

Valuation waves and merger activity: The empirical evidence

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Overview

Why M&A happen

Methodologies

Empirical results

Discussion

Why M&A happen

Benefits

- Neoclassical view: asset redeploy to more productive use
- Alternative: misvaluation

Who buys whom?

- RKV: misvaluation correlates with misinformation
- SV: target manager exploit SR misvaluation

Relative value prediction

Overvalued firms use stock to buy relatively undervalued firms when both firms are overvalued.

- SV: Only more overvalued firms have room in stock price to pay for a overvalued firm.
- RKV: Target is a Bayesian that have a prior that put more synergies, caused by a market-wide overvaluation. (implication: target unable to tell a firm specific overvaluation from potential synergies)

Relative value prediction

Overall merger activity will be higher in overvalued markets. On average, firms in overvalued sectors should use stock to buy firms in relatively less overvalued sectors

- SV: Cabs buyout only happen for undervalued target.
- RKV: Cash target still happen when synergies outweigh overvaluation.

From above:

Cash targets are more undervalued than stock targets. Cash acquirers are less overvalued than stock acquirers

Merger intensity predictions

firm level:

Increasing misvaluation increases the probability that a firm is in a merger, is the acquirer, and uses stock as the method of payment

- SV: The more overvalued, the more likely to win a bid.
- RKV: plus: probability of being a target also increase with sector-wide overvaluation.

sector level:

Increasing sector misvaluation increases merger activity, and the use of stock as method of payment, in that sector

Characteristics of merger sample

| Year | Acquirers | Targets | All stock | All cash | Mixed | Mean size |
|-------|-----------|---------|-----------|----------|-------|-----------|
| 1977 | 11 | 9 | 4 | 7 | 0 | 434.7 |
| 1978 | 11 | 11 | 1 | 4 | 0 | 88.3 |
| 1979 | 18 | 21 | 0 | 3 | 0 | 310.2 |
| 1980 | 61 | 44 | 1 | 4 | 0 | 856.5 |
| 1981 | 63 | 55 | 0 | 0 | 0 | 270.6 |
| 1982 | 95 | 94 | 2 | 9 | 1 | 307.8 |
| 1983 | 104 | 109 | 7 | 34 | 4 | 251.6 |
| 1984 | 113 | 110 | 17 | 55 | 16 | 406.2 |
| 1985 | 144 | 145 | 14 | 81 | 15 | 300.1 |
| 1986 | 164 | 168 | 25 | 95 | 25 | 273.7 |
| 1987 | 141 | 135 | 20 | 70 | 18 | 175.0 |
| 1988 | 141 | 123 | 28 | 66 | 15 | 362.6 |
| 1989 | 101 | 103 | 19 | 49 | 13 | 274.4 |
| 1990 | 108 | 90 | 31 | 32 | 16 | 233.8 |
| 1991 | 99 | 83 | 24 | 43 | 16 | 227.9 |
| 1992 | 170 | 147 | 51 | 69 | 27 | 460.4 |
| 1993 | 255 | 219 | 96 | 98 | 34 | 259.5 |
| 1994 | 315 | 284 | 100 | 124 | 58 | 568.8 |
| 1995 | 367 | 342 | 141 | 116 | 78 | 716.7 |
| 1996 | 413 | 411 | 157 | 116 | 103 | 713.4 |
| 1997 | 426 | 409 | 154 | 127 | 104 | 1840.1 |
| 1998 | 451 | 410 | 160 | 160 | 104 | 1420.9 |
| 1999 | 395 | 363 | 124 | 137 | 95 | 1665.7 |
| 2000 | 159 | 140 | 42 | 43 | 57 | 993.9 |
| Total | 4,325 | 4,025 | 1,218 | 1,542 | 799 | 839.4 |

Figure 1: Characteristics of merger sample

Characteristics of merger and nonmerger firms

| Variable | Nonmerger | Merger | <i>t</i> (diff) | Target | Acquirer | <i>t</i> (diff) |
|-----------------------------|-----------|----------|-----------------|---------|----------|-----------------|
| <i>Sample size</i> | 102,527 | 8,350 | | 4,025 | 4,325 | |
| <i>Size measures</i> | | | | | | |
| Market value (assets) | 2700.32 | 10743.50 | -17.62 | 2425.89 | 18486.55 | -18.66 |
| Book assets | 2352.61 | 6936.98 | -14.95 | 2017.70 | 11516.44 | -16.44 |
| Market equity | 889.40 | 5421.84 | -16.15 | 789.94 | 9733.78 | -16.79 |
| Book equity | 487.24 | 1467.56 | -19.13 | 338.49 | 2518.64 | -22.85 |
| PP&E | 515.42 | 1121.06 | -12.52 | 319.76 | 1869.88 | -17.06 |
| Long-term debt | 377.09 | 976.55 | -12.65 | 308.85 | 1596.73 | -14.53 |
| Capital expenditure | 93.97 | 271.89 | -13.02 | 66.67 | 466.12 | -15.37 |
| Net income | 53.72 | 223.37 | -17.17 | 32.09 | 401.63 | -19.90 |
| <i>Performance measures</i> | | | | | | |
| Return on assets | 0.0267 | 0.0297 | -1.78 | 0.005 | 0.052 | -14.98 |
| Return onequity | 0.0796 | 0.1019 | -6.97 | 0.046 | 0.152 | -17.46 |
| Market/book | 2.75 | 3.13 | -9.86 | 2.81 | 3.43 | -7.89 |
| <i>Leverage measures</i> | | | | | | |
| Leverage (book) | 0.54 | 0.58 | -14.09 | 0.56 | 0.59 | -7.00 |
| Leverage (market) | 0.43 | 0.44 | -3.16 | 0.44 | 0.44 | 0.08 |
| Quick ratio | 2.46 | 2.21 | 5.25 | 2.42 | 2.00 | 5.43 |
| Current ratio | 3.15 | 2.76 | 7.97 | 3.01 | 2.52 | 6.17 |

