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Collars and Renegotiation in Mergers and Acquisitions

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ABSTRACT

I examine the motivation for, and effect of, including a collar in a merger agreement. The most important cross-sectional determinants of the bid structure (cash vs. stock, and whether to include a collar) are the market-related stock return standard deviations for the bidder and target. This evidence supports the hypothesis that the method of payment is dependent on the sensitivities of the bidder and target to market-related risk because either has the incentive to demand renegotiation of the merger terms if the value of the bidder's offer changes materially relative to the value of the target during the bid period.

AN IMPORTANT DECISION MADE during merger or takeover negotiations is the method of payment to be offered to target shareholders. Takeover bids can be made in cash and/or some combination of securities issued by the bidding firm. A considerable number of papers in the finance literature provide empirical evidence on the determinants of the choice between stock and cash as the method of payment, including Carleton et al. (1983), Niden (1986), Crawford (1987), Auerbach and Reishus (1988), Amihud, Lev, and Travlos (1990), Chaney, Lovata, and Philipich (1991), and Martin (1996).

However, this literature typically ignores the increasing fraction (20% in recent years) of *stock* merger bids that contain a "collar." While an ordinary stock merger bid specifies the number of bidder shares offered as consideration for each target share (the exchange ratio), a collar bid provides for certain changes in the exchange ratio conditional on the level of the bidder's stock price around the effective date of the merger, often insulating target stockholders from volatility in the bidder's stock price and promising a cash-like payoff at the end of the bid period.

Collar bids come in two basic forms. The first, which I call fixed-exchange (FEX), specifies a constant exchange ratio over a range of bidder stock prices, with adjustment to the ratio outside those bounds. An example of this type of transaction is the merger agreement announced on January 17, 1994, between

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First Union Corp. (the bidder) and BancFlorida Financial Corp. (the target). The press release contained the following details:

> . . . the agreement's terms state BancFlorida's shareholders would receive 0.669 First Union common shares for each BancFlorida common share if First Union's common shares price is between $41.875 and $44.875 a share. If First Union's common stock price is below $41.875, BancFlorida's shareholders would receive $28 of First Union common shares for each BancFlorida common share. If First Union's common stock price is above $44.875, BancFlorida shareholders would receive $30 of First Union common shares for each BancFlorida common share. First Union said the calculation of its common share price will be based upon the average closing price of its common shares for the 10 trading days prior to the effective date of the acquisition.

Figure 1A depicts the target payoff at the effective date of the merger from this type of FEX collar bid.[1] The "bidder stock price at effective date of merger" in the figure is, in practice, usually defined as the average bidder share price over a window of fixed length (typically 10 or 20 days) preceding the closing of the merger.

The second basic variety of collar, which I call fixed-payment (FP) and is depicted in Figure 1B, guarantees the target shareholders a certain dollar value of the bidder's *stock* as long as the bidder's stock price stays within the collar bounds, and a fixed exchange ratio if the bidder's average stock price is outside the bounds around the effective date of the merger.[2] The press release accompanying the announcement of a merger agreement between Banc One Corp. (the bidder) and First Community Bancorp Inc. (the target) on July 22, 1992, contains an example of an FP collar:

> . . . the terms of the agreement call for the exchange of Banc One common shares for each share of First Community stock . . . If the market price of Banc One common stock, as defined in the agreement, is between $47 and $51 a share, the exchange rate will result in a market equivalent value of $31.96 in Banc One common stock. If the market price of Banc One common stock is above $51 a share, First Community shareholders will receive 0.6267 Banc One common shares. And if the market price of Banc One stock is below $47, shareholders will receive 0.68 Banc One common shares.

Houston and Ryngaert (1997) introduce a summary statistic for the sensitivity of the bidder's offer to changes in the value of the combined firm. This

[1] Some collar deals have multiple turning points that are not depicted in Figure 1, as discussed below.

[2] Merger arbitrageurs describe FEX collars as "Egyptians" (because of the similarity of the payoff function to hieroglyphic depictions of ancient Egyptians walking), and FP collars as "Travoltas" (for obvious reasons).

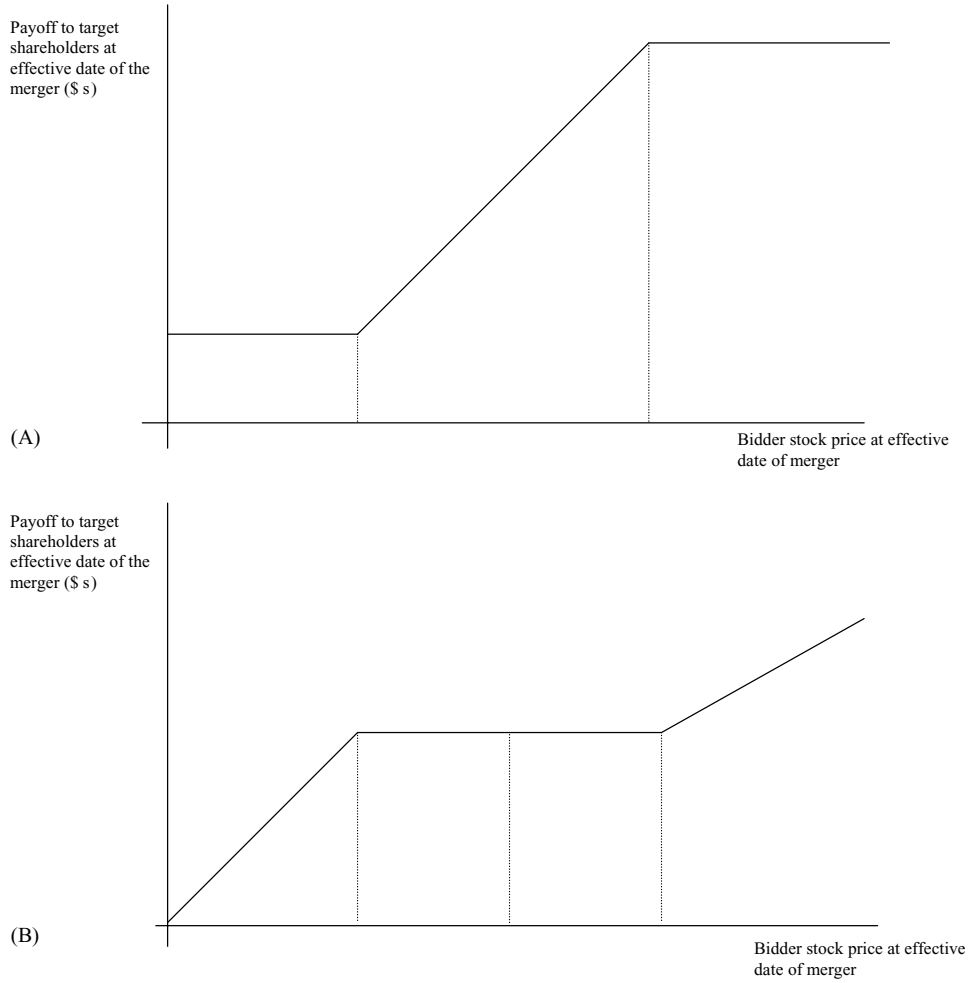

Figure 1. Target shareholder payoffs from two types of collar bids. (A) Stock bid with fixed-exchange (FEX) collar ("Egyptian"), (B) stock bid with fixed-payment (FP) collar ("Travolta").

measure is called the bid elasticity, and is defined as the percent revaluation of the target's compensation from the merger relative to the percent revaluation of the bidder's compensation that is induced by a change in the value of the combined firm. Using this measure, a pure stock offer has elasticity equal to 1 (equal percentage changes in the value of both parties' compensation), as the bidder and target have equally sensitive claims on the combined firm. A stock offer with either type of collar (or a mixed stock and cash offer) has elasticity less than 1, but greater than 0, while a plain cash offer has elasticity equal to 0. The elasticity measure is therefore a summary statistic that ranks bids on a spectrum, with those most like pure cash at one end (0), and those most like plain stock at the other (1).

