]} \tag{4}$$

The right-hand side of (4) is γ^0 if we substitute $D = N - E$. Comparing (2) and (3), it is easy to verify that $\gamma^0 > \hat{\gamma}$. ■

Now consider the regulator's problem. The regulator knows that if $e = 0$, then allowing the bank to continue produces a new equity value of $\hat{\gamma}N - D - c$, whereas closing the bank produces a net equity value of $\hat{\gamma}N - D$. Thus, continuation requires $e = 1$. For the regulator's continuation decision to be efficient, we need

$$\gamma N[1 + R(m)] - D - V(1) > c \tag{5}$$

Thus, the cut-off γ from the regulator's standpoint, say γ_c, such that the bank is continued if $\gamma \geq \gamma_c$ and closed if $\gamma < \gamma_c$, is given by the value of γ for which (5) holds as an equality. This leads to:

Lemma 3: The regulator permits the bank to continue if $\gamma \geq \gamma_c$ and closes it if $\gamma < \gamma_c$, where

$$\gamma_c = \frac{V(1) + N - E + c}{[1 + R(m)]N} \tag{6}$$

Proof: Obvious from the above discussion. ■

The regulator's closure policy here depends on the regulator's observation about the bank's asset quality at $t = 1$ (via γ) and the regulator's belief about the bank's equilibrium choice of monitoring m.

In practice, regulators typically have a pre-determined book equity cut-off (like 2% for U.S. banks) such that the bank is closed if its capital falls below that cut-off. Our analysis is robust to such a cut-off, as long as the cut-off is based on the bank's equity capital. Henceforth, we will assume that $R(m)D > V(1)$, so that γ^c is the relevant cut off, and if $\gamma \geq \gamma^c$, then the bank chooses $e = 1$ sine $\gamma_c > \gamma^0$.

Events at $t = 0$: The bank first solves for m, taking E as a given. That is, the bank solves:

$$\max_{m \in [o, \bar{m}]} \int_{\gamma_c} \left\{ \gamma N \left[1 + R(m) \right] - D - V(1) \right\} f(\gamma) d\gamma + B - k(E) - W(m). \tag{7}$$

Note that the bank chooses $e = 1$ only if the realized γ is such that the bank is not closed. We can now prove the following result.

Proposition 1: There exists a unique, interior optimal level of monitoring, $m^*(E)$, chosen at $t = 0$ that is a function of the equity level E, such that $dm^* / dE > 0$.

Proof: The first-order condition for an optimum is:

$$\int_{\gamma_c}^{1} \left\{ \gamma N R'(m^*) \right\} f(\gamma) d\gamma - W'(m^*) = 0. \tag{8}$$

The second-order condition is:

$$SOC \equiv \int_{\gamma_c}^{1} \left\{ \gamma N R''(m^*) \right\} f(\gamma) d\gamma - W''(m^*) < 0 \tag{9}$$

which is satisfied since $R''(m^*) < 0$ and $W''(m^*) > 0$.

Thus, m^* is a unique maximum. Further, it is also an interior maximum due to the Inada condition on $W(m)$.

Totally differentiating (8) yields:

$$\frac{dm^*}{dE} = \left[\frac{\left[\gamma_c N R'(m^*) f(\gamma_c) [d\gamma_c / dE \right]}{SOC} \right] \tag{10}$$

We know from (3) that $\partial \gamma_c / \partial E < 0$ and we also know that the terms multiplying $\partial \gamma_c / \partial E$ in the numerator of the right-hand side of (10) are strictly positive. Since $SOC < 0$ (see (9)), we have $dm^* / dE > 0$. ■

Proposition 1 establishes that banks that keep higher amounts of equity capital monitor more. The intuition is straightforward. Because γ_c is decreasing in E, a bank that keeps a higher E faces a lower probability of being closed at $t=1$ and hence a higher probability of retaining its relationship banking rents which are increasing in monitoring m. Hence, a higher E increases the marginal benefit of monitoring.

We now turn to the optimal solution for E. The bank chooses E to maximize (7), taking $m^*(E)$ as a given from (9).

Proposition 2: There exists a unique optimal bank capital level, $E*$, chosen at $t=0$ that is decreasing in the marginal cost of equity, $k'(E)$.

Proof: Using the Envelope Theorem, the first-order condition for E^* can be written as

$$-\left[\gamma_c N\left[1+R\left(m^*\right)\right]-D-V(1)\right] f(\gamma_c)\left[d\gamma_c/dE\right]-k'\left(E^*\right)=0. \tag{11}$$

Given the linearity of γ_c in E (see (6)), the second-order condition is $-k''\left(E^*\right)<0$, which is satisfied since $k''\left(E^*\right)>0$. Further, E^* is an interior maximum because of the Inada conditions on $k(\cdot)$.