Figure 2: Characteristics of merger and nonmerger firms

Industry characteristics used in subsequent valuation models

| Industry | Observations per year | | | Average multiples | | Average market equity | Merger activity | | |
|-------------------------------|-----------------------|------|-------|-------------------|------|-----------------------|-----------------|---------|-------|
| | Mean | Min. | Max. | p/e | M/B | | Acquirers | Targets | Total |
| (1) Consumer nondurables | 406 | 336 | 495 | 19.37 | 2.43 | 792.1 | 242 | 196 | 438 |
| (2) Consumer durables | 180 | 142 | 227 | 15.99 | 2.45 | 1033.4 | 106 | 99 | 205 |
| (3) Manufacturing | 796 | 639 | 904 | 16.51 | 2.44 | 445.4 | 453 | 377 | 830 |
| (4) Energy | 323 | 205 | 477 | 23.52 | 3.83 | 1454.4 | 161 | 141 | 302 |
| (5) Chemicals | 144 | 115 | 174 | 16.85 | 5.79 | 1211.7 | 104 | 80 | 184 |
| (6) Computers, software, etc. | 1,037 | 388 | 1,811 | 19.05 | 5.48 | 780 | 788 | 782 | 1570 |
| (7) Telephone and TV | 165 | 66 | 333 | 31.53 | 6.96 | 3948.8 | 233 | 156 | 389 |
| (8) Utilities | 191 | 103 | 222 | 12.74 | 1.5 | 987.4 | 103 | 84 | 187 |
| (9) Wholesale | 687 | 532 | 883 | 22.47 | 2.81 | 430.1 | 286 | 331 | 617 |
| (10) Medical | 489 | 133 | 838 | 17.57 | 8.29 | 1205.4 | 401 | 378 | 779 |
| (11) Finance | 630 | 298 | 897 | 16.9 | 6.42 | 812.5 | 983 | 908 | 1891 |
| (12) Everything else | 914 | 521 | 1,268 | 17.43 | 3.9 | 552.7 | 465 | 493 | 958 |

Methodologies

Decomposing market to book

Market value → true value → book value

$$m - b = (m - v) + (v - b)$$
 Log-linear

- firm-specific error
- time-series sector error
- long-run value to book

$$m_{i,t} - b_{i,t} = m_{i,t} - v(\theta_{i,t}; \alpha_{j,t}) + v(\theta_{i,t}; \alpha_{j,t}) - v(\theta_{i,t}; \alpha_j) - v(\theta_{i,t}; \alpha_j) - b_{i,t} \quad (1)$$

$\theta_{i,t}$: firm-specific accounting information (fundamental)

Estimating market value

FCF measure

$$M_t = \int_t^{\infty} e^{-\int_t^{\tau} r(\eta) d\eta} \mathbf{FCF} d\tau \quad (2)$$

market value = book value + EVA
RI: residual income

$$M_t = B_t + \int_t^{\infty} e^{-\int_t^{\tau} r(\eta) d\eta} \mathbf{RI} d\tau \quad (3)$$

RI = ROE - CoC

$$M_t = B_t + E_t \sum_{\tau=t+1}^{\infty} \frac{ROE_{\tau} - r_{\tau} B_{\tau-1}}{(1+r_{\tau})^{\tau}} \quad (4)$$

Model 1: market value and book value

Identifying restriction

1. $E_t(ROE_t) = \lambda E_t r_\tau$
2. B_t grows at a constant rate

$$m_{i,t} = \alpha_{0,j,t} + \alpha_{1,j,t} b_{i,t} + \epsilon_{i,t} \quad (5)$$

$\alpha_{0,j,t}$: value of intangibles in average firm in industry j.

$$v(B_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}) = \hat{\alpha}_{0,j,t} + \hat{\alpha}_{1,j,t} b_{i,t} \quad (6)$$

$$v(B_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}) = \bar{\alpha}_{1,j,t} + \bar{\alpha}_{1,j,t} b_{i,t} \quad (7)$$

Model 2: market value, book value, and net income

Identifying restriction

Net income grows at a constant rate

$$m_{i,t} = \alpha_{0,j,t} + \alpha_{1,j,t} b_{i,t} + \alpha_{2,j,t} \ln(NI)_{i,t}^+ + \alpha_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ + \epsilon_{i,t} \quad (8)$$

$$v(B_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}, \hat{\alpha}_{2,j,t}, \hat{\alpha}_{3,j,t}) = \hat{\alpha}_{0,j,t} + \hat{\alpha}_{1,j,t} b_{i,t} + \hat{\alpha}_{2,j,t} \ln(NI)_{i,t}^+ + \hat{\alpha}_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ \quad (9)$$

$$v(B_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}, \bar{\alpha}_{2,j,t}, \bar{\alpha}_{3,j,t}) = \bar{\alpha}_{0,j,t} + \bar{\alpha}_{1,j,t} b_{i,t} + \bar{\alpha}_{2,j,t} \ln(NI)_{i,t}^+ + \bar{\alpha}_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ \quad (10)$$

