WILEY EUROPEAN FINANCIAL MANAGEMENT

ORIGINAL ARTICLE

Worthless companies

J. B. Heaton

Managing Member, Conjecture LLC,
Chicago, Illinois.
Email: jb@conjecturellc.com

Abstract

Companies with worthless assets can have substantial efficient markets equity values and debt that trades near par if there is a probability that an irrational bidder will acquire the company. Even if most capital market participants recognize that the company's assets are worthless, efficient markets pricing of the worthless company's equity and debt precludes arbitrage, and it may be impossible to persuade the potential irrational bidder to abandon its plans. The worthless company hypothesis may shed light on the valuation of some high-profile start-ups, the 1990s dot-com bubble, and the bad performance of some short sellers.

KEYWORDS

mergers & acquisitions, bad bidders, bubble company, unicorns, short selling

JEL CLASSIFICATIONS

*G*02, *G*32, *G*34, *K*22

1 | INTRODUCTION

Consider a firm with a market value of equity of more than $1 billion. The firm has sales under $1 billion and has never been profitable. The firm describes its mission as 'to make incredible home cooking accessible to everyone' and its business is to sell its meals to customers who will buy ready-to-prepare meals 'instead of shopping at grocery stores, ordering takeout, or eating at restaurants'.[1] Or consider a firm with a market value of equity of more than $8 billion with revenues of just over $1 billion. The firm is not profitable and describes its mission to 'be the traveller's first and independent source of information for finding the ideal hotel at the lowest rate'.[2] Finally, consider a firm with a market value of equity of more than $2.4 billion, sales of less than $500 million and also no profits,

[1] Amendment No. 4 to Form S-1, Blue Apron Holdings, Inc., dated 28 June 2017, pp. 1-4, available online at: https://www.sec.gov/Archives/edgar/data/1701114/000104746917004287/a2232570zs-1a.htm. Prices, equity, income, and market capitalization from Bloomberg; market capitalization as of 30 June 2017.

[2] Filing pursuant to Rule 424(b)(4), travel B.V. doing business as 'trivago', dated 16 December 2016, p. 1, available online at: https://www.sec.gov/Archives/edgar/data/1683825/000119312516795038/d246736d424b4.htm. Prices, equity, income, and market capitalization from Bloomberg; market capitalization as of 19 July 2017.

and which describes itself as 'the leader in the Cloud Communications Platform category and enables developers to build, scale and operate real-time communications within their software applications via simple-to-use Application Programming Interfaces, or APIs'.[3]

Companies like these – with large market capitalizations and no profits, especially in new and largely unproven businesses – raise many interesting questions of interest to finance scholars, managers and investors. The large market values suggest the existence of large asset values behind them, perhaps in the form of so-called 'growth options'. At the same time, someone sympathetic to the possibility of rampant irrationality in the financial markets might write off such examples as evidence of 'animal spirits' and market mispricing.

This paper considers another possibility: worthless companies can trade for large positive values in efficient and rational markets.[4] A worthless company, as I use the term here, is a company whose assets have no value. The accounting identity, assets = liabilities + equity, suggests that the debt and equity of a worthless company should also have no value. Instead, however, the possibility of an irrational acquisition of the worthless company by another company can cause the debt and equity of the worthless company to trade at positive and potentially large values. Irrational acquisitions may occur, for example, because the acquiring company's managers are excessively optimistic (Heaton, 2002; Malmendier & Tate, 2008), because of extreme divergence of opinion among potential acquirers (Chatterjee, John, & Yan, 2012), or blind empire building (Baker, Dutta, Saadi, & Zhu, 2012). Well-known empirical evidence on the announcement-date returns to bidders and target firms[5] is interesting in this regard, since negative returns to bidders and positive returns to targets are strong predictions of the worthless company hypothesis.