From (11), we know that

$$k'(E)=-\left[\gamma_c N\left\{1+R\left(m^*\right)\right\}\right]-D-V(1)\Big] f(\gamma_c)\left[d\gamma_c/dE\right]. \tag{12}$$

The right-hand side of (12) is a positive constant. Consider two banks i and j, with $k_i'(E)>k_j'(E)$ for any $E\in(0,N)$. Then the right-hand side of (12) is the same for both banks i and j, which means $E_i^*<E_j^*$ because $k(\cdot)$ is convex and increasing in E. ■

We now permit the bank to be acquired at $t=1$ in a competitive market for corporate control. Since a solvent target will not accept a price lower than its expected value under continuation if it were not acquired, an acquirer would have to pay the target (at least) $P=\gamma N\left[1+R\left(m^*\right)\right]-D+B-k\left(E^*\right)-W(m)$ at $t=1$, where γ is the γ realized at $t=1$. At the time of the acquisition, the goodwill recorded in the acquisition will be P minus the "mark-to-market" value of the bank's equity. Computing the marked-to-market value means calculating how much the bank's assets and liabilities would be worth if they were sold piecemeal as individual loans and deposits. In our model, the marked-to-market value of the bank's equity is

$$E_m = \gamma N + \gamma\alpha NR(m^*) - D + B - k\left(E^*\right) - W\left(m^*\right)$$

since only a fraction α of the rent $R\left(m^*\right)$ can be captured if loans are sold piecemeal. Thus, the goodwill is[6]

$$G = \gamma NR\left(m^*\right)[1-\alpha] \tag{13}$$

If $k\left(E\right)$ varies in the cross-section of banks, and for two banks i and j, $k_i'\left(E\right) < k_j'\left(E\right) \forall E \in \left(0, N\right)$, then *Proposition 2* implies that $E_i^* > E_j^*$ *ceteris paribus*. In this case, it follows from (13) that $G_i > G_j$ since $dm^*/dE > 0$ and $R'\left(m^*\right) > 0$. This leads to:

Proposition 3: Among banks of equal size, ceteris paribus banks that have higher levels of book equity capital will be acquired at prices that result in more goodwill being recorded by the acquirer, assuming that regulatory capital requirements are not binding.

Proof: Obvious given the above discussion. ■

Proposition 4: Among banks of equal size, ceteris paribus banks that have higher levels of book equity capital will be acquired at higher prices.

Proof: Consider banks *i* and *j* with $k_i'\left(E\right) < k_j'(E) \forall E.$ Then from Proposition 2 we know that $E_i^* > E_j^*$. Now consider the price for bank *i* with equity Capital E_j^*. This will be

$$P_i(E_j^*) = \gamma N\left[1 + R(m_j^*(i))\right] - D + B - k_i(E_j^*) - W(m_j^*(i)) \tag{14}$$

where $m_j^*(i)$ is the monitoring level chosen by bank *i* when it chooses capital E_j^*. Since each bank chooses its optimal equity capital to maximize its P, we know that $P_i(E_i^*) > P_i(E_j^*)$, where E_i^* maximizes P_i for bank *i* and

$$P_i(E_i^*) = \gamma N\left[1 + R(m_i^*)\right] - D + B - k_i(E_i^*) - W(m_i^*) \tag{15}$$

This completes the proof. ■

The only exception to Propositions 3 and 4 will be if regulatory capital requirements are *above* the privately optimal levels of equity for banks, and thus binding. In this case, it is possible, although not necessarily true, that banks with higher capital levels will be associated

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[6] Observe that, as noted in the Introduction, the purchase price, P, decomposes into E_m, which is indirectly a function of E, and G, which is not directly affected by E.

with lower levels of goodwill and possibly lower purchase prices. In our empirical tests, we will examine whether higher capital levels are associated with lower or higher goodwill and purchase prices.

While our analysis clearly predicts that goodwill should be increasing in the target bank's equity capital, assuming capital requirements are not binding, it does not make an unambiguous prediction about E_m. Empirically, we will examine whether E_m is increasing or decreasing in book equity, E. We recognize that book equity capital, E, may be distorted by accounting practices, and we make the assumption that the "true" book equity capital - - which accurately represents the historically invested capital by the bank's shareholders - - is a monotonically increasing function of the reported book equity capital; we do not need the two to be equal.

4. DATA, METHODOLOGY AND EMPIRICAL RESULTS

4.1. Data

Our primary source of data on M&A is SDC Platinum. We start by collecting data on announcement dates, completion dates, transaction values, and methods of payment of all completed M&A deals in the *banking industry* in the period January 1980 to September 2006. We focus on acquisitions where both the acquirer and target are public firms[7]. We exclude deals with an acquisition price below $1 million dollars, as well as acquisitions of less than 100% of the target bank. We obtain financial data for the acquirer and target banks from the Federal Reserve Banks' Y-9C reports and from Compustat's Industrial Quarterly database. We collected monthly stock return data from CRSP for the five years prior to the announcement date of each acquisition, for both the acquirer and the target. From SNL, we obtain monthly returns on the SNL Financial bank total return index over the twelve months prior to the announcement date of each acquisition. Our sample was further restricted to acquisition completions beginning in 1991

[7] We also impose the restriction that both the acquirer and target are bank holding companies to allow merging SDC data with Y9C reports by CUSIP.

as some of the Y9C variables of interest were not available before that year. Multiple acquisitions by one bank in the same quarter are also removed. The final sample consists of 167 deals.

Table 1 provides descriptive statistics for the acquirer and the target firms, as well as deal characteristics. As *Panel A* shows, mean (median) target asset size is \$6.9 billion (\$1 billion). The average acquisition price is \$1.5 billion and the median is \$211 million. Targets on average have 9.0% capital/assets with a median of 8.8%. *Panel B* shows acquirer characteristics. The average acquirer is 6.5 times larger in terms of book value of assets than the average target. Acquirers on average have capital/assets of 8.8% and a median of 8.6%. *Panel C* describes deal characteristics. The price paid for targets is on average (median) about 26% (15%) of the acquirer's market value. Goodwill/assets for the target firm is about 7.6% on average with a median of 6.1%. The target marked-to-market value/assets is on average 13.5% with a median of 11.1%. The total acquisition price/assets of the target firm is on average 21.1% with a median of 20.2%.