The main objective of this paper is to provide evidence on the determinants of the inclusion of collars in merger bids. I test two principal hypotheses explaining the method of payment choice: asymmetric information and negotiation cost minimization (under full information). Under the asymmetric information hypothesis (Hansen (1987)), either the bidder or the target is hypothesized to have better information than the other (or the market) about its assets and opportunities. When only the target firm has an information advantage with respect to its own value, the acquirer will prefer to make a stock offer because target shareholders (by exchanging their shares for an ownership stake in the merged firm) share the costs of any overpayment (revealed ex post) with the acquiring firm shareholders. When both target and bidder managers possess differential information, the medium of exchange becomes a signal to the target of bidder quality, with the bidder revealing information about itself through its method of payment choice (i.e., high-quality bidders use cash, overvalued bidders use stock).

Hansen (1987) predicts that target firm information asymmetries will be more important when the target is larger relative to the bidder, and under those circumstances the merging parties will agree to a stock-swap transaction. Houston and Ryngaert (1997) extend this hypothesis to collar stock bids, arguing that the most general prediction is that bid elasticity will be increasing in the size of the target relative to the bidder. More specifically, the elasticity of the offer should be increasing (decreasing) in reasonable proxies for the information advantage possessed by target (bidder) managers. The asymmetric information hypothesis also suggests that high-elasticity offers will be associated with more negative announcement returns for bidders, as high-elasticity offers are a bad signal about bidder quality.

An alternative (but not mutually exclusive) hypothesis is that the method of payment is chosen to minimize the costs of negotiation, given full information at the time a merger contract is signed by both boards of directors. The average length of the period between bid announcement and resolution is approximately half a year, during which time regulatory and shareholder approvals must be obtained. Both the bidder and the target boards of directors have an ex post incentive (and fiduciary duty) to demand *renegotiation* of the proposed merger terms if the value of the offer made by the bidder changes materially relative to the value of the target during this bid period.[3]

Both negotiating a collar ex ante and renegotiating the offer terms ex post (during the bid period) are costly alternatives for both parties. Examples of the costs of negotiation include the cost of managerial time spent negotiating the collar and the cost of independent advice on the fairness of the offer terms. While the use of a collar increases the initial pre-bid costs of contracting between

[3] However, the June 15, 2001 decision in IBP, Inc. v. Tyson Foods, Inc. casts considerable doubt on the prerogative of a merging firm to back out of a proposed deal by, for example, invoking a material adverse change clause (see Houston and Ryngaert (1997)). In that decision, the Chancery Court of Delaware ordered specific performance of the merger contract despite the bidder's claim that accounting fraud and an adverse change in business conditions had significantly impaired the value of the target.

the negotiating parties, I hypothesize that collars are used as contractual devices to reduce the *ex ante expected costs of negotiation over the entire bid period*.

The ex ante expected costs of renegotiation during the period between bid announcement and resolution are the lowest if the elasticity of the bidder's offer to target shareholders matches the relative sensitivities of the bidder and target to economic shocks during the bid period. If the merging firms face very different economic shocks, or have very different market-value sensitivities to the same shocks, a plain stock exchange (high elasticity) bid is likely to require ex post renegotiation. Therefore, the desire to structure merger bids in a way that minimizes the costs of negotiation will induce bidders and target to choose the method of payment such that the changes in the value of the bidder's offer correspond to changes in the value of the target's assets. This hypothesis suggests that bid elasticity should increase from 0 (cash) to 1 (pure stock) as a proxy for the similarity of the firms' stock price response to economic shocks moves from "very dissimilar" to "very similar," and hence that collars will be used when the bidder and target firms' stock prices are not positively correlated enough to expect a pure stock transaction to be completed without the need for renegotiation.

Prior research on the use of collars is limited. The only published paper (of which I am aware) that specifically addresses the issue of collars (or conditional stock offers) is Houston and Ryngaert (1997). Houston and Ryngaert report evidence consistent with the asymmetric information hypothesis: Bidder abnormal announcement returns are significantly decreasing in bid elasticity. However, Houston and Ryngaert primarily focus on the relation between bidder abnormal announcement returns and bid elasticity, and their sample only contains firms in the banking industry. Houston and Ryngaert present only limited evidence on the potential determinants of the choice of bid elasticity. Their results confirm the Hansen (1987) hypothesis of a positive association between target size and bid elasticity, and they also find a positive association between bidder and target return correlation and the elasticity of the target's compensation. The latter result is consistent with the negotiating cost minimization hypothesis described above, and this paper expands on that result by decomposing the return correlation into systematic and idiosyncratic components.

I find that the most pervasive determinants of bid elasticity are the bidder and target market-related stock return volatility. This evidence is consistent with the hypothesis that the merging parties take account of differences in the historical sensitivity of their market values to systematic economic shocks when negotiating a merger bid. Failing to account for differences in market-related risk exposure could result in perceived over- or under-payment for the target's assets, precipitating costly renegotiation in the period during which the outcome of the merger bid is uncertain. Furthermore, I find that collar use significantly increases the probability that a merger bid will be consummated without the need for a change in the offer terms. While the elasticity-choice models provide little support for the information-asymmetry hypothesis, I do confirm the result from Houston and Ryngaert (1997) that bidder abnormal announcement returns are negatively associated with bid elasticity—stock

swap bids with a collar (making them more cash like) result in less negative bidder announcement returns. This result supports the notion that the method of payment choice reveals asymmetric information about the bidding firm.

This paper proceeds as follows. Section I describes the collar sample and Section II contains evidence on the determinants of bid elasticity. In Section III I examine the effects of collar inclusion and Section IV concludes the paper.

I. Data

My sample of collars is from a merger bid sample taken from the Securities Data Corporation's (SDC) Mergers and Acquisitions database. Tender offers are excluded from the sample, primarily because virtually no tender offers recorded on SDC include collar provisions. The first merger agreement recorded by SDC that contains a collar is in 1991, thus to avoid a sample selection bias and ensure time-consistency of the sample all offers announced before that year are excluded. The sample period ends in 1999. Bids are excluded from the sample if the value of the transaction (as recorded by SDC) is lower than $10 million or if the bidder intends to hold less than 50% of the voting stock of the target following completion of the deal. Bids are also omitted from the sample if either the bidder or the target does not have enough data on the CRSP and COMPUSTAT databases to compute meaningful statistics. The final sample includes 1,366 bids, of which 66 (133) have an FEX (FP) collar included in the announced deal terms.

The specific details of the collar terms are difficult to obtain from the SDC database, as the database does not discriminate between the collar types and frequently has missing or incorrect data on the collar bounds. Using the SDC data as a starting point, I gather the collar details from either Dow Jones News Retrieval or the SEC Edgar database. In many cases, the basic collar information is provided in the press release that often accompanies an announced merger bid. Where the details are not provided in the press release, a search of the Edgar database for the official merger agreement is necessary to obtain precise information on the collar structure.[4]

In almost all cases, these details are publicly available on the bid announcement date. If any aspects of the agreement changed following the initial merger announcement, I use only the original terms. Contractual collar terms are adjusted automatically for transactions such as stock splits or stock dividends during the bid period. I retain the original terms in my analysis, and adjust the prices reported on CRSP to ensure consistency with the original contract.