The possibility of worthless companies that trade for significant value in the capital markets does not depend on *market* irrationality. Worthless companies can trade for significant market values in efficient markets. It only need be the case that a probability exists that some potential bidder will (irrationally, mistakenly, or for reasons contrary to the interests of its own shareholders) determine that the acquisition of the worthless company makes sense. Because the resulting security prices are correct, arbitrage is impossible, except when aimed at the irrational acquirer, a difficult task if the irrational acquirer is large and impossible if it is privately held or controlled.

The worthless company hypothesis may help explain large valuations that, in the dot-com era, were placed on companies with little in the way of visible assets and nothing in the way of profits, valuations that disappeared, along with the firms, when the market for stock and cash acquisitions for dot.com firms dried up in 2000. In present times, the possibility of worthless companies may explain widespread disagreement in capital markets about the value of some high profile start-ups (so-called 'unicorns'), some initial public offerings of firms with large losses, and the bad performance of some prominent short sellers despite strong and plausible cases against the businesses underlying their short trades.

The remainder of the paper is structured as follows: section 2 presents the basic modeling set-up for a worthless company without debt. Section 3 analyzes the equity value of the worthless company without debt. Section 4 presents results on merger announcement effects without debt and an example. Section 5 adds debt to the simple model. Section 6 shows the effect of debt on announcements effects, again providing an illustrative example. Section 7 addresses the problem of arbitrage against the security prices of the worthless company, and Section 8 concludes.

---

[3] Form 10-Q, Twilio Inc., dated 13 November 2017, p. 8, available online at: https://www.sec.gov/Archives/edgar/data/1447669/000110465917068034/a17-20572_110q.htm. Prices, equity, income, and market capitalization from Bloomberg; market capitalization as of 1 December 2017.

[4] The examples above merely help motivate thinking. I do not assert here that any of those firms are worthless.

[5] Jensen & Ruback (1983), Jarrell & Poulsen (1989), Andrade et al. (2001), Moeller et al. (2005).

2 | BASIC MODEL

Consider two companies, a worthless target company, T, and a potential bidding company, B. There are three periods, times $t = 0$, $t = 1$ and $t = 2$. The discount rate is zero.

The target company has no assets of value at any time. That is, if we denote the value of the worthless target company's assets as A_T, the worthless company assumption is that $A_T = 0$. The bidding company has valuable assets A_B, where $A_B > 0$. Asset market values are not directly observable. This assumption captures the idea that many of the businesses we are concerned with do not have assets with a readily ascertainable market value, but instead may consist of growth options or business concepts with unknown future cash flows.

We start by assuming that neither the target company nor the bidder company has debt, then relax that assumption below for the target company. The value of the target company's equity is $E_{T,i}$, where i is the relevant time period. The value of the bidding company's equity is $E_{B,i}$.

There is a probability $p > 0$ that the the bidding company will acquire the target company by giving the target company's shareholders a share s in the merged company $M = B + T$, where $s \in (0, 1)$. We denote the equity of the merged firm M as E_M. We assume that the bidding firm is not itself a target firm of some other firm, so that the bidding firm's security values depend only on the assets to which the securities have a claim.

At time $t = 0$, the equity value of the target and the bidder reflect the probability of a merger. At time $t = 1$, the bidder makes and announces its merger decision whether or not to acquire the target for share s. Thus, at time $t = 1$, the equity values reflect the 'announcement effect' of the merger decision. The merger closes at time $t = 2$ if announced at time $t = 1$. If the merger is not announced at time $t = 1$, the worthless target company goes out of existence at time $t = 2$, and the bidding company's equity no longer reflects the possibility of a bid for the worthless target company.

3 | EQUITY VALUES WITHOUT DEBT

If there is no merger, then at time $t = 2$, $E_{T,2} = 0$ and $E_{B,2} = A_B$.

If there is a merger, then at time $t = 2$, $E_M = A_B$, since the merged company has no debt and its only assets are A_B, the assets that the bidding company had before the merger. Of the equity in the merged company, the target company's shareholders receive sE_M with value sA_B, while the bidding company's shareholders receive $(1 - s)E_M$ with value $(1 - s)A_B$.