4.2. Methodology for Testing Propositions 3 and 4

Our goal is to confront Proposition 3 with the data. Thus, the main regression equation we wish to estimate in testing Proposition 3 is:

$$(GW/TA)_i = \beta_0 + \beta_1 (E/TA)_i + X_i \mathrm{B} \qquad (16)$$

where $(GW/TA)_i$ is the ratio of goodwill to total assets for target firm *i*, β_0 is a scalar intercept, β_1 is the regression coefficient on $(E/TA)_i$ which is the ratio of book equity capital to total assets for target firm *i*, X_i is a vector of control variables and B is a vector of regression coefficients for these control variables. The control variables we use in our main multivariate regressions are the log of the acquirer's assets (measured at the quarter prior to acquisition completion), the acquirer's average monthly stock returns (calculated over 12 months prior to the acquisition announcement), the volatility of the acquirer's stock returns, the ratio of the acquirer's book equity capital to total assets, the bank stock index, the target's average stock returns, the size of the target relative to the acquirer, and location and year dummies.

When we test Proposition 4, we use a regression equation similar to (16), with the only change being that the dependent variable now is $(P/TA)_{i,}$ where P is the acquisition price, and TA is the target's total assets.

We discuss briefly the definition of each variable and the rationale for these control variables. Goodwill is defined as the acquisition price minus the marked-to-market value of the assets minus the liabilities. We observe an acquiring bank's recorded goodwill at the end of the quarter before and after an acquisition and attribute the difference to the acquisition transaction. $(E/TA)_i$ is the ratio of the target bank's book equity capital divided by its total assets for the quarter ending prior to the acquisition completion. As for the control variables, the log of the acquirer's assets is included to account for the fact that the size of the acquirer may affect the price the acquirer is willing to offer the target, and hence the goodwill in the deal. The acquirer's stock returns are measured as the average monthly stock returns for 12 months prior to the acquisition announcement. The idea here is that the acquirer's willingness to pay a higher price for the target may depend on the stock returns it has experienced prior to the acquisition. For example, we do know that stock return dynamics seem to significantly influence equity issuance decisions and capital structure dynamics (e.g. Baker and Wurgler (2002), Dittmar and Thakor (2007), and Welch (2004)), so it is possible that stock return dynamics could also influence prices in acquisitions. For a similar reason we also include the volatility in the acquirer's stock returns, measured as the standard deviation of monthly returns for five years ending the month prior to the announcement. In particular, this control variable is meant to capture the potential effect of the risk of the acquirer on the price it is willing to pay for a target.

The ratio of the acquirer's book equity capital to total assets is included because the acquirer's ability to make a bid for certain types of targets may be predicated on how well capitalized the acquirer is at the time of the acquisition, particularly because regulatory approval of the deal depends on the acquirer's capital. The bank stock index is the average return on the SNL Financial bank total return index over the 12 months prior to the acquisition announcement. We include this control variable because the state of the overall market for bank stocks may also affect the price paid in an acquisition, given the existing empirical evidence that mergers tend to come in waves and tend to be a bull-market phenomenon (e.g. Jovanovic and Rosseau (2001) and Shleifer and Vishny (2003)). The target's average stock returns is included as a control variable because the stock return dynamics of the target could also potentially influence the price paid for it in an acquisition. The relative size of the target is the ratio of the acquisition price to the market value of the acquirer four weeks prior to acquisition announcement, both taken from SDC Platinum. The rationale for this control variable is that the acquisition price could very well be affected by how large the target is relative to the size of the acquirer. Finally, the location dummy is set equal to 1 if the acquirer and target banks are headquartered in the same region of the country and zero otherwise, which is meant to capture a possible "home bias" in acquisitions that may affect prices (e.g. Garcia-Herrero and Vasquez (2006) document a home bias in international bank expansion strategies, whereas Danthine, Giavazzi and von Thadden (2001) document a home bias in European acquisitions). Year dummies for the year the acquisition is completed are included to account for year fixed effects in the environment for M&A which may affect prices.

4.3 Empirical Results on Testing Proposition 3

Regression results for the estimation of equation (16) appear in *Table 2*. The estimates are presented in four size cohorts based on restrictions for acquisition price/market value of the acquirer. In the first estimate we focus on those acquisitions where the relative size of the target to the acquirer is greater than 1%. The estimated coefficient on target capital/assets is positive and significant at the 10% level, as is that for target stock returns. When we constrain the sample so that the relative size of the target to the acquirer is greater than 3%, the statistical significance of target capital/assets increases to the 5% level, and its economic significance also increases. The variable remains statistically significant at the 5% level when the relative size of the target to the acquirer is restricted to greater than 5%. When we apply a 10% restriction on the relative size of the target, the estimated coefficient on target capital/assets rises to .506 and is significant at the 1% level. All the regression equations are statistically significant, with R-squareds of the explanatory variables in all specifications at 55% or better. Thus, these results provide strong empirical support for Proposition 3, that goodwill recorded in an acquisition will be increasing in target capital.