Model 3: market value, book value, net income and leverage

Identifying restriction

Leverage affects CoC

$$m_{i,t} = \alpha_{0,j,t} + \alpha_{1,j,t} b_{i,t} + \alpha_{2,j,t} \ln(NI)_{i,t}^+ + \alpha_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ + \alpha_{4,j,t} LEV + \epsilon_{i,t} \quad (11)$$

$$v(B_{i,t}; \hat{\alpha}_{0,j,t}, \hat{\alpha}_{1,j,t}, \hat{\alpha}_{2,j,t}, \hat{\alpha}_{3,j,t}) = \hat{\alpha}_{0,j,t} + \hat{\alpha}_{1,j,t} b_{i,t} + \hat{\alpha}_{2,j,t} \ln(NI)_{i,t}^+ + \hat{\alpha}_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ + \hat{\alpha}_{4,j,t} LEV \quad (12)$$

$$v(B_{i,t}; \bar{\alpha}_{0,j,t}, \bar{\alpha}_{1,j,t}, \bar{\alpha}_{2,j,t}, \bar{\alpha}_{3,j,t}) = \bar{\alpha}_{0,j,t} + \bar{\alpha}_{1,j,t} b_{i,t} + \bar{\alpha}_{2,j,t} \ln(NI)_{i,t}^+ + \bar{\alpha}_{3,j,t} I_{(<0)} \ln(NI)_{i,t}^+ + \bar{\alpha}_{4,j,t} LEV \quad (13)$$

Conditional regression multiples

| Parameter | Fama and French industry classification | | | | | | | | | | | |
|---|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| <i>Model 1:</i> $m_{it} = \alpha_{0it} + \alpha_{1it}b_{it} + \varepsilon_i$ | | | | | | | | | | | | |
| $E_t(\hat{z}_0)$ | 0.98 | 1.65 | 1.19 | 1.46 | 1.47 | 1.70 | 2.06 | 0.66 | 1.13 | 1.97 | 1.16 | 1.70 |
| | 0.06 | 0.11 | 0.06 | 0.08 | 0.09 | 0.07 | 0.12 | 0.10 | 0.07 | 0.05 | 0.07 | 0.05 |
| $E_t(\hat{z}_1)$ | 0.87 | 0.71 | 0.81 | 0.79 | 0.83 | 0.77 | 0.74 | 0.92 | 0.85 | 0.77 | 0.80 | 0.72 |
| | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| R^2 | 0.68 | 0.65 | 0.74 | 0.80 | 0.77 | 0.68 | 0.76 | 0.88 | 0.72 | 0.73 | 0.75 | 0.65 |
| <i>Model 2:</i> $m_{it} = \alpha_{0it} + \alpha_{1it}b_{it} + \alpha_{2it}ni_{it}^+ + \alpha_{3it}(I_{(i < 0)}ni_{it}^+)_t + \varepsilon_i$ | | | | | | | | | | | | |
| $E_t(\hat{z}_0)$ | 1.86 | 2.39 | 1.79 | 1.87 | 2.26 | 2.24 | 2.31 | 1.21 | 1.87 | 2.29 | 1.83 | 2.17 |
| | 0.06 | 0.13 | 0.05 | 0.08 | 0.06 | 0.07 | 0.07 | 0.09 | 0.06 | 0.06 | 0.05 | 0.05 |
| $E_t(\hat{z}_1)$ | 0.47 | 0.35 | 0.51 | 0.62 | 0.39 | 0.49 | 0.55 | 0.66 | 0.50 | 0.54 | 0.49 | 0.48 |
| | 0.02 | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.02 | 0.02 | 0.02 | 0.01 |
| $E_t(\hat{z}_2)$ | 0.38 | 0.38 | 0.33 | 0.18 | 0.46 | 0.33 | 0.21 | 0.27 | 0.37 | 0.28 | 0.32 | 0.26 |
| | 0.02 | 0.02 | 0.02 | 0.02 | 0.04 | 0.02 | 0.05 | 0.04 | 0.02 | 0.02 | 0.01 | 0.01 |
| $E_t(\hat{z}_3)$ | -0.35 | -0.35 | -0.22 | -0.15 | -0.23 | -0.22 | 0.18 | -0.03 | -0.25 | 0.02 | -0.14 | -0.18 |
| | 0.04 | 0.10 | 0.04 | 0.04 | 0.07 | 0.04 | 0.06 | 0.04 | 0.05 | 0.05 | 0.06 | 0.05 |
| R^2 | 0.73 | 0.71 | 0.78 | 0.82 | 0.82 | 0.73 | 0.79 | 0.89 | 0.77 | 0.77 | 0.79 | 0.68 |
| <i>Model 3:</i> $m_{it} = \alpha_{0it} + \alpha_{1it}b_{it} + \alpha_{2it}ni_{it}^+ + \alpha_{3it}I_{(i < 0)}(ni_{it}^+)_t + \alpha_{4it}\text{Lev}_{it} + \varepsilon_i$ | | | | | | | | | | | | |
| $E_t(\hat{z}_0)$ | 2.39 | 2.56 | 2.20 | 2.35 | 2.38 | 2.55 | 2.91 | 2.15 | 2.44 | 2.68 | 2.21 | 2.60 |
| | 0.04 | 0.11 | 0.05 | 0.06 | 0.11 | 0.05 | 0.10 | 0.13 | 0.05 | 0.04 | 0.04 | 0.05 |
| $E_t(\hat{z}_1)$ | 0.64 | 0.56 | 0.64 | 0.66 | 0.64 | 0.59 | 0.60 | 0.85 | 0.62 | 0.61 | 0.58 | 0.60 |
| | 0.01 | 0.02 | 0.01 | 0.02 | 0.05 | 0.02 | 0.03 | 0.03 | 0.01 | 0.02 | 0.01 | 0.01 |
| $E_t(\hat{z}_2)$ | 0.27 | 0.30 | 0.27 | 0.23 | 0.31 | 0.29 | 0.26 | 0.12 | 0.28 | 0.26 | 0.30 | 0.25 |
| | 0.01 | 0.02 | 0.01 | 0.02 | 0.04 | 0.01 | 0.04 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 |
| $E_t(\hat{z}_3)$ | 0.08 | 0.05 | 0.10 | 0.00 | 0.13 | -0.03 | 0.27 | 0.17 | 0.01 | -0.09 | -0.16 | 0.00 |
| | 0.03 | 0.06 | 0.03 | 0.04 | 0.06 | 0.04 | 0.05 | 0.04 | 0.04 | 0.05 | 0.05 | 0.04 |
| $E_t(\hat{z}_4)$ | -2.59 | -2.36 | -2.09 | -2.13 | -2.43 | -2.55 | -2.27 | -2.52 | -2.11 | -2.42 | -1.06 | -2.15 |
| | 0.05 | 0.09 | 0.07 | 0.15 | 0.19 | 0.11 | 0.18 | 0.23 | 0.06 | 0.10 | 0.05 | 0.09 |
| R^2 | 0.84 | 0.80 | 0.86 | 0.88 | 0.90 | 0.83 | 0.87 | 0.94 | 0.86 | 0.85 | 0.82 | 0.80 |