At time $t = 1$, no merger announcement leads to an equity value of $E_{T,1} = 0$ for the target company and $E_{B,1} = A_B$ for the bidding company, the same as at time $t = 2$. But if there is a merger announcement at time $t = 1$, the equity value of the target company is $E_{T,1} = sA_B$, reflecting its pending value in the merged firm, while the equity value of the bidding company is $E_{B,1} = (1 - s)A_B$, reflecting its pending value in the merged firm.

At time $t = 0$, the equity value of the worthless target company is $E_{T,0} = psA_B$, the probability of the merger occurring times the share the target company's shareholders will receive in the merged firm times the value of the bidding company's assets. Thus, the equity value of the worthless company is positive at time $t = 0$.

The equity value of the bidding company at time $t = 0$ is $E_{B,0} = p(1 - s)A_B + (1 - p)A_B$, the probability of the merger occurring times the share the bidding company's shareholders will receive in the merged company times the value of the bidding company's assets, plus the probability that the merger will not occur times the value of the bidding company's assets, since with no merger the bidding company's shareholders retain a full claim on the bidding company's assets.

4 | ANNOUNCEMENT EFFECTS WITHOUT DEBT

One of the more robust findings in the merger and acquisition literature relates to the announcement effects in tender offers. As Jarrell and Poulsen (1989, p.12) stated nearly 30 years ago: 'Extensive empirical evidence supports the view that takeovers are beneficial to the shareholders of target firms. Virtually every study has found that these shareholders receive large premiums, averaging about 30%, for their shares. The wealth effects on shareholders of acquiring firms, however, are much more puzzling. Researchers measuring these wealth effects have found them to average close to zero and to be negative for some categories of offers'.

Consider the model above in view of this evidence. If the bidding company announces a merger with the worthless target company, then the worthless target company's equity increases from $E_{T,0} = psA_B$ to $E_{T,1} = sA_B$, an increase of $1/p - 1$, while the bidding company's equity falls from $E_{B,0} = p(1 - s)A_B + (1 - p)A_B$ to $E_{B,1} = (1 - s)A_B$, a decrease of $s(p - 1)/(1 - ps)$.

Consider the following example: suppose $A_B = \$10$ billion, $p = 0.8$ and $s = 0.2$. Then $E_{T,0} = \$1.6$ billion and $E_{B,0} = \$8.4$ billion. If the merger is announced, the worthless target company's equity value rises 25% to $E_{T,1} = \$2$ billion, while the bidding company's equity value falls about 4.8% to $E_{B,1} = \$8.0$ billion.

Figure 1 illustrates potential worthless company target equity values using $A_B = \$30$ billion, which is approximately the median enterprise value of constituent firms in the S&P500 Index as of 1 December 2017.[6] The figure shows that even relatively low acquisition probabilities and modest post-acquisition ownership by the target firm shareholders can support nine- and ten-figure valuations.

5 | WORTHLESS COMPANIES WITH DEBT

Worthless companies can support debt as well as equity, and that debt can trade near par if the probability of a merger is high and the debt is assumed by the merged company or paid off as part of the merger transaction.

Let $D_{T,F} < A_B$ be the face value of the debt of the worthless target company due at time $t = 2$. We assume that if the merger is announced, then the worthless target company's debt is paid off in full at the time the merger closes, $t = 2$. Let $D_{T,i}$ be the market value of the debt of the worthless target company at time i.

If there is no merger, then at time $t = 2$, $E_{T,2} = 0$, $D_{T,2} = 0$ and $E_{B,2} = A_B$.

If there is a merger, then at time $t = 2$ the debt of the worthless target company is paid off, so the equity of the merged company is $E_M = A_B - D_{T,F}$. Of the equity in the merged company, the worthless target company's shareholders receive sE_M with value $s(A_B - D_{T,F})$, while the bidding company's shareholders receive $(1 - s)E_M$ with value $(1 - s)(A_B - D_{T,F})$.