Table 3 presents the *economic significance* of our estimated coefficient on target capital/assets. Focusing on the specification where the relative size of the target to the acquirer is at least 10%, the coefficient on target capital/assets is 0.506. The median target has a capital/assets ratio of 8.76%, and the estimated contribution of such a target's capital/assets to goodwill/assets is 4.43%. Now consider an identical bank, but with a 10 percent greater capital/assets ratio of 9.64%. *Table 3* shows that the contribution of target capital/assets to goodwill/assets jumps from 4.43% to 4.88%, an increase of 0.44%. Using the median goodwill/assets ratio of 6.10% as the benchmark, this 0.44% increase represents a 7.27% increase in the premium paid for a target bank that has a 10 percent higher capital/assets ratio at the time of the acquisition. Thus, the positive effect of target book capital on the goodwill paid for the target in an acquisition is not only statistically significant, but also economically significant.

4.4 Endogeneity Issues

One issue that needs to be addressed is the potential endogeneity problem associated with goodwill and capital. It is possible that goodwill and target capital are simultaneously determined, so that capital would not be truly an exogenous variable. Specifically, higher-growth banks or riskier banks may endogenously keep more capital to support their higher growth or absorb more risk, and such banks may also exhibit greater synergies among their assets that would generate higher goodwill. To address this issue we introduce various proxies for growth as independent variables: earnings per share growth, asset growth, and the market-to-book ratio. We use the volatility of the target bank's monthly stock returns for five years prior to the merger announcement as a proxy for target risk. Our estimates taking into account potential endogeneity issues are provided in *Table 4*. Specifications 2, 3, and 4 clearly show that growth variables do not have a strong statistical relation to goodwill/assets. Specification 5 indicates that higher risk is significantly and positively related to goodwill/assets. However, the inclusion of risk does not reduce the significance of capital/assets, nor greatly impact the size of the estimated coefficient.

In Specification 6 we directly investigate the effect of risk on target capital/assets, and find it to be insignificant in determining the level of capital for the target firm. We extract the residual capital/assets from Specification 6 which is orthogonal to target risk, and use it in Specification 7 to re-estimate the original goodwill/assets regression. We find that the coefficient on the residual of the target capital/assets is still significant and almost unchanged. This implies that target capital/assets is truly a determinant of goodwill/assets. To further check the robustness of our estimates, we conducted a Hausman test for the endogeneity of target risk. The test rejects the hypothesis that including the volatility of stock returns as a proxy for target risk is necessary to produce consistent estimators in our original specification. We conclude that, after controlling for numerous factors, the empirical evidence strongly supports Proposition 3, that banks with higher capital command higher goodwill premia in acquisitions.

4.5 Empirical Results on Testing Proposition 4

In *Table 5*, we present the results from replacing goodwill/target assets with total acquisition price/target assets as the dependent variable in equation (16). The estimates are presented in the same four size cohorts based on restrictions for acquisition price/market value of the acquirer, as in the previous analysis. For all four size cohorts, the estimated coefficient on target capital/assets is positive and significant at the 1% level, with a value of about 1.20. The log of acquirer assets is also consistently positive and significant at the 1% or 5% levels. All the regression equations are statistically significant, with R-squareds of the explanatory variables in all specifications at 60% or better. Thus, these results provide strong empirical support for Proposition 4, that banks with higher capital are acquired at higher prices.

4.6 Effect of Target Bank Capital on the Marked-to-market Value of Equity in Acquisitions

Although our theory does not make an unambiguous prediction about the effect of target bank capital, E, on the marked-to-market value of the target bank's equity, E_m, we can empirically check how E impacts E_m. We use the same set of control variables from equation (16) to estimate the following equation:

$$(E_m / TA)_i = r_0 + r_1 (E / TA)_i + X_i \text{ C} \qquad (17)$$

where C is a vector of regression coefficients for the control variables.

The results of this estimation are presented in *Table 6*. As is apparent, the regression coefficient on $(E/TA)_i$ is positive and statistically significant. As with goodwill, we ran our specified equation for four size cohorts based on the ratio of acquisition price to the market value of the acquirer being greater than one, three, five, and ten percent. The estimated coefficient on the target's capital over its assets was significant at the 1% level for each size cohort. All four estimations of the regression equation proved significant with an R-squared of 51% or higher. These results empirically imply that the marked-to-market value of a target bank's equity is increasing in the target's capital, in a statistically and economically significant fashion.

4.7 Effect of Target Bank Capital on the NPV to Target Bank Shareholders

As a final check, we now examine whether higher equity capital in the target bank adversely affects the NPV to the target bank's shareholders in an acquisition. We estimate the following equation:

$$((P - E) / TA)_i = S_0 + S_1 (E / TA)_i + X_i J \qquad (18)$$

where we use the same set of control variables as before and J is a vector of regression coefficients for the control variables. The results of this estimation are presented in *Table 7*. As is apparent, the regression coefficient on $(E/TA)_i$ is not statistically significant. Thus, the target bank's equity capital does *not* appear to adversely affect the NPV to the target bank's shareholders in an acquisition.