Table I shows the distribution of bids by announcement year and method of payment.[5] Panel A demonstrates that the total number of bids in both

[4] Further details on collar range and symmetry can be found in Officer (2004).

[5] The cash category includes only those bids for which the compensation offered by the bidder has a cash component but no stock component. Offers including both stock and cash components (mixed bids) are included in the stock category.

Table I
Sample Distribution

This table shows the distribution of a sample of merger bids from 1991 to 1999, and subsamples of bids that contain one of two types of collars (FEX is fixed-exchange; FP is fixed-payment; see Figure 1 for definitions). A cash bid includes cash as part of the compensation offered to target shareholders, but not common stock. A stock bid includes bidder common stock as part of the compensation offered to target shareholders, and possibly also cash. The samples in Panel A are the original raw SDC data and the final sample used in this paper. The final sample excludes those bids for which both bidder and target are not on both the COMPUSTAT and CRSP databases. The numbers in parentheses in Panel B are the percentage of stock bids including each collar type within each year.

Panel A: Distribution of SDC and Final Sample by Year

	No. of Bids in Original SDC Sample		No. of Bids in Final Sample	
Announcement Year	Cash	Stock	Cash	Stock
1991	88	131	5	36
1992	75	180	5	31
1993	109	207	23	63
1994	153	326	25	104
1995	209	326	33	129
1996	253	347	32	150
1997	404	489	31	215
1998	997	712	31	208
1999	1,515	875	54	191
Total	3,803	3,593	239	1,127

Panel B: Distribution of Collar Bids by Year

	Number of Bids		% of Stock Bids	
Announcement Year	Cash	Stock	With FEX Collar (%)	With FP Collar (%)
1991	5	36	1 (2.8)	0 (0.0)
1992	5	31	0 (0.0)	1 (3.2)
1993	23	63	5 (7.9)	7 (11.1)
1994	25	104	11 (10.6)	16 (15.4)
1995	33	129	12 (9.3)	14 (10.9)
1996	32	150	7 (4.7)	12 (8.0)
1997	31	215	15 (7.0)	22 (10.2)
1998	31	208	7 (3.4)	29 (13.9)
1999	54	191	8 (4.2)	32 (16.8)
Total	239	1,127	66 (5.9)	133 (11.8)

method-of-payment categories increases almost monotonically throughout my sample period, consistent with the well-documented boom in merger and acquisition activity following the lull in the early 1990s. Panel A also illustrates the attrition from the original SDC sample, with a more substantial fraction of the cash mergers bids lost in the screening process described above, primarily via the COMPUSTAT requirement. While there is time-series variation in the use of both types of collars (Panel B), it does not appear that either type

of collar is clustered in any particular year. In particular, there is evidence of increasing use of FP collars over time. In unreported results, I find that bidders and targets are clustered in the financial, services, and machinery industries, but that collar bids are not more or less clustered than the rest of the sample.

I employ several empirical proxies for the sensitivity to economic shocks with differential implications for the bidder or target over the period during which the outcome of the merger is uncertain. Common industry membership decreases the likelihood that the bidder and target will experience different economic shocks over the bid period.[6] I also decompose the stock return correlation between the bidder and the target to get several different measures of the similarity in the firms' economic environments. I use a traditional market model to measure the difference between bidder and target market-related and idiosyncratic risk components. Bidders and targets with smaller differences in (market or idiosyncratic) stock-return sensitivity or correlated idiosyncratic risks should be more likely to agree to high-elasticity offers. One advantage of decomposing return volatility into systematic and idiosyncratic components is that market volatility has no connection to (firm-specific) information asymmetry, and therefore the relation between bid structure and bidder and target sensitivity to market-wide shocks represents the strongest test of the renegotiation-cost hypothesis.

I use several empirical proxies to test for the impact of ex ante information asymmetry on the method-of-payment choice. My most direct proxy is the coefficient of variation of analysts' earnings forecasts for the fiscal year ending prior to the merger for both bidder and target. I assume that the dispersion of analysts' earnings forecasts is positively correlated with the amount of information asymmetry concerning a firm (as in Barry and Brown (1985)). The arguments presented above suggest that bid elasticity should be negatively associated with the difference between bidder and target forecast dispersion (greater information disparities for the bidder than for the target should imply greater use of cash as a medium of exchange, and vice versa).

In addition, Martin (1996) and Houston and Ryngaert (1997) use the relative size of the bidder and the target as a proxy for the relative importance of information disparities to the offer structure. When the target is larger relative to the bidder, the target board's decision to recommend that its shareholders accept bidder stock resolves a substantial amount of the information disparity concerning the target's value because the value of the "bidder's" stock (post-merger) will be greatly affected by the target's operating performance. I follow this strand of the literature and use the ratio of bidder to target market value as a proxy for the importance of information asymmetries, predicting a negative association between this measure of relative size and bid elasticity.

[6] Common industry membership may, however, increase the length of time between bid announcement and deal closing, as DoJ/FTC regulatory approvals may be more difficult to obtain in intra-industry mergers.

Finally, I consider bidder and target market-to-book ratios as an additional proxy, under the assumption that private information is more likely to concern future growth opportunities than assets in place. Under the information-asymmetry hypothesis, bid elasticity should be increasing in the target's market-to-book ratio and decreasing in the bidder's market-to-book ratio.[7] Martin (1996) finds that targets with high market-to-book ratios are significantly more likely to be the recipient of a stock offer, rather than a cash offer, and interprets this result as supportive of Hansen's (1987) model of information asymmetry.

Fishman (1989) and Berkovitch and Narayanan (1990) provide theoretical models demonstrating that potential competition to acquire the target increases the amount of cash offered by the bidder. Both these papers, however, have restricted method-of-payment choice menus. The most general prediction available is that anticipated competition should result in low-elasticity offers (cash, or stock with a collar), guaranteeing the target shareholders a fixed dollar value of compensation over a range of bidder share prices. To evaluate the relative importance of competition, I use a dummy variable indicating whether another bidder makes an offer for the target during a 1-year window centered on bid announcement. While observed competition is likely to be a poor proxy for the credible threat of competing bids, the latter concept is not measurable.[8]

Table II contains medians (or means, where medians are not meaningful) for the independent variables described above, and tests for difference in medians across the method-of-payment categories. The incidence of competing bids within a 1-year window centered on bid announcement is significantly lower for those offers that include stock in any form, but not significantly different between the various categories of stock bids. This reflects the self-selection of cash when bidders expect competing offers. I estimate the historical explained and residual return standard deviations for the bidder and target. Betas are estimated using a daily market model for each firm, using 200 days of returns ending 50 days prior to bid announcement and Dimson (1979) adjustments for infrequent trading.[9] "Risk" is then divided into market-related and firm-specific components using weekly market and firm returns.

Table II contains the medians for *differences* in these risk components between bidder and target, labeled BDMKTSD – TDMKTSD (market-related risk difference) and BDRESSD – TDRESSD (idiosyncratic risk difference).

[7] The misvaluation of corporate securities may offset this effect. Specifically, if bidders are more likely to try to pay with overvalued stock when market-to-book ratios are (irrationally) high (see, e.g., Rhodes-Kropf, Robinson, and Viswanathan (2004)) then bid elasticity would be increasing in the bidder market-to-book ratio.

[8] The U.S. tax code may provide incentives in the method-of-payment choice, but collar bids appear to be identical to fixed-exchange-ratio stock bids from a tax perspective, and changes to the tax code have removed many of the method-of-payment incentives discussed in prior research (e.g., Carleton et al. (1983), Niden (1986), and Crawford (1987)). For these reasons, I do not investigate any incentive to make a collar bid that may be provided by the U.S. tax code.