Components of the decomposed market-to-book ratio

| M/B component | Definition |
|--|--|
| $m_{it} - b_{it}$ | The natural log of the market-to-book ratio for firm i at time t |
| $\bar{m}_t - \bar{b}_t$ | In Table 10 , this notation refers to sector-average market-to-book in year t |
| $v(\theta_{it}; \alpha_{jt})$ | The fundamental value of the firm obtained by applying annual, sector-average regression multiples to firm-level accounting values. The individual time t values of the α s from Table 4 are used to obtain this number. Using model II, for instance, we would have $v = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt} \ln(\mathbf{B})_{it}$ |
| $v(\theta_{it}; \tilde{\alpha}_j)$ | The fundamental value of the firm obtained by applying long-run industry average multiples to firm-level accounting values. The long-run average values of α_j from Table 4 are used to obtain this number. Using Model 2, for instance, $v = \bar{\alpha}_{0jt} + \bar{\alpha}_{1jt} \ln(\mathbf{B})_{it}$ |
| $m_{it} - v(\theta_{it}; \alpha_{jt})$ | The component of $m_{it} - b_{it}$ that results from firm-specific deviations from valuations implied by sector valuation multiples calculated at time t . This is called firm-specific error |
| $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \tilde{\alpha}_j)$ | The component of $m_{it} - b_{it}$ that results from valuations implied by current sector multiples deviating from valuations implied by long-run multiples. In Table 6 , this notation refers to firm-level observations calculated by applying sector multiples to firm-specific accounting information. This is called time-series sector error |
| $\bar{v}(\alpha_{jt}) - \bar{v}(\tilde{\alpha}_j)$ | In Table 10 , this notation refers to sector average time-series sector error |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | The component of $m_{it} - b_{it}$ that is attributable to the difference between valuations implied by long-run multiples and current book values. In Table 6 , this notation refers to firm-level observations calculated by applying long-run sector multiples to firm-specific accounting information. This is called long-run value to book |
| $\bar{v}(\alpha_{jt}) - \bar{b}_t$ | In Table 10 , this notation refers to sector average long-run value to book |