CONCLUSION

In this paper we have examined both theoretically and empirically the effect of bank capital on the value of the bank. We believe this issue is of central importance in the debate over whether capital requirements hurt banks. Exploring this question is empirically hampered by a host of factors including accounting distortions in the measurement of book capital, the difficulty of separating out different components of the bank's value so as to be able to isolate which components of value are affected and in what manner by bank capital, and the potential impact of asymmetric information on the market value of the bank that may be correlated cross-sectionally with bank capital. A further complication in isolating the effect of bank capital is that the very factors that move the bank's value in a particular direction may also cause the bank to endogenously choose a certain level of capital. For example, if we find that higher-valued banks keep more capital, it may simply reflect the fact that the higher-valued banks are those with higher growth prospects, and such banks keep more capital to support higher future growth.

We deal with this issue by examining the purchase prices paid in bank acquisition done using purchase accounting. With purchase accounting, the acquiring bank separately records the marked-to-market value of the bank as well as its goodwill. This decomposition is very convenient in the sense that it allows us to separately examine the value impact of the target bank's equity capital on each component. Moreover, by examining goodwill, we minimize the effect of distortions in the measurement of book equity capital on the value effect of that capital. And the focus on prices paid in acquisitions minimizes the likelihood of asymmetric information contaminating the results. The model predicts that, despite the absence of a direct effect of the target bank's equity capital on goodwill, there is an indirect effect that makes goodwill an increasing function of the target bank's equity capital. It also predicts that the purchase price paid in an acquisition is an increasing function of the target bank's capital.

We confront this prediction of the model with the data on bank acquisitions and find that the predictions have strong empirical support, even after controlling for a host of other factors that could affect goodwill and accounting for potential endogeneity problems associated with bank capital. We also examine how the marked-to-market value of the bank is affected by the target bank's equity capital. We find that this value is also increasing in the bank's equity capital. Finally, we find that the target bank's equity capital does not adversely affect the incremental value created for its shareholders in an acquisition, measured as the difference between the acquisition price and the book value of the target bank's equity capital. We conclude that our evidence suggests that bank values are not adversely affected by bank capital. Rather, data from bank acquisitions suggest that various components of the bank's value are positively impacted by bank capital

Table 1
Summary statistics for 167 acquisitions

The acquisitions were completed between 1991 and 2006. Relative size of target is the acquisition price/market value of the acquirer four weeks prior to acquisition announcement. Goodwill is the acquisition price less the marked-to-market value of assets and liabilities. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Stock returns is the average monthly stock returns for 12 months prior to acquisition announcement. Values are in $millions.

Panel A: Target characteristics

Variables	Mean	Median	Min	Max
Acquisition price	1,549	211	26	58,761
Assets	6,850	1,023	151	299,303
Capital/assets (%)	9.03	8.76	2.58	21.68
Stock returns (%)	1.72	1.93	-6.70	11.66
Volatility of returns (%)	8.13	7.88	2.88	25.16

Panel B: Acquirer characteristics

Variables	Mean	Median	Min	Max
Market value	7,752	1,838	25	185,716
Assets	44,620	10,176	386	1,294,320
Capital/assets (%)	8.83	8.63	5.52	20.19
Stock returns (%)	1.51	1.44	-2.89	6.10
Volatility of returns (%)	7.48	7.22	0.71	17.11

Panel C: Deal characteristics

Variables	Mean	Median	Min	Max
Relative size of target (%)	26.30	14.80	0.82	142.31
Goodwill	786	45	-20	34,216
Goodwill/assets (%)	7.58	6.10	-1.91	33.81
Marked-to-market/assets (%)	13.54	11.08	-0.14	38.60
Acquisition price/assets (%)	21.12	20.28	3.82	57.89

Table 2
Regression of goodwill/assets on target capital/assets

Relative size of target is the acquisition price/market value of the acquirer four weeks prior to acquisition announcement. Goodwill is the acquisition price less the marked-to-market value of assets and liabilities. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Bank stock index is the average monthly return on the SNL Financial bank total return index over the 12 months prior to acquisition announcement. Stock returns is the average monthly stock return for 12 months prior to acquisition announcement. Location dummy is set to 1 if the acquirer and target banks are headquartered in the same region of the country. Year dummy is set to 1 based on the year the acquisition is completed, from 1991-2006 with 1991 as the base year. T-stats appear below estimated parameters. Significance levels: *** 1%, ** 5%, * 10%.

	Relative size of target restriction							
Independent variables	**(>1%)**		**(>3%)**		**(>5%)**		**(>10%)**	
Intercept	**-0.067**		**-0.019**		**-0.052**		**-0.224**	
	-0.807		-0.247		-0.760		-3.653	
Target capital/assets	**0.342**	*	**0.431**	**	**0.384**	**	**0.506**	***
	1.814		2.491		2.426		3.709	
Log(acquirer assets)	**0.004**		**0.001**		**0.003**		**0.008**	***
	1.121		0.434		0.891		3.244	
Volatility of acquirer returns	**0.046**		**0.012**		**0.134**		**0.240**	
	0.167		0.046		0.595		1.163	
Acquirer capital/assets	**-0.057**		**-0.136**		**0.001**		**0.486**	**
	-0.203		-0.529		0.006		2.274	
Bank stock index	**-0.684**		**-0.809**	*	**-0.886**	**	**-0.592**	
	-1.313		-1.733		-2.071		-1.610	
Acquirer stock returns	**0.062**		**-0.348**		**-0.121**		**0.137**	
	0.172		-0.987		-0.351		0.446	
Target stock returns	**0.523**	*	**0.437**	*	**0.218**		**0.243**	
	1.917		1.798		0.950		1.188	
Relative size of target	**-0.029**		**-0.024**		**-0.010**		**-0.005**	
	-1.599		-1.463		-0.690		-0.403	
Location dummy	**-0.005**		**-0.009**		**-0.020**		**0.011**	
	-0.324		-0.604		-1.498		0.903	
Year dummies	Yes		Yes		Yes		Yes	
R-squared	0.556		0.667		0.772		0.871	
Number of obs.	164		148		128		103	