[9] As suggested in Dimson (1979), I use four lags and one lead of market returns (in addition to the contemporaneous return), and sum the associated regression coefficients.

Table II
Descriptive Statistics

This table contains medians (or means where medians are not meaningful, *italicized*) for a sample of merger bids from 1991 to 1999. *SIND* is a dummy variable equal to 1 if the bidder and target are in the same industry, where industry definitions are taken from Fama and French (1997), and 0 otherwise. *COMP* is a dummy variable equal to 1 if another bidder bids for the target within a 1-year window centered on bid announcement, and 0 otherwise. *SUCCESS* is a dummy variable equal to 1 if the bid results in a completed acquisition and 0 otherwise. *PREMIUM* is the bid premium, measured as the percent difference between the value of the compensation offered by the bidder and the market price of the target's shares 4 days prior to bid announcement (as described in greater detail in the appendix). *RETCOR* is the correlation between the weekly bidder and target stock returns during the historical estimation period used for the market model for both firms. *BDMKTSD* (*BDRESSD*) is the explained (residual) weekly standard deviation of returns using betas taken from an historical daily market model for the bidder with Dimson (1979) adjustments for infrequent trading. *TDMKTSD* (*TDRESSD*) is the explained (residual) weekly standard deviation of returns using betas taken from an historical daily market model for the target with Dimson adjustments for infrequent trading. Both historical market models are estimated over 200 trading days ending 50 days prior to bid announcement. *RSDCOR* is the correlation between the weekly residuals for the bidder and target. *RSIZE* is the ratio of bidder market value of equity to target market value of equity, both measured 4 days prior to bid announcement. *BM2B* (*TM2B*) is the market-to-book equity ratio for the bidder (target), measured using data from COMPUSTAT for the last fiscal year ending prior to bid announcement. *BACV* (*TACV*) is the coefficient of variation of analysts' earnings forecasts for the most recent fiscal year ending prior to the merger bid for the bidder (target). *ELAST* is the elasticity of each bid, computed as the percent revaluation of the target's compensation relative to the percent revaluation of the bidder's compensation induced by a change in the value of the combined firm, as in Houston and Ryngaert (1997). *ELASTA* is the same as *ELAST*, but is computed using an option-pricing algorithm that accounts for the Asian feature of most collar options. *TIME* is the number of weeks from bid announcement to resolution (capped at 52). FEX (FP) denotes a fixed-exchange (fixed-payment) collar. The superscripts a, b, and c indicate that the median (or mean, where the median is not meaningful) in any column is significantly different from the median (or mean) in the cash (stock, no collar) [stock, FEX collar] sample at the 5% level (respectively), using a two-sided test.

	Cash	Stock		
		No Collar	FEX Collar	FP Collar
	$N = 239$	$N = 923$	$N = 66$	$N = 133$
SIND	*0.53*	*0.53*	*0.54*	*0.54*
COMP	*0.10*	*0.05*[a]	*0.02*[a]	*0.03*[a]
SUCCESS	*0.81*	*0.85*	*0.92*[a]	*0.95*[ab]
PREMIUM	0.29	0.29	0.26	0.26
RETCOR	0.14	0.18[a]	0.14[b]	0.19[ac]
RSDCOR	0.06	0.10[a]	0.05	0.09
BDMKTSD − TDMKTSD	0.0030	0.0016	0.0024	0.0011
BDRESSD − TDRESSD	−0.0164	−0.0104[a]	−0.0126	−0.0136
RSIZE	13.00	5.93[a]	8.05	11.25[b]
BM2B	1.92	2.48[a]	2.46[a]	2.65[a]
TM2B	1.44	1.79[a]	1.57	1.89[a]
BACV	0.03	0.03	0.03	0.02[abc]
TACV	0.07	0.05[a]	0.04	0.03[ab]
ELAST	*0.00*	*0.98*[a]	*0.48*[ab]	*0.56*[abc]
ELASTA	*0.00*	*0.98*[a]	*0.60*[ab]	*0.41*[abc]
TIME (Weeks)	23.29	22.00	20.93[ab]	18.43[ab]

Bidders appear to have greater market-related risk exposure than targets, and vice versa for firm-specific risk. The only significant difference noted in the table, however, is between cash and pure stock offers. Pure stock offers involve bidders and targets with significantly less negative idiosyncratic risk differentials than those in the cash category, consistent with the notion that stock is used as a medium of exchange when the bidder and target are more similar. It is also notable that the other residual risk differentials follow an intuitively monotonic pattern of increasing as the medium of exchange becomes more cash-like, although the other differentials in Table II are not significantly different from each other.

The median relative size of the bidder compared to the target is significantly lower for plain stock bids than for FP collar or cash bids. This result is consistent with the information-asymmetry hypothesis. However, the median bidder in plain stock deals is still five times larger than the target, a ratio that could not reasonably be described as small. This also suggests that cash is used for relatively small acquisitions because a cash acquisition implies a dramatic increase in leverage for the merged firm if the target is larger relative to the bidder. Both median market-to-book ratios are significantly higher in the stock bid sample than in the cash bid sample, suggesting that stock is the preferred medium of exchange when the bidder and target have ample growth opportunities. There is no significant difference in either ratio between the subcategories of stock bids analyzed here.

Using the coefficient of variation of analyst earnings forecasts (from IBES) for the most recent fiscal year ending prior to the merger bid, both bidders and targets involved in FP collar bids appear to have significantly less information asymmetry than merging firms in the rest of the sample. These results are somewhat perplexing from the perspective of Hansen's information-asymmetry hypothesis because targets receiving cash offers (lower elasticity than FP collars) appear to have greater information disparities than those receiving FP collar offers.

At the bottom of Table II are descriptive statistics for the elasticity of the compensation offered to target shareholders with respect to changes in the value of the deal to bidder shareholders, computed using deltas from option-pricing models as described in the appendix. Announced deals are often not as simple as Figure 1 suggests—a number of collar contracts contain secondary collar turning points outside what I label the primary bounds.[10] The first elasticity measure in Table II, *ELAST*, uses only the non-termination collar bounds, and makes use of Black-Scholes deltas to measure the sensitivity of the options

[10] Many collar deals involve termination-topping rights. These allow one party to terminate the merger agreement following movements in the bidder's stock price even more dramatic than those specified under the primary (or secondary, if relevant) collar, subject to the right of the other to make them whole and negate the termination right (hence the "topping"). For example, a termination-topping bound may specify that a fixed dollar payment to target shareholders must change to a fixed exchange ratio *below* a certain bidder stock price or the *bidder* has the right to cancel the merger.

implicit in collar bids.[11] Using this metric, FEX collars have lower mean and median elasticity than FP collars, despite the fact that FP collars are cash-equivalent bids within the collar range. This measure of elasticity is therefore dominated by the payoff structures outside the collar bounds, which is consistent with the observation that the bidder's bid period stock return volatility is, on average, highly relative to the width of the collar (officer (2004)).

Later in this paper I use the elasticity variable as a continuous (albeit truncated) summary statistic for the method-of-payment choice. While explaining bid elasticity will be the primary focus of this paper, elasticity is not a perfect summary statistic for the terms of the deal. For example, a FEX collar bid, a FP collar bid, and a mixed cash/stock bid can all have the same measured elasticity. This would confound any conclusions about collar use derived from an elasticity choice model if mixing of cash and stock to achieve similar elasticity as a collar bid were common in my sample. However, in my sample there are only 52 mixed cash and stock offers (with enough information to compute the bid elasticity), and these mixed bids do not typically have low elasticity relative to the elasticity achieved through the use of a collar. In fact, the median mixed-bid elasticity is 0.67, and 95% of the mixed bids have elasticity greater than 0.31. However, the average elasticity of stock offers in Table II is 0.98 (rather than 1) because of this small fraction of mixed cash-and-stock bids in the stock (no collar) category.