Figure 5: Components of the decomposed market-to-book ratio

Implication

**Everything that is not accounted for by book value, net income, and leverage is pricing error
Does it hold?**

Empirical results

Decomposition of MB ratio at firm level

| Valuation component | Overall comparison | | | Only mergers | | | Only all cash | | | Only mixed | | | Only all stock | | |
|--|--------------------|--------|-----------------|--------------|------|-----------------|---------------|------|-----------------|------------|------|-----------------|----------------|------|-----------------|
| | Nonmerger | Merger | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) |
| $m_{it} - b_{it}$ | 0.59 | 0.76 | -15.81 | 0.69 | 0.83 | -6.95 | 0.61 | 0.79 | -5.13 | 0.61 | 0.77 | -3.29 | 0.87 | 1.12 | -6.97 |
| <i>Model I:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{jt})$ | -0.02 | 0.26 | -26.81 | 0.01 | 0.50 | -25.12 | -0.11 | 0.49 | -18.34 | 0.04 | 0.46 | -9.20 | 0.11 | 0.64 | -16.60 |
| $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.07 | 0.15 | -27.70 | 0.13 | 0.18 | -8.08 | 0.13 | 0.19 | -6.10 | 0.14 | 0.17 | -2.54 | 0.18 | 0.26 | -7.09 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.54 | 0.34 | 33.64 | 0.54 | 0.16 | 37.91 | 0.59 | 0.11 | 29.61 | 0.43 | 0.14 | 12.95 | 0.58 | 0.23 | 18.97 |
| <i>Model II:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{jt})$ | -0.01 | 0.22 | -24.48 | 0.02 | 0.41 | -22.00 | -0.09 | 0.38 | -15.45 | 0.04 | 0.39 | -8.27 | 0.11 | 0.57 | -15.65 |
| $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.06 | 0.15 | -26.19 | 0.12 | 0.18 | -9.11 | 0.12 | 0.19 | -7.16 | 0.14 | 0.17 | -2.65 | 0.17 | 0.25 | -6.90 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.54 | 0.39 | 22.69 | 0.55 | 0.25 | 24.77 | 0.58 | 0.22 | 17.53 | 0.43 | 0.20 | 8.00 | 0.60 | 0.30 | 13.30 |
| <i>Model III:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{jt})$ | -0.01 | 0.18 | -25.21 | 0.03 | 0.32 | -20.21 | -0.08 | 0.29 | -15.01 | 0.17 | 0.29 | -3.46 | 0.05 | 0.44 | -16.09 |
| $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.03 | 0.10 | -24.20 | 0.07 | 0.12 | -8.73 | 0.06 | 0.14 | -8.40 | 0.08 | 0.12 | -3.97 | 0.12 | 0.17 | -5.21 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.57 | 0.48 | 10.69 | 0.58 | 0.39 | 12.52 | 0.62 | 0.37 | 9.97 | 0.36 | 0.36 | 0.20 | 0.71 | 0.51 | 6.94 |

Figure 6: Decomposition of MB ratio at firm level

Robustness of firm level market-to-book decomposition

| Valuation component | Pre-1996 only | | | Within industry | | | Across industry | | | No LBO firms | | | Quick-closing deals | | |
|--|---------------|------|-----------------|-----------------|------|-----------------|-----------------|------|-----------------|--------------|------|-----------------|---------------------|------|-----------------|
| | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) | Tar. | Acq. | <i>t</i> (diff) |
| $m_{it} - b_{it}$ | 0.6 | 0.73 | -5.87 | 0.63 | 0.8 | -7.25 | 0.76 | 0.83 | -2.29 | 0.69 | 0.83 | -6.95 | 0.69 | 0.72 | -0.48 |
| <i>Model 1:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | -0.03 | 0.43 | -23.01 | 0 | 0.47 | -20.81 | 0.07 | 0.58 | -16.72 | 0.01 | 0.5 | -25.12 | 0.02 | 0.49 | -8.34 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.08 | 0.09 | -1.98 | 0.13 | 0.19 | -14.65 | 0.12 | 0.17 | -6.48 | 0.13 | 0.18 | -8.08 | 0.08 | 0.12 | -2.94 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.56 | 0.21 | 28.63 | 0.5 | 0.14 | 43.93 | 0.57 | 0.08 | 35.81 | 0.54 | 0.16 | 37.91 | 0.59 | 0.1 | 18.43 |
| <i>Model 2:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | -0.02 | 0.36 | -20.07 | 0 | 0.39 | -17.67 | 0.08 | 0.47 | -13.91 | 0.02 | 0.41 | -22 | 0.01 | 0.39 | -7.04 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.06 | 0.08 | -2.96 | 0.12 | 0.19 | -14.51 | 0.11 | 0.17 | -7.03 | 0.12 | 0.18 | -9.11 | 0.06 | 0.13 | -3.93 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.56 | 0.29 | 18.24 | 0.51 | 0.22 | 23.36 | 0.57 | 0.19 | 21.24 | 0.55 | 0.25 | 24.77 | 0.62 | 0.2 | 11.65 |
| <i>Model 3:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | 0.02 | 0.29 | -17.3 | 0.04 | 0.31 | -14.96 | 0.05 | 0.37 | -13.8 | 0.03 | 0.32 | -20.21 | -0.02 | 0.28 | -6.98 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.04 | 0.05 | -2.26 | 0.07 | 0.13 | -10.67 | 0.06 | 0.12 | -7.43 | 0.07 | 0.12 | -8.73 | 0.02 | 0.09 | -5.05 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.55 | 0.39 | 8.43 | 0.51 | 0.36 | 10.41 | 0.65 | 0.34 | 14.12 | 0.58 | 0.39 | 12.52 | 0.69 | 0.35 | 7.72 |