At time $t = 1$, no merger announcement leads to an equity value of $E_{T,1} = 0$ and a debt value of $D_{T,2} = 0$ for the worthless target company, and $E_{B,1} = A_B$ for the bidding company. But if there is a merger announcement at time $t = 1$, the equity value of the target company is $E_{T,1} = s(A_B - D_{T,F})$, reflecting its pending value in the merged firm and the value of the worthless target's company's debt is $D_{T,F}$. The equity value of the bidding company is $E_{B,1} = (1 - s)(A_B - D_{T,F})$, reflecting its pending value in the merged company.

---

[6] Data from Bloomberg, accessed 3 December 2017. This calculation of enterprise value uses book value of total debt instead of market value of debt. Note that this value is used to approximate a 'large acquirer'; in the model, the true asset value would be smaller than the sum of the equity and debt of the potential acquirer by the amount of the equity of the worthless company target, as in the example.
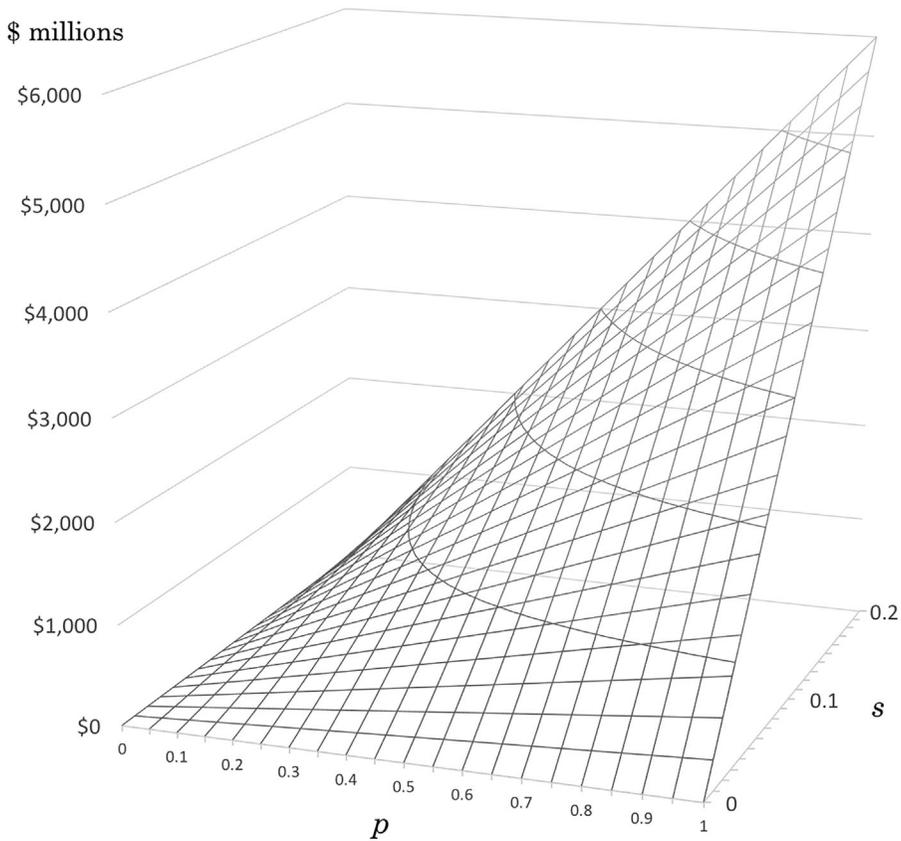
FIGURE 1 **Target worthless company equity value as a function of p and s with acquirer assets equal to $30 billion.** The figure shows worthless company target equity values assuming that the potential acquiring firm has asset value equal to $30 billion, the approximate median enterprise value of firms constituting the S&P500 as of 3 December 2017. Probability of acquisition p ranges from 0 to 1, while share to the target firm shareholders s ranges from 0 to 0.2.