The second measure of bid elasticity uses only the nontermination bounds, but employs the deltas from an Asian option-pricing algorithm (Turnbull and Wakeman (1991), Hull (1997, p. 465)). The bidder share price used to compute the final stock exchange ratio in a collar bid is always averaged over a number of trading days (typically 10 or 20) around the merger completion date. Averaging of the spot price is characteristic of Asian options, and hence I employ an Asian option-pricing algorithm. The bid elasticity computed in this fashion is empirically more consistent with the notion that FP collars are similar to cash bids and that FEX collars are more like stock bids. This results from the fact that the volatility of returns on the underlying asset in the Asian option-pricing algorithm is lower than that in the simple Black-Scholes model, implying that the payoffs from each type of collar bid are dominated by the contractual terms within the primary range.

II. Regression Results

I use bid elasticity as a simple and convenient way of indexing the method-of-payment choice with a continuous variable, and use double-sided Tobit models to explain the bid elasticity choice. Using elasticity as a choice variable offers the advantage of a continuous (albeit truncated) dependent variable that

[11] Incorporating the termination-topping bounds (as with the ELAST2 measure in Houston and Ryngaert (1997, p. 203)) changes the mean and median elasticity very little. In fact, these elasticity measures have a sample correlation coefficient of over 0.9. In results available on request, I show that the all the conclusions in this paper are qualitatively unaffected by including the termination-topping bounds in the elasticity measure.

captures the sensitivity of target shareholders' compensation to market movements. Arguably, this sensitivity is the most economically important aspect of the bid structure offered to target shareholders. However, the disadvantage of using bid elasticity as a dependent variable is that it is not unique, in the sense that both an FP and FEX collar bid (and a mixed cash and stock bid) can have the same elasticity.[12]

Table III contains the results of double-sided Tobit models explaining the elasticity of merger bids.[13] The elasticity measure is defined as the percent change in the value of the target's compensation from the proposed merger relative to the percent change in the bidder's compensation that is induced by a change in the value of the combined firm (Houston and Ryngaert (1997)). This measure lies between 0 (pure cash offers) and 1 (pure stock offers), with collar or mixed bids having intermediate values. The first three columns in Table III employ the full sample of bids. Given my uncertainty about where collars fit in the menu of method-of-payment choices, the last three columns include only bids in which common stock was one of the methods of payment. In other words, I want to control for the possibility that bidders and targets make a primary decision between cash and stock, with collar inclusion only a consideration if stock is the chosen method of payment. I also separate stock bids from cash bids because the latter imply significant increases in leverage that may distort the method-of-payment choice in a way that is difficult to control in this setting.

As in Houston and Ryngaert (1997), the correlation of weekly bidder and target stock returns is an important determinant of the elasticity of bids in the full sample. The elasticity of the agreed compensation is significantly increasing in the return correlation, suggesting that bidders and targets that face similar economic environments choose stock-like compensation because it is likely that changes in the value of the bidder's offer will mimic changes in the value of the target. However, this result holds only weakly in the common stock bid subsample, suggesting that it is principally driven by the cash/stock choice.

The difference between market-related stock return standard deviations does, however, have significant explanatory power for the elasticity choice in both samples. Low-elasticity offers (including some cash or a collar) are more likely to be made when the bidder is expected to have high market-related volatility relative to the target over the bid period. This is consistent with the contracting-cost hypothesis. When the bidder is more sensitive than the target to general economic shocks a high-elasticity offer is likely to leave one party better off at the other's expense during the period in which the outcome of the merger is uncertain, potentially precipitating costly renegotiation of the bid terms when each board of directors acts in the interests of its own shareholders. The same intuition holds (but in reverse) for high-elasticity offers when the target is "riskier."[14]

[12] An earlier version of this paper contained unordered multinomial logit models explaining method-of-payment choice, with qualitatively similar results.

[13] The results are qualitatively similar to unreported OLS estimates.

[14] All the results in Table III are qualitatively unchanged if the elasticity measure from the

Table III
The Determinants of the Elasticity of Merger Bids

This table contains estimates from double-sided Tobit regressions explaining the elasticity (*ELAST*) of announced merger bids between 1991 and 1999. *BDMKTSDT* (*TDMKTSDT*) is the product of *BDMKTSD* (*TDMKTSD*) and the square root of the number of trading weeks between bid announcement and resolution (capped at 1 year). *BDRESSDT* (*TDRESSDT*) is the product of *BDRESSD* (*TDRESSD*) and the square root of the number of trading weeks between bid announcement and resolution (capped at 1 year). The first three columns employ the full sample of bids, while the last three columns use the subsample of bids for which common stock was one of the methods of payment. All independent variables are defined in previous tables. Standard errors are in parentheses.

	All Bids			Bids Including Common Stock		
Constant	1.34***	1.50***	1.35***	1.39***	1.42***	1.33***
	(0.10)	(0.14)	(0.10)	(0.06)	(0.05)	(0.06)
SIND	−0.06			−0.02		
	(0.11)			(0.06)		
RETCOR	1.13***			0.23*		
	(0.26)			(0.12)		
BDMKTSDT − TDMKTSDT		−1.82***	−1.62**		−0.84**	−0.91**
		(0.69)	(0.75)		(0.35)	(0.43)
BDRESSDT − TDRESSDT		0.88**	0.77		0.23	−0.04
		(0.42)	(0.49)		(0.22)	(0.29)
RSDCOR		0.95***	1.14***		0.23*	0.43***
		(0.28)	(0.30)		(0.13)	(0.16)
RSIZE	−0.0008**	−0.0007**	−0.0006	0.0003	0.0004	0.0003
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)
COMP	−0.96***	−0.98***	−0.91***	−0.12	−0.13	−0.14
	(0.24)	(0.25)	(0.24)	(0.14)	(0.14)	(0.15)
BM2B			0.01			−0.0040
			(0.01)			(0.0041)
TM2B			0.0008			−0.0010
			(0.0025)			(0.0012)
BACV − TACV			0.78**			0.04
			(0.32)			(0.18)
No. of observations	1,212	1,215	781	985	988	646
R^2	0.04	0.04	0.07	0.00	0.01	0.02

***, **, and * indicate that the parameter estimate is significantly different from 0 at the 1%, 5%, or 10% level, respectively.

The difference in residual volatilities is generally not significant in explaining bid elasticity; but in the one specification that it is significant, it has the wrong sign (positive) for both the contracting and information hypotheses. Neither theory would predict that high-elasticity offers would be more likely to be made by bidders with greater idiosyncratic risk than the target. The correlation of the idiosyncratic components of risk is, however, significantly positive in all

Asian option-pricing algorithm is used as the dependent variable instead of the elasticity derived from the Black-Scholes model.

specifications, and consistent with the contracting-cost hypothesis. Again it appears that bidders and targets facing similar economic shocks are more likely to choose higher-elasticity bid structures, even conditional on the choice to make stock the method of payment to begin with.

The negative effect of competition on bid elasticity seems to be limited to the full sample, suggesting that perceived competition to acquire the target is important in determining the choice between stock and cash, but not collar inclusion. While Houston and Ryngaert (1997) find relative size to be a robust determinant of bid elasticity, it is also only significantly negative (the sign predicted in Hansen (1987)) in two of the full sample regressions, and is insignificant in the common stock subsample. The coefficient on the difference in the bidder and target analyst forecast dispersion has the wrong sign (positive) for the information-asymmetry hypothesis and is statistically significant at the 5% level. Considered as a whole, the evidence in Table III does not appear to favor the explanation that the bid elasticity is chosen to resolve the problem of ex ante information asymmetries. Interestingly, Datar, Frankel, and Wolfson (2001) come to the same conclusion (using a very different methodology) about the method-of-payment choice in their analysis of earnouts in mergers.