Figure 7: Robustness of firm level market-to-book decomposition

Transaction size and the components of market to book

| Valuation component | Quintile 1 (Smallest) | | | Quintile 2 | | | Quintile 3 | | | Quintile 4 | | | Quintile 5 (Largest) | | |
|--|-----------------------|------|---------|------------|------|---------|------------|------|---------|------------|------|---------|----------------------|-------|---------|
| | Tar. | Acq. | t(diff) | Tar. | Acq. | t(diff) | Tar. | Acq. | t(diff) | Tar. | Acq. | t(diff) | Tar. | Acq. | t(diff) |
| $m_{it} - b_{it}$ | 0.69 | 0.86 | -2.85 | 0.55 | 0.75 | -4.19 | 0.54 | 0.82 | -6.40 | 0.68 | 0.94 | -6.11 | 0.92 | 0.93 | -0.15 |
| <i>Model 1:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | -0.23 | 0.34 | -10.72 | -0.32 | 0.31 | -15.24 | -0.19 | 0.45 | -16.99 | 0.07 | 0.65 | -15.64 | 0.51 | 0.80 | -6.46 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.10 | 0.14 | -2.47 | 0.09 | 0.14 | -3.83 | 0.11 | 0.18 | -5.24 | 0.14 | 0.20 | -4.73 | 0.20 | 0.25 | -3.30 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.82 | 0.39 | 15.81 | 0.78 | 0.30 | 22.00 | 0.62 | 0.19 | 22.14 | 0.47 | 0.09 | 20.11 | 0.21 | -0.12 | 16.73 |
| $v(\theta_{it}; \alpha_{ji}) - b_{it}$ | 0.92 | 0.52 | 12.39 | 0.87 | 0.44 | 17.25 | 0.73 | 0.37 | 15.61 | 0.61 | 0.30 | 13.69 | 0.41 | 0.14 | 11.45 |
| <i>Model 2:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | -0.19 | 0.26 | -9.22 | -0.26 | 0.25 | -13.81 | -0.16 | 0.39 | -16.28 | 0.09 | 0.55 | -13.27 | 0.45 | 0.67 | -5.17 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.07 | 0.13 | -3.30 | 0.08 | 0.14 | -4.44 | 0.10 | 0.18 | -5.60 | 0.14 | 0.20 | -4.58 | 0.20 | 0.25 | -3.55 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.81 | 0.47 | 9.30 | 0.73 | 0.36 | 12.89 | 0.61 | 0.26 | 13.72 | 0.46 | 0.19 | 11.40 | 0.27 | 0.01 | 10.81 |
| $v(\theta_{it}; \alpha_{ji}) - b_{it}$ | 0.88 | 0.60 | 7.18 | 0.81 | 0.50 | 10.18 | 0.71 | 0.44 | 9.81 | 0.59 | 0.39 | 7.72 | 0.47 | 0.26 | 7.47 |
| <i>Model 3:</i> | | | | | | | | | | | | | | | |
| $m_{it} - v(\theta_{it}; \alpha_{ji})$ | -0.18 | 0.19 | -8.87 | -0.18 | 0.20 | -12.22 | -0.09 | 0.31 | -13.77 | 0.08 | 0.44 | -12.65 | 0.37 | 0.48 | -3.63 |
| $v(\theta_{it}; \alpha_{ji}) - v(\theta_{it}; \tilde{\alpha}_j)$ | 0.02 | 0.09 | -4.89 | 0.04 | 0.09 | -3.68 | 0.06 | 0.12 | -5.21 | 0.09 | 0.14 | -4.59 | 0.14 | 0.19 | -4.12 |
| $v(\theta_{it}; \tilde{\alpha}_j) - b_{it}$ | 0.85 | 0.59 | 5.63 | 0.69 | 0.47 | 6.10 | 0.58 | 0.39 | 5.52 | 0.51 | 0.36 | 4.88 | 0.42 | 0.26 | 5.20 |
| $v(\theta_{it}; \alpha_{ji}) - b_{it}$ | 0.87 | 0.67 | 4.00 | 0.73 | 0.55 | 4.72 | 0.64 | 0.51 | 3.46 | 0.60 | 0.50 | 2.84 | 0.56 | 0.45 | 3.02 |

Figure 8: Transaction size and the components of market to book

Firm-level merger intensity

| Valuation component | Baseline | | Model 1 | | Model 2 | | Model 3 | |
|--|------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| <i>Panel A. Merger = 1, Nonmerger = 0</i> | | | | | | | | |
| $m_{it} - b_{it}$ | 0.088 (15.95) | -0.034 (1.19) | 0.153 (23.63) | 0.119 (3.26) | 0.162 (22.86) | 0.151 (3.74) | 0.209 (24.13) | 0.206 (4.02) |
| $v(\theta_{it}; z_{jt})$ | | | 0.671 (30.95) | 0.075 (0.72) | 0.537 (27.36) | -0.011 (0.12) | 0.722 (28.38) | -0.233 (1.90) |
| $v(\theta_{it}; \tilde{z}_j) - b_{it}$ | | | -0.392 (31.90) | -0.462 (7.32) | -0.174 (17.63) | -0.317 (5.63) | -0.083 (10.59) | -0.125 (3.28) |
| Log likelihood | -29492 | -14867 | -28189 | -14831 | -28631 | -14840 | -28782 | -14850 |
| χ^2 | 258.14 | 1.43 | 2864.90 | 71.43 | 1857.24 | 53.46 | 1555.31 | 32.78 |
| <i>Panel B. Acquirer = 1, Target = 0</i> | | | | | | | | |
| $m_{it} - b_{it}$ | 0.097 (6.86) | | 0.279 (16.77) | | 0.302 (17.60) | | 0.379 (18.00) | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | | | 0.208 (3.81) | | 0.226 (4.71) | | 0.491 (8.39) | |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; \tilde{z}_j)$ | | | -0.974 (30.13) | | -0.526 (20.15) | | -0.229 (11.27) | |
| Log likelihood | -5758 | | -4971 | | -5302 | | -5483 | |
| χ^2 | 46.84 | | 1621.19 | | 937.73 | | 575.22 | |
| <i>Panel C. Stock = 1, Not stock = 0</i> | | | | | | | | |
| $m_{it} - b_{it}$ | 0.232 (14.35) | 0.179 (10.11) | 0.158 (8.99) | 0.141 (7.94) | 0.174 (9.20) | 0.151 (7.98) | 0.146 (6.33) | 0.116 (5.02) |
| $m_{it} - v(\theta_{it}; z_{jt})$ | | | 0.707 (13.33) | 0.404 (6.52) | 0.636 (12.88) | 0.374 (6.81) | 0.643 (10.53) | 0.373 (5.70) |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; \tilde{z}_j)$ | | | 0.326 (10.55) | 0.331 (10.44) | 0.239 (9.06) | 0.225 (8.35) | 0.236 (10.87) | 0.219 (9.92) |
| Log likelihood | -4891 | -4676 | -4839 | -4658 | -4843 | -4662 | -4852 | -4660 |
| χ^2 | 215.28 | 102.11 | 320.36 | 167.68 | 292.50 | 144.09 | 274.03 | 148.17 |
| Fixed effects? | | Year | | Year | | Year | | Year |