Table 3
Economic significance of estimated coefficient on target capital/assets

		Estimated coefficient on target capital/assets	Contribution to goodwill/assets
Median target capital/assets	8.76%	0.506	4.43%
Target with 10% greater capital/assets	9.64%	0.506	4.88%
			+0.44%
Median goodwill/assets	6.10%		
Premium paid for higher capital target	0.44%		
The estimated premium paid for a higher capital bank relative to the median goodwill/assets in our sample	**7.27%**		

Notes: Estimated coefficient is from table 2 from the specification with a relative size of target restriction of (>10%).

Table 4
Endogeneity tests

The restriction on the relative size of the target to the acquirer, measured as acquisition price/market value of the acquirer four weeks prior to acquisition announcement, is restricted to be greater than 10%. Goodwill is the acquisition price less the marked-to-market value of assets and liabilities. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Target EPS growth is earnings per share growth over the 12 months prior to acquisition announcement. Target market to book ratio is stock price times shares outstanding divided by book value of equity in the quarter prior to acquisition announcement. Target asset growth is the average annual growth in assets over the five years prior to acquisition announcement. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Bank stock index is the average monthly return on the SNL Financial bank total return index over the 12 months prior to acquisition announcement. Stock returns is the average monthly stock returns for 12 months prior to acquisition announcement. Location dummy is set to 1 if the acquirer and target banks are headquartered in the same region of the country. Year dummy is set to 1 based on the year the acquisition is completed, from 1991-2006 with 1991 as the base year. T-stats appear below estimated parameters. Significance levels: *** 1%, ** 5%, * 10%.

											Dependent variables			
	Dependent variable: Goodwill/assets										**Target capital/assets**		**Goodwill/assets**	
Independent variables	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**	
Intercept	**-0.237**		**-0.238**		**-0.234**		**-0.198**		**-0.248**		**0.092**		**-0.203**	
	-3.604		-3.579		-3.541		-2.922		-3.815		2.260		-3.302	
Target capital/assets	**0.531**	***	**0.530**	***	**0.568**	***	**0.506**	***	**0.562**	***				
	3.676		3.638		3.788		3.553		3.931					
Residual target capital/assets													**0.514**	***
													3.685	
Target EPS growth			**0.000**											
			-0.130											
Target market value/book value					**0.008**									
					0.934									
Target asset growth							**-0.006**	*			**-0.003**			
							-1.911				-1.128			
Volatility of target returns									**0.385**	*	**-0.181**		**0.267**	
									1.858		-1.175		1.440	

Table 4 (continued)

	Dependent variable: Goodwill/assets										Dependent variables			
											Target capital/assets		Goodwill/assets	
Independent variables	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**	
Log(target assets)											**-0.001**			
											-0.520			
Log(acquirer assets)	**0.008**	***	**0.008**	***	**0.007**	**	**0.007**	**	**0.007**	**			**0.008**	***
	2.959		2.942		2.542		2.383		2.613				2.929	
Volatility of acquirer returns	**0.243**		**0.246**		**0.280**		**0.185**		**0.179**				**0.220**	
	1.098		1.098		1.244		0.844		0.812				1.056	
Acquirer capital/assets	**0.503**	**	**0.500**	**	**0.492**	**	**0.494**	**	**0.506**	**			**0.493**	**
	2.232		2.200		2.179		2.233		2.285				2.276	
Bank stock index	**-0.819**	*	**-0.814**	*	**-0.726**		**-0.889**	**	**-0.869**	**	**-0.467**	*	**-0.879**	**
	-1.874		-1.844		-1.618		-2.065		-2.020		-1.675		-2.415	
Acquirer stock returns	**0.148**		**0.150**		**0.131**		**0.232**		**0.209**				**0.149**	
	0.457		0.458		0.401		0.722		0.651				0.485	
Target stock returns	**0.233**		**0.237**		**0.180**		**0.206**		**0.176**		**0.017**		**0.214**	
	1.081		1.081		0.808		0.974		0.825		0.108		1.029	
Relative size of target	**-0.006**		**-0.006**		**-0.008**		**-0.010**		**-0.008**				**-0.006**	
	-0.449		-0.451		-0.581		-0.723		-0.607				-0.455	
Location dummy	**0.011**		**0.011**		**0.011**		**0.002**		**0.011**		**-0.012**		**0.009**	
	0.819		0.819		0.840		0.146		0.871		-1.116		0.688	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.869		0.869		0.871		0.876		0.876		0.323		0.873	
Number of obs.	96		96		96		96		96		102		102	

Table 5
Regression of acquisition price/assets on target capital/assets

Relative size of target is the acquisition price/market value of the acquirer four weeks prior to acquisition announcement. Acquisition price is composed of the marked-to-market value of assets and liabilities and goodwill. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Bank stock index is the average monthly return on the SNL Financial bank total return index over the 12 months prior to acquisition announcement. Stock returns is the average monthly stock return for 12 months prior to acquisition announcement. Location dummy is set to 1 if the acquirer and target banks are headquartered in the same region of the country. Year dummy is set to 1 based on the year the acquisition is completed, from 1991-2006 with 1991 as the base year. T-stats appear below estimated parameters. Significance levels: *** 1%, ** 5%, * 10%.