Table IV examines the issue of whether my results differ for firms in one important industry included in my study: financial services. Many studies in corporate finance exclude financial service firms, but this industry contains over one-third of the bidders and targets in my sample and is the sole focus of prior collar research (Houston and Ryngaert (1997)). The results in Table IV indicate significant differences for deals in which both the bidder and target are in the financial services industry. Specifically, the coefficients on the differential between the bidder and target market-related volatility and the residual correlation are insignificantly different from 0 in financial service mergers.[15]

Bidder and target stock return correlation is significantly positively associated with bid elasticity in financial service mergers as it is in the rest of the sample, albeit with a coefficient of lower magnitude. The information-asymmetry hypothesis receives slightly more support in this context, as the coefficient on the analyst forecast dispersion difference is negative for financial service mergers, but insignificantly different from 0. Why the decomposition of risk into market-related and idiosyncratic components for financial service mergers produces such different (and insignificant) results remains a puzzle, especially given the focus on bank mergers in prior research.

The most pervasive determinants of bid structure (cash/stock, and whether to include a collar) are the bidder and target market-related stock return volatility, particularly for mergers outside the financial service industry. My results have an intuitive interpretation. The offer structure has significantly lower elasticity when the bidder has high market-related return standard deviation and the target has low market-related risk. This suggests that the merging parties take account of differences in the historical sensitivity of their market values to general economic shocks when negotiating a merger bid. Failing to

[15] Test statistics for sums of the coefficients in Table IV are not reported in the table.

Table IV
The Determinants of the Elasticity of Merger Bids Involving Financial Service Firms

This table contains estimates from double-sided Tobit regressions explaining the elasticity (*ELAST*) of announced merger bids between 1991 and 1999 for financial service firms. *FINSERV* is a dummy variable equal to 1 if both bidder and target are in the financial services industry (as defined in Table I), and 0 otherwise. All other independent variables are defined in previous tables. Standard errors are in parentheses.

	All Bids		
Constant	1.31***	1.49***	1.39***
	(0.08)	(0.09)	(0.09)
RETCOR	1.33***		
	(0.30)		
FINSERV ∗ *RETCOR*	−0.52		
	(0.41)		
BDMKTSDT − *TDMKTSDT*		−2.57***	−2.53***
		(0.79)	(0.84)
BDRESSDT − *TDRESSDT*		0.83*	0.62
		(0.46)	(0.52)
RSDCOR		1.25***	1.18***
		(0.32)	(0.33)
FINSERV ∗ (*BDMKTSDT* − *TDMKTSDT*)		3.23**	3.87**
		(1.56)	(1.74)
FINSERV ∗ (*BDRESSDT* − *TDRESSDT*)		0.17	0.95
		(0.87)	(1.04)
FINSERV ∗ *RSDCOR*		−1.07*	−0.14
		(0.55)	(0.62)
RSIZE	−0.0008**	−0.0007**	0.0008**
	(0.0003)	(0.0003)	(0.0003)
COMP	−0.98***	−0.98***	−0.83***
	(0.25)	(0.24)	(0.24)
BACV − *TACV*			0.76**
			(0.34)
FINSERV ∗ (*BACV* − *TACV*)			−1.65*
			(0.86)
No. of observations	1,216	1,215	816
R^2	0.04	0.05	0.08

***, **, and * indicate that the parameter estimate is significantly different from 0 at the 1%, 5%, or 10% level, respectively.

account for differences in market-related risk exposure could result in perceived over- or under-payment for the target's assets, precipitating costly renegotiation during the bid period. This interpretation of the evidence is consistent with the contracting-cost hypothesis because bid elasticity appears to be chosen to ensure that the bid is less likely to require renegotiation. Furthermore, the relation between bid elasticity and market volatility differentials represents the strongest evidence that minimizing the need for costly renegotiation plays a role in merger offer structure, as market volatility measures should not proxy for any aspect of firm-specific information asymmetry.

III. The Effects of Collar Inclusion

A. Abnormal Announcement Returns

Houston and Ryngaert (1997) examine the information-asymmetry hypothesis by explaining abnormal announcement returns to collar merger agreements. The hypothesis tested is that if bilateral information asymmetries are important in the choice of whether to include a collar the market reaction in the bidder's stock to high-elasticity bids should be more negative than the market reaction to low-elasticity bids because in the latter case the bidder offers greater price protection to target shareholders. In particular, Houston and Ryngaert argue that in the banking industry regulated capital requirements favor the use of stock as a means of payment, and that undervalued financial service bidders may use an FP collar bid as a substitute for cash.

Panel A of Table V contains median bidder and target cumulative abnormal returns for the three trading-day window centered on bid announcement. The results in Panel A demonstrate the well-known finding that bidders offering stock to target shareholders experience significantly negative abnormal announcement returns that are not experienced by cash bidders (Asquith, Bruner, and Mullins (1983), Travlos (1987), and Brown and Ryngaert (1991), among others). I also separate mixed bids from plain stock and cash offers, and find that bidder abnormal announcement returns in mixed bids are similar to those in cash offers (i.e., roughly 0), which suggests either that any cash in an offer is enough to overcome concerns about information asymmetry or that bidders negotiate a better price in mixed offers (as evidenced by the low target abnormal returns in that subsample).[16] Importantly, the bidder abnormal announcement returns are roughly consistent with the notion that the bidder's market reaction is more positive for low-elasticity bids, with the median reaction being the most negative for plain stock bids and monotonically decreasing in magnitude across the categories of FEX collar bids (stock like), FP collar bids (cash like), and finally cash itself.[17]

Panel B contains the results from OLS regressions explaining the bidder's cumulative abnormal announcement return, partially replicating the analysis in Houston and Ryngaert (1997). The results demonstrate that bidder abnormal announcement returns are significantly negatively related to bid elasticity—more cash-like bids reward the bidder with more positive announcement returns. Importantly, this result even holds when cash bids are omitted from the sample (Column 3). Panel B in Table V also demonstrates that the negative relation between elasticity and bidder abnormal return is not specific to mergers in the banking industry (Columns 1 and 3), nor is it affected by using the elasticity measure computed from deltas obtained from the Asian option-pricing

[16] Of course, while I have allowed for only one mixed category, mixed offers can differ greatly in the proportions of cash and stock included in the bid. An analysis of the relation between bidder returns and cash/stock proportions is outside the scope of this study (and has already been examined in Brown and Ryngaert (1991), among other studies).

[17] The small sample size in the FEX collar category limits the power to detect statistical difference from zero, but the median is more negative than the FP collar median.

Table V

Cumulative Abnormal Announcement Returns

This table contains descriptive statistics and OLS regressions for bidder and target cumulative abnormal announcement returns for a sample of merger bids between 1991 and 1999. The cumulative abnormal announcement returns (CAARs) for the bidder and target are measured over the 3-day window centered on bid announcement. Abnormal returns are measured using a market model, with the parameters estimated using 200 trading days of returns ending 50 days prior to bid announcement and the intercept suppressed for bidders (as in Schwert (1996)). In both panels. Standard errors are in parentheses in Panel B.