Valuation waves, merger intensity, and method of payment

| Valuation component | Using market to book alone (Columns 1–5) | | | | | Using M/B decomposition (Columns 6–10) | | | | |
|---|--|--------------------|---------------------|--------------------|---------------------|--|---------------------|----------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| <i>Panel A. Dependent variable is merger count in industry j, year t</i> | | | | | | | | | | |
| $\tilde{m}_t - \tilde{b}_t$ | 24.673 (3.82) ** | 12.676 (1.82) | 24.640 (3.81) ** | 8.260 (1.24) | 19.117 (3.06) ** | 54.675 (6.97) ** | 39.079 (4.11) ** | 54.539 (6.93) ** | 42.197 (4.10) ** | 56.096 (6.59) ** |
| $\tilde{v}(z_{jt}) - \tilde{v}(z_j)$ | | | | | | -27.281 (2.73) ** | -21.054 (2.04) * | -27.077 (2.69) ** | -17.403 (2.02) * | -18.655 (2.23) * |
| $\tilde{v}(z_j) - \tilde{b}_t$ | | | | | | | | | | |
| Total mergers, | | 0.004 (0.83) | | 0.005 (0.94) | | | | 0.001 (0.27) | | 0.002 (0.42) |
| Year t | | | | | | | | | | |
| Total mergers, | | 0.013 (5.25) ** | | 0.012 (4.69) ** | | | | 0.015 (6.05) ** | | 0.015 (5.98) ** |
| Sector j | | | | | | | | | | |
| Fixed effects | Sector | Sector, year | Sector | Year | None | Sector | Sector, year | Sector | Year | None |
| R^2 | 0.05 | 0.20 | 0.05 | 0.12 | 0.13 | 0.16 | 0.25 | 0.16 | 0.18 | 0.23 |
| <i>Panel B. Dependent variable is stock-financed merger count in industry j, year t</i> | | | | | | | | | | |
| $\tilde{m}_t - \tilde{b}_t$ | 8.733 (2.83) ** | 5.165 (1.52) | 8.713 (2.82) ** | 3.395 (1.04) | 6.668 (2.23) * | 20.067 (5.23) ** | 15.822 (3.37) ** | 19.911 (5.17) ** | 18.132 (3.57) ** | 21.246 (5.12) ** |
| $\tilde{v}(z_{jt}) - \tilde{v}(z_j)$ | | | | | | -10.961 (2.24) * | -8.449 (1.66) | -10.728 (2.18) * | -7.721 (1.82) | -8.255 (2.02) * |
| $\tilde{v}(z_j) - \tilde{b}_t$ | | | | | | | | | | |
| Total mergers, | | 0.002 (1.06) | | 0.003 (1.16) | | | | 0.001 (0.63) | | 0.002 (0.74) |
| Year t | | | | | | | | | | |
| Total mergers, | | 0.006 (4.59) ** | | 0.005 (4.33) ** | | | | 0.007 (5.26) ** | | 0.006 (5.31) ** |
| Sector j | | | | | | | | | | |
| Fixed effects | Sector | Sector, year | Sector | Year | None | Sector | Sector, year | Sector | Year | None |
| R^2 | 0.03 | 0.14 | 0.03 | 0.09 | 0.10 | 0.10 | 0.18 | 0.10 | 0.14 | 0.17 |