	Relative size of target restriction							
Independent variables	**(>1%)**		**(>3%)**		**(>5%)**		**(>10%)**	
Intercept	**-0.151**		**-0.157**		**-0.160**		**-0.179**	
	-2.092		-2.007		-1.917		-1.812	
Target capital/assets	**1.213**	***	**1.249**	***	**1.201**	***	**1.163**	***
	7.342		6.950		6.248		5.281	
Log(acquirer assets)	**0.008**	***	**0.009**	***	**0.009**	**	**0.010**	**
	2.657		2.658		2.612		2.552	
Volatility of acquirer returns	**0.056**		**0.098**		**0.211**		**0.332**	
	0.231		0.376		0.772		1.000	
Acquirer capital/assets	**0.212**		**0.138**		**0.139**		**0.204**	
	0.867		0.518		0.496		0.590	
Bank stock index	**-0.321**		**-0.046**		**-0.053**		**-0.211**	
	-0.702		-0.095		-0.102		-0.356	
Acquirer stock returns	**0.687**	**	**0.363**		**0.280**		**0.103**	
	2.176		0.990		0.668		0.208	
Target stock returns	**0.174**		**0.238**		**0.323**		**0.625**	*
	0.730		0.943		1.161		1.892	
Relative size of target	**0.027**	*	**0.020**		**0.013**		**0.010**	
	1.687		1.189		0.711		0.479	
Location dummy	**0.003**		**0.007**		**0.001**		**-0.003**	
	0.179		0.466		0.058		-0.151	
Year dummies	Yes		Yes		Yes		Yes	
R-squared	0.602		0.610		0.647		0.685	
Number of obs.	164		148		128		103	

Table 6

Regression of marked-to-market value/assets on target capital/assets

Relative size of target is the acquisition price/market value of the acquirer four weeks prior to acquisition announcement. The marked-to-market value of assets and liabilities is acquisition price less goodwill recorded in the acquisition. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Bank stock index is the average monthly return on the SNL Financial bank total return index over the 12 months prior to acquisition announcement. Stock returns is the average monthly stock return for 12 months prior to acquisition announcement. Location dummy is set to 1 if the acquirer and target banks are headquartered in the same region of the country. Year dummy is set to 1 based on the year the acquisition is completed, from 1991-2006 with 1991 as the base year. T-stats appear below estimated parameters. Significance levels: *** 1%, ** 5%, * 10%.

	Relative size of target restriction							
Independent variables	**(>1%)**		**(>3%)**		**(>5%)**		**(>10%)**	
Intercept	**-0.085**		**-0.139**		**-0.108**		**0.045**	
	-0.869		-1.473		-1.139		0.442	
Target capital/assets	**0.871**	***	**0.818**	***	**0.817**	***	**0.657**	***
	3.912		3.789		3.749		2.917	
Log(acquirer assets)	**0.004**		**0.008**	*	**0.007**		**0.002**	
	1.023		1.865		1.657		0.530	
Volatility of acquirer returns	**0.010**		**0.086**		**0.077**		**0.093**	
	0.030		0.276		0.248		0.273	
Acquirer capital/assets	**0.269**		**0.273**		**0.138**		**-0.283**	
	0.815		0.855		0.434		-0.802	
Bank stock index	**0.363**		**0.763**		**0.833**		**0.381**	
	0.590		1.310		1.414		0.628	
Acquirer stock returns	**0.625**		**0.711**		**0.401**		**-0.034**	
	1.468		1.616		0.844		-0.067	
Target stock returns	**-0.348**		**-0.199**		**0.105**		**0.382**	
	-1.080		-0.657		0.334		1.131	
Relative size of target	**0.056**	**	**0.044**	**	**0.023**		**0.015**	
	2.604		2.163		1.129		0.713	
Location dummy	**0.008**		**0.016**		**0.021**		**-0.014**	
	0.407		0.872		1.139		-0.695	
Year dummies	Yes		Yes		Yes		Yes	
R-squared	0.511		0.605		0.664		0.724	
Number of obs.	164		148		128		103	

Table 7

Regression of (acquisition price - target capital)/assets on target capital/assets

Relative size of target is the acquisition price/market value of the acquirer four weeks prior to acquisition announcement. Acquisition price is composed of the marked-to-market value of assets and liabilities and goodwill. Capital is the book value of equity of the target in the quarter before acquisition completion. Target and acquirer assets are from the quarter prior to acquisition completion. Volatility of returns is the standard deviation of monthly returns for five years prior to acquisition announcement. Bank stock index is the average monthly return on the SNL Financial bank total return index over the 12 months prior to acquisition announcement. Stock returns is the average monthly stock return for 12 months prior to acquisition announcement. Location dummy is set to 1 if the acquirer and target banks are headquartered in the same region of the country. Year dummy is set to 1 based on the year the acquisition is completed, from 1991-2006 with 1991 as the base year. T-stats appear below estimated parameters. Significance levels: *** 1%, ** 5%, * 10%.