Panel A: Median Bidder and Target Cumulative Abnormal Announcement Returns

Sample	Median Bidder CAAR	Median Target CAAR
Cash	0.27%	17.38%***
Mixed (cash and stock)	0.14%	12.77%***
Stock, no collar	−1.96%***	13.93%***
FEX collar	−0.89%	13.83%***
FP collar	−0.79%***	14.29%***

Panel B: OLS Regressions Explaining Bidder 3-day Cumulative Abnormal Announcement Returns

Sample	All Bids		Bids Including Common Stock
Intercept	0.0047	0.0030	0.0158
	(0.0060)	(0.0059)	(0.0101)
SIND	−0.0015	−0.0016	−0.0050
	(0.0042)	(0.0042)	(0.0049)
ELAST	−0.0302***		−0.0384***
	(0.0056)		(0.0099)
FINSERV ∗ *ELAST*	0.0024		0.0018
	(0.0050)		(0.0049)
ELASTA		−0.0274***	
		(0.0045)	
PREMIUM	−0.0381***	−0.0382***	−0.0539***
	(0.0085)	(0.0085)	(0.0106)
Log(*RSIZE*)	0.0054***	0.0054***	0.0072***
	(0.0017)	(0.0015)	(0.0018)
No. of observations	975	975	789
R^2	0.06	0.06	0.06

***, **, and * indicate that the parameter estimate is significantly different from 0 at the 1%, 5%, or 10% level, respectively.

algorithm (Column 2). This evidence confirms Houston and Ryngaert's results in a broader sample, and is consistent with the information-asymmetry hypothesis. While not directly supportive, these regression results are certainly not inconsistent with the contracting-cost hypothesis (since the information and contracting hypotheses are not mutually exclusive).

B. Collars and Renegotiation

One of the hypotheses tested in this paper is that collars are included in stock merger bids in order to reduce the probability that the bid terms will

have to be amended prior to the stockholder vote. While adding a collar to a stock merger bid undoubtedly increases the costs of contracting between the two parties, the offsetting benefit is hypothesized to be a reduction in the ex ante expected costs of renegotiation. The empirical relation between collar use and bid amendment is, however, complicated by a selection bias. Under the null hypothesis, a collar will be included in a merger agreement when the ex ante probability of renegotiation absent collar inclusion is high enough to warrant the additional contracting costs. The sign of the relation between collar use and bid renegotiation is therefore indeterminate.

Therefore, I examine the effect of collar inclusion on the probability that the deal is renegotiated using a probit regression. The dependent variable in the probit is *RENEG*, a dummy variable indicating whether the terms of the merger are amended before resolution. Starting with my sample of bids described in Section I, I gather data from SDC on changes in the offer price over the bid period. For stock bids, I only consider the offer price to have changed if the exchange ratio changes between bid announcement and resolution, and only if such changes were not precontracted (as is the case with a collar).[18] To avoid data errors, I discard bid changes of less than 5% in absolute value. The resulting sample includes bid price changes (renegotiations) for 72 offers out of the original 1,366 bids (approximately 5% of the sample), with 49 bid increases and 23 bid decreases. The average bid increase is 19%, while the average bid decrease is −21%. I also redefine the competition dummy variable to represent whether another bidder makes an offer for the target firm in the 6-month period *after* the initial bid announcement (*POSTCOMP*), as pre-bid competition should affect the originally negotiated offer terms rather than bid renegotiation.

Table VI presents the results from the estimation of this probit model, with the first column containing estimates using the full sample of bids and the second column containing estimates where the sample is restricted to common-stock bids only. The magnitudes of the parameters do not have a natural interpretation, so I provide estimates of these marginal effects (in brackets). The marginal effects are computed by first calculating the probability of renegotiation using the sample means for all continuous independent variables and zeroes for all dummy independent variables (the base predicted probabilities). These probabilities are then recomputed by changing each independent variable in turn, adding one standard deviation to the mean of continuous variables, or using a 1 for each dummy variable. The marginal effects reported in the table are the differences between the new and base probabilities, and represent the change in the probability of renegotiation from a one standard deviation change in each continuous independent variable, or a change from 0 to 1 for each dummy independent variable.

[18] I screened the entire collar renegotiation sample to ensure that a change in the bid price, as coded by SDC, is not simply caused by the collar itself. I also checked a number of the plain stock bids to ensure that SDC does not record a change in the bid price directly caused by movements in the bidder's stock price under a fixed exchange ratio, but that the recorded price changes are genuine renegotiations of the exchange ratio.

Table VI
The Determinants of Bid Renegotiation

This table contains results from a probit regression explaining the probability that the offer price is revised during the bid period for a sample of merger bids from 1991 to 1999. The dependent variable is *RENEG*, a dummy variable equal to one if SDC records a change in the price offered by the specific bidder during the period in which the outcome of the bid is uncertain and 0 otherwise. *COLLAR* is a dummy variable equal to 1 if the stock bid contains a collar and 0 otherwise. *POSTCOMP* is a dummy variable equal to 1 if another bid by a different bidder is recorded by SDC in the 6 months after the current bid and 0 otherwise. Log(*MKTVAR*) is the natural logarithm of the variance of weekly CRSP value-weighted market returns (including distributions) over the 200 trading-day period ending 50 days prior to bid announcement. All other independent variables are defined in previous tables. Base predicted probability is the base case predicted probability of renegotiation, evaluated at the mean of continuous variables and with all dummy variables equal to 0. The marginal effects of a change from the sample means of continuous independent variables, and from 0 for dummy variables, are in brackets. Standard errors are in parentheses.

Independent Variable	All Bids		Bids Including Common Stock	
Intercept	0.80		1.75*	
	(0.75)		(0.98)	
COLLAR	−0.34*		−0.66**	
	(0.21)	[−0.03]	(0.33)	[−0.04]
ELAST	0.02		−0.62	
	(0.15)	[0.00]	(0.52)	[−0.01]
POSTCOMP	0.78***		0.77**	
	(0.26)	[0.14]	(0.32)	[0.15]
Log(*MKTVAR*)	0.31****		0.35***	
	(0.09)	[0.02]	(0.11)	[0.03]
No. of Observations	1,233		995	
Pseudo R^2	0.04		0.05	
Base predicted probability	0.05		0.05	

***, **, and * indicate that the parameter estimate is significantly different from 0 at the 1%, 5%, or 10% level, respectively.

The results in Table VI support the contention that collar use significantly reduces the probability that the bidder and target will have to revise the terms of the merger prior to completion, particularly in the common-stock subsample. The marginal reduction in the probability of renegotiation with collar use (3 to 4%) is more than one-half of the base predicted probability, suggesting that the inclusion of a collar is an economically important determinant of the likelihood that the bidder and target have to rework the terms of the agreed merger. The regressions in Table VI also include bid elasticity as a control variable, as it is important to control for the non-collar terms of the merger agreement when interpreting the effect of collar inclusion. The emergence of competing bidders following an announced merger bid increases the likelihood of renegotiation by 15%, more than tripling the base case probability. Pre-bid market volatility is also significantly positively associated with deal renegotiation, suggesting that

deals agreed to during turbulent markets are more likely to need reworking by the negotiating parties.[19]

IV. Conclusions

Announced merger agreements increasingly contain complicated provisions allowing for changes to the bidder's offer conditional on the level of the bidder's stock price. This paper is one of the first to provide evidence that the agreed bid structure (cash vs. stock, and whether to use a collar) is dependent on the anticipated sensitivity of bidder and target returns to general economic shocks during the bid period, and that the use of a collar has important implications for the outcome of the offer. My results demonstrate that low-elasticity stock offers (e.g., those including a collar) are more likely to be observed when the difference between bidder and target market-related return volatility is high. Furthermore, the inclusion of a collar in a merger bid significantly reduces (by half) the probability that the bid price requires renegotiation prior to resolution. Some of my results are also consistent with the information-asymmetry hypothesis. In particular, I find that bidder abnormal announcement returns are significantly decreasing in bid elasticity, consistent with Houston and Ryngaert (1997). On the whole, however, I interpret my evidence as being most consistent with the hypothesis that bidders and targets choose the bid structure (i.e., collar inclusion) to ensure that the terms of the offer are less likely to require renegotiation over the period during which the outcome of the merger is uncertain.