Failed versus successful targets

| Valuation component | Targets | | | | | | | | |
|---|------------------|--------|---------|---------------------|--------|---------|----------------------|--------|---------|
| | All transactions | | | Only all cash deals | | | Only all stock deals | | |
| | Success | Failed | r(diff) | Success | Failed | r(diff) | Success | Failed | r(diff) |
| $m_{it} - b_{it}$ | 0.71 | 0.58 | 3.45 | 0.64 | 0.43 | 4.09 | 0.87 | 0.89 | -0.18 |
| <i>Model I:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.02 | -0.00 | 0.62 | -0.10 | -0.22 | 2.40 | 0.12 | 0.14 | -0.24 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.13 | 0.11 | 1.92 | 0.13 | 0.13 | 0.29 | 0.18 | 0.14 | 2.30 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.56 | 0.47 | 4.41 | 0.61 | 0.52 | 2.67 | 0.57 | 0.62 | -1.05 |
| <i>Model II:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.03 | -0.00 | 0.93 | -0.07 | -0.17 | 2.10 | 0.12 | 0.10 | 0.23 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.12 | 0.10 | 2.00 | 0.11 | 0.12 | -0.14 | 0.18 | 0.11 | 2.84 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.56 | 0.49 | 3.06 | 0.60 | 0.48 | 2.73 | 0.58 | 0.68 | -1.93 |
| <i>Model III:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.03 | 0.05 | -0.86 | -0.08 | -0.09 | 0.31 | 0.06 | 0.04 | 0.32 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.07 | 0.06 | 1.72 | 0.06 | 0.07 | -0.79 | 0.13 | 0.07 | 3.11 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.60 | 0.47 | 4.47 | 0.65 | 0.44 | 4.04 | 0.70 | 0.79 | -1.54 |
| Valuation component | Acquirers | | | | | | | | |
| | All transactions | | | Only all cash deals | | | Only all stock deals | | |
| | Success | Failed | r(diff) | Success | Failed | r(diff) | Success | Failed | r(diff) |
| $m_{it} - b_{it}$ | 0.85 | 0.74 | 2.32 | 0.80 | 0.72 | 1.29 | 1.14 | 1.02 | 1.48 |
| <i>Model I:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.53 | 0.31 | 5.49 | 0.52 | 0.30 | 3.78 | 0.67 | 0.40 | 3.96 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.19 | 0.12 | 5.93 | 0.20 | 0.14 | 3.20 | 0.27 | 0.15 | 5.84 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.13 | 0.31 | -8.39 | 0.08 | 0.28 | -5.77 | 0.19 | 0.47 | -7.08 |
| <i>Model II:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.44 | 0.25 | 5.13 | 0.41 | 0.22 | 3.62 | 0.60 | 0.37 | 3.80 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.19 | 0.12 | 5.80 | 0.20 | 0.13 | 3.28 | 0.27 | 0.16 | 4.64 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.22 | 0.38 | -6.51 | 0.20 | 0.36 | -4.17 | 0.27 | 0.50 | -5.07 |
| <i>Model III:</i> | | | | | | | | | |
| $m_{it} - v(\theta_{it}; z_{jt})$ | 0.34 | 0.23 | 3.76 | 0.30 | 0.19 | 2.53 | 0.46 | 0.29 | 3.48 |
| $v(\theta_{it}; z_{jt}) - v(\theta_{it}; z'_j)$ | 0.13 | 0.07 | 5.48 | 0.14 | 0.11 | 2.16 | 0.18 | 0.10 | 4.23 |
| $v(\theta_{it}; z'_j) - b_{it}$ | 0.38 | 0.45 | -2.20 | 0.36 | 0.42 | -1.12 | 0.49 | 0.64 | -2.57 |

A horse race between competing theories of merger

| Independent variable | Full sample period | | | Low valuation | | High valuation | |
|--|--------------------|------------------|-------------------|------------------|------------------|------------------|-------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| $\bar{m}_t - \bar{b}_t$ | 26.729 (4.31) | 23.988 (3.73) | | 18.228 (2.54) | | 21.800 (1.78) | |
| Q dispersion | 14.007 (1.65) | 20.426 (2.10) | 4.773 (0.50) | 16.716 (2.03) | 14.049 (1.55) | 7.786 (0.51) | -9.189 (0.47) |
| $\bar{v}(\alpha_{jt}) - \bar{v}(\bar{\alpha}_j)$ | | | 53.829 (6.70) | | 49.383 (4.09) | | 117.355 (4.78) |
| $\bar{v}(\bar{\alpha}_j) - \bar{b}_t$ | | | -26.277 (2.57) | | 1.541 (0.13) | | -46.934 (2.95) |
| Sample size | 299 | 299 | 299 | 144 | 144 | 155 | 155 |
| R^2 | 0.07 | 0.06 | 0.16 | 0.07 | 0.15 | 0.02 | 0.17 |
| Industry fixed effects? | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Figure 12: A horse race between competing theories of merger

Misvaluation and merger activity during economic shocks

| | $m_{it} - b_{it}$ | $v(x_{jt}) - v(\bar{x}_j)$ | $v(\bar{x}_j) - b_{it}$ | R^2 | χ^2 |
|---|---------------------|----------------------------|--------------------------|----------------------|----------|
| <i>Panel A. Probability of merger wave based on valuation</i> | | | | | |
| Pr(Merger wave) | 0.94 | | | 7.37 | 39.24 |
| | 0.16 | | | | |
| Pr(Merger wave) | | 3.31 | | 15.28 | 81.33 |
| | | 0.47 | | | |
| Pr(Merger wave) | | 3.37 | 0.46 | 16.01 | 85.18 |
| | | 0.47 | 0.23 | | |
| Merger statistic | Lowest quintile (%) | 20th–50th percentile (%) | 50th–80th percentile (%) | Highest quintile (%) | Total |
| <i>Panel B. Distribution of mergers across misvaluation quantiles</i> | | | | | |
| Acquisitions | 8.21 | 17.57 | 32.02 | 42.20 | 4,325 |
| Dollar volume | 5.08 | 10.01 | 25.02 | 59.89 | 6,112 |
| Stock acquisitions | 5.75 | 12.64 | 34.07 | 47.54 | 1218 |
| <i>Panel C. Merger/misvaluation distribution during economic shocks</i> | | | | | |
| Acquisitions | 10.78 | 13.05 | 27.24 | 48.92 | 881 |
| (Percent of overall total) | | | | | (20) |
| Dollar volume | 4.92 | 12.65 | 16.68 | 65.75 | 2,391 |
| (Percent of overall total) | | | | | (39) |
| Stock acquisitions | 7.92 | 10.85 | 28.15 | 53.08 | 341 |
| (Percent of overall total) | | | | | (28) |

Discussion

Discussion

Study is self-contained, but empirical framework not strong.

- No clear identification strategy
- No clear causal relationship
- No clear mechanism

The End