	Relative size of target restriction							
Independent variables	**(>1%)**		**(>3%)**		**(>5%)**		**(>10%)**	
Intercept	**-0.151**		**-0.157**		**-0.160**		**-0.179**	
	-2.092		-2.007		-1.917		-1.812	
Target capital/assets	**0.213**		**0.249**		**0.201**		**0.163**	
	1.289		1.387		1.046		0.740	
Log(acquirer assets)	**0.008**	***	**0.009**	***	**0.009**	**	**0.010**	**
	2.657		2.658		2.612		2.552	
Volatility of acquirer returns	**0.056**		**0.098**		**0.211**		**0.332**	
	0.231		0.376		0.772		1.000	
Acquirer capital/assets	**0.212**		**0.138**		**0.139**		**0.204**	
	0.867		0.518		0.496		0.590	
Bank stock index	**-0.321**		**-0.046**		**-0.053**		**-0.211**	
	-0.702		-0.095		-0.102		-0.356	
Acquirer stock returns	**0.687**	**	**0.363**		**0.280**		**0.103**	
	2.176		0.990		0.668		0.208	
Target stock returns	**0.174**		**0.238**		**0.323**		**0.625**	*
	0.730		0.943		1.161		1.892	
Relative size of target	**0.027**	*	**0.020**		**0.013**		**0.010**	
	1.687		1.189		0.711		0.479	
Location dummy	**0.003**		**0.007**		**0.001**		**-0.003**	
	0.179		0.466		0.058		-0.151	
Year dummies	Yes		Yes		Yes		Yes	
R-squared	0.447		0.467		0.519		0.570	
Number of obs.	164		148		128		103	

Appendix

Calculations Supporting Numerical Examples in the Introduction

Illustration 1: Bank A has \$10 in equity and \$90 in deposits. Bank B has \$20 in equity and \$80 in deposits. The unlevered equity cost of capital is 10% and the cost of deposits is 5% for both banks. Loans yield 10% and this is also the appropriate discount rate for loan cash flows for both banks. Taxes are zero.

Solution: Let K_U be the unlevered equity cost of capital and K_E the levered equity of capital. Then,

$$K_E = K_U + [K_U - K_d][D/V_E]$$

where K_d is the cost of deposits and $[D/V_E]$ is the ratio of deposits, D, to the market value of equity, V_E. Thus, for bank A:

$$K_E^A = 0.10 + [0.10 - 0.05]\left[\frac{D}{V_E^A}\right]$$

$$= 0.10 + 0.05\left[\frac{90}{V_E^A}\right]$$

$$= 0.10 + \left[\frac{4.5}{V_E^A}\right]$$

The market value of bank A's equity = $V_E^A = \dfrac{L^A R_L - D^A K_d}{K_E^A}$

where L^A is the size of bank A's loan portfolio, R_L is the loan interest rate, D^A is bank A's deposit level and K_d is the deposit rate. Thus,

$$V_E^A = \frac{\$100[0.10] - \$90[0.05]}{0.10 + [4.5/V_E^A]}$$

which implies

V_E^A = \$10, which means

K_E^A = 0.10 + 0.45 = 55%

for bank B, similar calculations yield:

$$K_E^B = 0.10 + \frac{4}{V_E^B}$$

$$V_E^B = \frac{\$100[0.10] - \$80[0.05]}{0.10 + [4/V_E^B]}$$

We then obtain V_E^B = \$20 and K_E^B = 30%

Illustration 2: Now R_L = 15% for both banks and all other data are unchanged.

Solution: Note that

$$V_E^A = \frac{\$100[0.15] - \$90[0.05]}{0.10 + \left[\frac{4.5}{V_E^A}\right]}$$

which implies

V_E^A = \$60 and

$K_E^A = 0.10 + \left[\frac{4.5}{V_E^A}\right] = 17.5\%$

Similarly,

$$V_E^B = \frac{\$100[0.15] - \$80[0.05]}{0.10 + \left[\frac{4.0}{V_E^B}\right]}$$

which means

V_E^B = \$70 and K_E^B = 15.7%

Illustration 3: Loans sold on a stand-alone basis fetch 11% yield. Discount rate for loan cash flows is 10%. R_L = 15% for bank A and 14% for bank B. All other data are unchanged.

Solution: For bank A, the stand-alone value of loans = $\frac{\$100 \text{ x } 0.11}{0.10} = \$110$. Since the value of deposits is \$90, the marked-to-market value of bank A's equity = E_M^A = \$110 - \$90 = \$20. Now, the market value of the bank's equity = V_E^A = \$60, the same as in Illustration 2. The NPV for bank A's shareholders = V_E^A - book value of bank A's equity = \$60 - \$10 = \$50. Goodwill = V_E^A - E_M^A = \$60 - \$20 = \$40.

For bank B, the stand-alone value of loans is also \$110. Since the value of deposits is \$80, the marked-to-market value of bank B's equity = E_m^B = \$110 - \$80 = \$30. The market value of the bank's equity = $V_E^B = \dfrac{\$100[0.14] - \$80[0.05]}{0.10 + \left[\dfrac{4.0}{V_E^B}\right]}$

which means

V_E^B = \$60.

The NPV for bank B's shareholders = \$60 - \$20 = \$40.

Goodwill = $V_E^B - E_m^B$ = \$60 - \$30 = \$30.

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