Appendix: Computation of Bid Premium, Collar Value, and Elasticity

The bid premium is measured as the percent difference between the value of the consideration offered by the bidder (*excluding* the value of the options implicit in a collar; see Officer (2004)) and the market value of the target 4 days prior to bid announcement. I separate collar bids into two parts: a fixed exchange ratio (for FEX collars) or fixed-payment (for FP collars) component and implicit options that make FEX (FP) collar bids different from plain stock (cash) offers. The bid premium (*PREMIUM*) is computed using the product of the fixed exchange ratio and the bidder's stock price 4 days prior to bid announcement for plain stock and FEX collar bids, and using the "fixed" component for FP collar or cash bids. The premium for mixed bids is computed using the percentages of each type of consideration recorded by SDC.

[19] Interestingly, Mitchell and Pulvino (2001) report that market returns during the pre-bid period are significantly negatively associated with success for merger arbitrageurs, suggesting that deals are more likely to fail or bid prices revised downward following market downturns.

Bid elasticity (*ELAST*) is computed as described in Houston and Ryngaert (1997) as

$$ELAST = \frac{\partial TCOMP/\partial V}{\partial BCOMP/\partial V} \times \frac{BCOMP}{TCOMP}, \tag{A1}$$

where *TCOMP* and *BCOMP* are the values of the compensation offered to bidder and target shareholders from the merger bid, and V is the value of the combined firm. Details of the computation of *ELAST* are discussed at length in Houston and Ryngaert (1997), but I will summarize the important points here. In Houston and Ryngaert's notation, $V = BCOMP + TCOMP$. I measure the current value of the combined firm (V) as the sum of the bidder's market value from CRSP 4 days prior to bid announcement (*BCOMP*) and the corresponding payment promised to the target under the merger agreement (*TCOMP*). Because $BCOMP = (V - TCOMP)$, it follows that:

$$\partial BCOMP/\partial V = 1 - \partial TCOMP/\partial V. \tag{A2}$$

The partial derivative $\partial TCOMP/\partial V$ is computed as the sum of the deltas from each component of the compensation offered to target shareholders.

Consider the two examples described in the introduction. An FEX collar consists of a portfolio of options on the bidder's stock that when combined with the fixed exchange ratio generates the fixed dollar payments outside the collar range. However, as noted by Houston and Ryngaert (1997), the description of these options as being on the shares of the "bidder" is overly simplistic. After the merger has been announced, the share price of the bidder actually represents the bidder shareholders' proposed portion of the *combined* firm. Therefore, assuming that the deal will be successful with probability 1,[20] I rewrite the payoff for the target shareholders as a function of the value of the combined firm. For the merger agreement between First Union (bidder) and BancFlorida (target) let $B(T)$ be the number of bidder (target) shares outstanding on the bid announcement date. For bidder share prices within the primary collar range, the target shareholders receive a fraction of the combined firm equal to S, where S is defined as

$$S = 0.669T/(0.669T + B).$$

For bidder share prices below (above) the collar range, the target shareholders receive a fixed payment of $\$28T$ ($\$30T$). Therefore, the package of implicit options that comprise the collar is a long position in S put options on the value of the combined firm with a strike price of $\$28T/S$, and a short position of S call options on the value of the combined firm with a strike price of $\$30T/S$.[21]

FP collars are slightly more complicated. Recalling that the basic offer premium is computed using the cash-equivalent payment promised by the bidder

[20] Incorporating the probability of deal success into the option valuation would require recognition of the fact that target stockholders in *all* takeover bids have the option not to accept the bidder's offer. Collar bids therefore represent compound options, or "options on options."

[21] Secondary and termination-topping collar bounds are dealt with in a similar fashion.

within the collar range, the portfolio of options on the value of the combined firm that comprise the collar actually increases target shareholders' exposure to changes in the value of the combined firm. Again, I rewrite the payoff to the target shareholders as a function of the value of the combined firm. In the merger agreement between Banc One (bidder) and First Community (target) let $B(T)$ be the number of bidder (target) shares outstanding on the bid announcement date. For bidder share prices below (above) the primary collar range, the target shareholders receive a fraction of the combined firm equal to $S_1(S_2)$, defined as

$$S_1 = 0.68T/(0.68T + B),$$

and

$$S_2 = 0.6267T/(0.6267T + B).$$

The collar promises target shareholders a fixed payment of $\$31.96T$ when the bidder share price is within the collar range at the effective date of the merger. Therefore, the collar consists of a short position in S_1 puts with a strike price of $\$31.96T/S_1$, and a long position in S_2 calls on the value of the combined firm with a strike price of $\$31.96T/S_2$.[22]

For these two examples:

$$\text{First Union/BancFlorida: } \partial TCOMP/\partial V = S(1 + \delta_{P_1} - \delta_{C_1}), \tag{A3}$$

$$\text{Banc One/First Community: } \partial TCOMP/\partial V = (S_2 * \delta_{C_2}) - (S_1 * \delta_{P_2}), \tag{A4}$$

where δ represents a delta for the implicit options. To compute these deltas I use both the basic Black-Scholes formula and a version of the Black-Scholes formula that accounts for the Asian nature of the options.[23] Both option pricing models require assumptions about five variables: the current value of the combined firm, the variance of the returns on the combined firm over the life of the implicit options, the dividend yield of the combined firm over the life of the implicit options, the risk-free interest rate, and the time to maturity of the implicit options. I measure the current value of the combined firm as the sum of the bidder's market value from CRSP 4 days prior to bid announcement and the corresponding payment promised to the target under the merger agreement. This assumes that the bidder bids away all of the synergies available

[22] This combination of a fixed value offer and options is not the only way to replicate the payoff function in Figure 1B. The payoff function can also be replicated using a long position in the common stock of the bidder, combined with a short call with exercise price equal to the low primary collar bound and a long call with exercise price equal to the high primary collar bound (as in Houston and Ryngaert (1997)). While many of the descriptive statistics change for obvious reasons, none of the important results in this paper are qualitatively affected by changing the replicating portfolio.

[23] The implicit options that comprise the collars are not exactly European options (see Officer (2004) for further discussion). However, I employ the Black-Scholes valuation formula for simplicity, and an Asian option pricing algorithm to attempt to account for at least one of the wrinkles in these options.

from the proposed business combination and that the deal will proceed with probability 1.

The variance of the returns on the combined firm is computed using continuously compounded weekly returns on a value-weighted portfolio containing both the bidder and target over a 200 trading-day period ending 50 days prior to bid announcement. I assume that the dividend yield on the combined firm is zero over the bid period. For the risk-free rate, I use the 3-month T-Bill rate on the CRSP Monthly U.S. Government Bills, Notes, and Bonds Database with a quote date within 30 days prior to bid announcement. The time to maturity of the options is difficult to assess from an ex ante perspective. The provisions of a typical collar arrangement specify that the embedded options expire around the latest date on which the proposed merger is approved by both sets of shareholders or all regulatory approvals are obtained. Neither of these dates is knowable in advance. Therefore, I use the ex post number of calendar days between the announcement and resolution date of the bid, capped at 1 year, as a proxy for the ex ante expected length of time it will take the deal to close.[24]

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[24] Using the in-sample average of the number of days between the bid announcement and effective dates for successful bids does not qualitatively affect any of the results.

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