At time $t = 0$, the equity value of the worthless target company's equity is $E_{T,0} = ps(A_B - D_{T,F})$, the probability of the merger occurring times the share the target company's shareholders will receive in the merged firm times the value of the bidding company's assets after repayment of the worthless target company's debt in full. Thus, the equity value of the worthless company is positive at time $t = 0$. The value of the worthless target company's debt is $D_{T,0} = pD_{T,F}$, the expected value of the debt given the probability of merger with repayment in full. If p is near 1, then the worthless target company's debt will trade near par value.

The equity value of the bidding company at time $t = 0$ is $E_{B,0} = p(1 - s)(A_B - D_{T,F}) + (1 - p)A_B$, the probability of the merger occurring times the share the bidding company's shareholders will receive in the merged company times the value of the bidding company's assets less the repayment of the worthless target company's debt in full, plus the probability that the merger will not occur times the value of the bidding company's assets.

6 | ANNOUNCEMENT EFFECTS WITH DEBT

If the bidding company announces a merger with the worthless target company, then the target company's equity rises from $E_{T,0} = ps(A_B - D_{T,F})$ to $E_{T,1} = s(A_B - D_{T,F})$, an increase of $1/p - 1$,

while the bidding company's equity falls from $E_{B,0} = p(1-s)(A_B - D_{T,F}) + (1-p)A_B$ to $E_{B,1} = (1-s)(A_B - D_{T,F})$, a decrease of $(D_{T,F}(p-1))/(A_B(1-ps) + D_{T,F}p(s-1))$.

Suppose A_B = \$10 billion, p = 0.8, s = 0.2 and $D_{T,F}$ = \$1.0 billion. Then $E_{T,0}$ = \$1.44 billion and $E_{B,0}$ = \$7.76 billion. If the merger is announced, the worthless target company's equity value rises 25% to $E_{T,1}$ = \$1.8 billion, while the bidding company's equity value falls about 2.6% to $E_{B,1}$ = \$7.2 billion. The worthless target company's debt trades at 80% of par at time $t = 0$, reflecting the probability of merger and full repayment.

These announcement effects are consistent with the results in Billett, King, and Mauer (2004). They examine the effects of mergers and acquisitions on target and firm bondholders in the 1980s and 1990s, and find that target bonds earn significantly positive announcement-period returns, returns that are (p. 107): 'significantly larger returns when the target's rating is below the acquirer's, when the combination is anticipated to decrease target risk or leverage, and when the target's maturity is shorter than the acquirer's [and] are significantly larger in the 1990s'.

7 | WORTHLESS COMPANY ARBITRAGE

The possibility of worthless companies does not require that anyone other than the potential bidder believes that the worthless target company's assets have value. But if that potential bidder exists, the securities in the model are *not* mispriced. Though the worthless company's assets are worth zero, its securities are not. Their worth, it is true, derives from the probability of irrational acquisition of the worthless company by a potential bidder, but the value of the *securities* is rational. To the extent that short sellers infer from the fact that the worthless company's *assets* are worth zero that the *securities* are worth zero, the expected value of their short trades will be much less than they believe. The poor performance of many short sellers with otherwise compelling cases against the underlying *businesses* of some firms may be due, in part or in whole, to the failure to recognize the fact that worthless companies can support valuable securities in the presence of potential irrational acquisition.

An alternative possibility for arbitrage against the effects of the irrational bidder is to attack it directly. Recall that at time $t = 0$ the bidding company's equity trades (in the debt-free case) for $E_{B,0} = p(1-s)A_B + (1-p)A_B$. If it is possible to acquire a position in the bidding firm's equity at this price and then influence the bidding company to abandon the possibility of the acquisition, the value of the bidding firm's equity will rise to $E_{B,0} = A_B$. If the acquisition has already been announced, but an arbitrageur can acquire a position and influence the bidder to abandon it, then the bidder's equity will rise from $E_{B,0} = (1-s)A_B$ to $E_{B,0} = A_B$.

