OPTIMAL CAPITAL STRUCTURE AND GROWTH OPTIONS IN MERGERS AND ACQUISITIONS

Elettra Agliardi
University of Bologna and RCEA
elettra.agliardi@unibo.it

Amir Amel-Zadeh[1]
University of Cambridge - Judge Business School
a.amelzadeh@jbs.cam.ac.uk

Nicos Koussis
Frederick University Cyprus
bus.kn@fit.ac.cy

This draft: June 2012

[1] The authors would like to thank Erwan Morrelec, Hayne Leland, Geoff Meeks, Toni Whited, Geoff Whittington and seminar participants at University of Cambridge for helpful comments and suggestions.
Address for correspondence: Amir Amel-Zadeh, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, UK; email: a.amelzadeh@jbs.cam.ac.uk

OPTIMAL CAPITAL STRUCTURE AND GROWTH OPTIONS IN MERGERS AND ACQUISITIONS

Abstract

We develop and empirically test a dynamic trade-off model for the analysis of the optimal capital structure in mergers and acquisitions. The model captures financial and operational synergies and accommodates growth options resulting from the merger. The model predicts that merging firms that have lower correlation of cash flows, have larger merger gains, reduce debt before the merger and increase leverage more significantly after the merger. We further find that mergers which result in a decrease in volatility and bankruptcy costs due to the merger, are more likely to reduce debt prior to acquisition and have higher increases in leverage after the merger. Moreover, the model predicts that positive changes in growth options of the merged firm relative to the growth options of the acquirer and target firms will monotonically enhance merger gains and that growth opportunities have a U-shaped relationship with leverage. Using a large sample of US acquisitions between 1980 and 2010 we provide evidence in support of the model. Our findings are consistent with a dynamic capital structure theory which endogenizes investment and capital structure decisions under the existence of growth opportunities.

Keywords: Capital Structure, Mergers and Acquisitions, Growth Options, Dynamic Trade-off Model

Classification: G13, G32, G34, L25

1. Introduction

In the frictionless world without taxes, bankruptcy costs and agency conflicts, underlying Modigliani and Miller's (1958) irrelevance theorem, financial synergies and capital structure considerations in mergers and acquisitions can be ignored and thus much of the traditional theoretical and empirical literature on mergers and acquisitions has focused on operational synergies as one of the prime motives why firms merge. In the presence of these frictions, however, capital structure decisions may become relevant and, in addition, may be influenced by the expansion of growth opportunities in mergers. These effects have only recently been investigated in the literature, albeit separately (e.g., Barclay, Morellec and Smith 2006; Leland 2007; Morellec and Zhdanov 2008; Uysal 2011; DeAngelo, DeAngelo and Whited 2011; Hackbarth and Mauer 2012). In this paper we propose a dynamic trade-off model of the optimal capital structure that accommodates operational synergies and growth options in mergers. We then empirically test the main predictions of our model on a large sample of US acquisitions between 1980 and 2010. Our paper sheds light on the cross-sectional differences in leverage and merger gains in connection with diversification effects, operational synergies, merger related growth options, and changes in the volatility, bankruptcy costs of the merged firm relative to acquirer and target firms. We also provide and test predictions about leverage changes surrounding mergers. We investigate both the case where growth options exist prior to the merger and the case where growth options are created with the merger.

With imperfectly correlated cash flows of separate activities consolidation via mergers reduces risk and thus increases potential leverage allowing for greater financial benefits (Lewellen 1971). Hence, even in the absence of operational synergies the co-insurance effect of merging imperfectly correlated firms reduces the risk of default, increases debt capacity and optimal leverage and thereby leads to higher firm value. Leland (2007) shows that this diversification effect may not always be positive, with the sign of the financial benefits affected by factors such as the relative volatility and bankruptcy costs of the two firms and the level of the correlation of the firms' cash flows.[2] However, operational synergies and growth opportunities are exogenous to his model. Yet, highly profitable firms tend to be less levered because they use their earnings to pay down debt as generally predicted by pecking order theories (e.g. Myers and Majluf 1984, Titman and Wessels 1988), thus operational synergies might have an effect on changes in capital structure around mergers. Moreover, a growing

[2] Scott (1977), building on Kraus and Litzenberger (1973) state-preference model, has also shown that the financial effects of mergers are not always clear-cut.

literature documents a negative relationship between growth opportunities and leverage (e.g., Rajan and Zingales 1995; Hovakimian, Opler and Titman 2001; Barclay, Morellec and Smith 2006) motivated by Myers' (1977) debt overhang argument. It suggests that due to lower collateral value and high underinvestment costs, firms with high growth opportunities tend to have lower leverage despite higher firm value. On the other hand, several studies have also found a mixed relationship between market-to-book and leverage ratios (e.g., Frank and Goyal, 2004; Chen and Zhao 2005; Fama and French 2002). In this paper we investigate the relationship between growth opportunities and leverage in the context of acquisitions. Major investment decisions such as mergers are generally associated with changes in investment opportunity sets which in turn might influence financing decisions.