One role of hedge fund activism may be stopping bad acquisition policies at the acquiring company (Wu and Chung, 2017), a more effective strategy than betting against the correctly-valued securities of a worthless target company.[7] It can be hard to defeat such takeover attempts, however. If potential acquirers are very large, this may be infeasible, both because the cost of acquiring influence may be too high, and because the value impact of the irrational acquisition may be small relative to the other idiosyncratic risks of the position. Of course, if the potential acquirer is privately held or controlled, there may be no possibility of arbitrage.

8 | CONCLUSION

The securities of some companies may benefit from the probability that an acquirer will overpay for an acquisition of that company. This paper demonstrates the extreme version of that possibility. Worthless

---

[7] See 'Deal Activism: Lessons from the EQT Proxy Contest', available online at: https://corpgov.law.harvard.edu/2017/11/13/deal-activism-lessons-from-the-eqt-proxy-contest/#more-102815.

companies – companies whose assets have no value – may trade for large and positive prices in efficient markets for no reason other than the probability of acquisition by an irrational acquirer. This possibility demonstrates the importance of care with the accounting identity that assets = liabilities + equity.[8] While it is possible to interpret the probability of irrational acquisition as an 'asset', that seems a semantic stretch too far.

The possibility of worthless companies may explain widespread disagreement in capital markets about the value, if any, of a number of high profile start-ups (so-called 'unicorns') and the bad performance of some prominent short sellers with strong and plausible cases against the underlying businesses supporting their short trades. Further empirical implications of the possibility of worthless companies remains for future research.

REFERENCES

Andrade, G., Mitchell, M., & Stafford, E. (2001). New evidence and perspectives on mergers. *Journal of Economic Perspectives*, *15*, 103–120.

Baker, K., Dutta, S., Saadi, S., & Zhu, P. (2012). Are good performers bad acquirers? *Financial Management*, *41*, 95–118.

Billett, M., King, T., & Mauer, D. (2004). Bondholder wealth effects in mergers and acquisitions: New evidence from the 1980s and 1990s. *Journal of Finance*, *59*, 107–135.

Chatterjee, S., John, K., & Yan, A. (2012). Takeovers and divergence of opinion. *Review of Financial Studies*, *25*, 227–277.

Heaton, J. (2002). Managerial optimism and corporate finance. *Financial Management*, *31*, 33–45.

Israel, R. (1991). Capital structure and the market for corporate control: The defensive role of debt financing. *Journal of Finance*, *46*, 1391–1409.

Jarrell, G., & Poulsen, A. (1989). The returns to acquiring firms in tender offers: Evidence from three decades. *Financial Management*, *18*, 12–19.

Jensen, M., & Ruback, R. (1983). The market for corporate control: The scientific evidence. *Journal of Financial Economics*, *11*, 5–50.

Malmendier, U., & Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the markets reaction. *Journal of Financial Economics*, *89*, 20–43.

Mitchell, M., & Lehn, K. (1990). Do bad bidders become good targets? *Journal of Political Economy*, *98*(2), 372–398.

Moeller, S., Schlingemann, F., & Stulz, R. (2005). Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *Journal of Finance*, *60*, 757–782.

Wu, J., & Kee, H. (2017). Hedge fund activism and corporate M&A decisions. *Working Paper*.

---

[8] For example, it is common in determining the balance sheet solvency of a company to compare the sum of its market values of debt and equity – interpreted through the accounting identity as the market value of its assets – to the face amount of its debt, where the company is concluded to be solvent if the sum exceeds the face value of debt, and insolvent otherwise. The possibility that security prices in an efficient market may reflect the probability of irrational acquisition casts some doubt on the reliability of this method.