Our theoretical model builds on Leland (1994) and (2007) in the context of mergers and adds operational synergies and growth options. While Leland (2007) focuses on a two-stage setting assuming normally distributed firms' cash flows without operational synergies and growth options, we adopt a numerical lattice framework in finite horizon with correlated geometric Brownian motions as underlying stochastic processes of the revenues of the two firms. We broadly confirm results in Leland (2007), both theoretically and empirically, and additionally provide theoretical predictions and empirical evidence on market and book leverage levels and changes for the merged firm relative to the individual leverage ratios of the acquirer and target firms in the presence of operational synergies and growth options. We further link these effects to empirically testable hypotheses on the incentives of the merging firm to reduce leverage prior to the merger and increase leverage after the merger in order to avoid coinsurance effects. Our model does not require to make the restrictive assumptions, that are necessary for analytical tractability, and is compatible with conglomerates mergers (non-perfectly correlated firms), horizontal mergers (highly correlated firms), and captures financial, operational synergies and growth options resulting from the merger, as is often the case in complementary resources and high technology mergers (see Makri, Hitt and Lane, 2010).

We first build and investigate several hypotheses that relate to the pure financial benefits of mergers (without growth options or operational synergies) conditional on the correlation of revenues, and changes in the volatility, bankruptcy costs and profitability of the merged firm relative to individual firms. With respect to diversification effects our theoretical results predict that merged firms that have lower correlation of cash flows, have larger merger gains, reduce debt before the merger and increase leverage more significantly after the merger. An increase in the volatility of the merged firm relative to the volatilities of the acquirer and target firms is expected to decrease the leverage of the merged firm relative to the two firms and reduce the incentive of the acquirer and target firm to

decrease debt in the years before the merger. Merger gains are expected to have a U-shape with respect to increases in the volatility of the merged firm relative to pre-merger volatilities. An increase in bankruptcy costs of the merged firm relative to the bankruptcy costs of individual firms results in a reduction in merger gains and a negative change in leverage. Moreover, operational synergies, modeled as enhancement in profit margins of the merged firm relative to the acquirer and target, generates higher merger gains, results in an increase in leverage and provides greater incentives for the acquirer and target firm to reduce debt prior to the acquisition.

In the case of growth options, our model predicts that positive changes in growth options of the merged firm relative to the growth options of the acquirer and target firms will monotonically enhance merger gains, but may have a U-shape relationship with market and book leverage. In contrast to the generally observed negative relationship between growth options and leverage, debt levels and leverage ratios may actually increase when the merged firm creates new growth options relative to the acquirer and target firm. This happens when the change in growth option is significant. Our simulations show that if the relative contribution of growth options for firm value is sufficiently large, an increase in growth opportunities significantly increases the optimal coupon level and leverage ratios. These findings are consistent with dynamic models allowing for financial flexibility and pro-active leverage (e.g., Denis and McKeon, 2012, De Angelo, De Angelo, Whited, 2011), where debt increases may be used to fund operating and investment needs. On the other hand, for small changes in growth options we find that firms may decrease leverage. Our simulations show that when growth options have a relatively small value, an increase has no positive effect on the optimal coupon, and so the leverage ratio decreases as growth increases. We thus establish a U-shape relationship of leverage changes with changes in growth options. This U-shape relationship of market leverage with growth options is consistent with recent theoretical evidence in Hackbarth and Mauer (2012). Our work extends their result theoretically and empirically for the case of mergers.

The empirical tests largely corroborate our model predictions. Correlation, volatility and bankruptcy costs are negatively associated with leverage levels of merging firms, and size. Growth opportunities have a U-shape relationship with leverage so that for low growth opportunities the effect on leverage is negative while for large growth opportunities the effect on leverage is positive. Merging firms tend to decrease leverage just before the merger and increase leverage significantly in the years after the merger. Moreover, we find that this effect is stronger for merging firms that are less correlated, have larger growth options, lower bankruptcy costs and lower volatility.

The rest of the paper is organized as follows. Section 2 provides a literature review, Section 3 presents the theoretical model and Section 4 provides sensitivity results and discusses the main conjectures, in relation with other capital structure and related theories. Section 5 presents an empirical investigation and simulation results and, finally, Section 6 concludes.

2. Literature review

2.1. Coinsurance in M&A

A broad literature has focused on the pure financial effects of mergers, which are defined by the gains or losses due to diversification[3] , in the absence of operational synergies and growth options. In a model without tax benefits, bankruptcy costs, operational synergies and growth options, Galai and Masulis (1976) show that mergers enhance debt value but have a negative effect on equity value, because of coinsurance. Thus, for equity holders to be able to appropriate the benefits, they propose that firms retire debt before the merger and issue new debt after the merger, since volatility becomes lower and the firm can raise cheaper debt. Leland (2007), who also focuses on the pure financial benefits of mergers, makes a similar argument and suggests the use of callable bonds. This diversification, or coinsurance effect, of mergers is hard to be incorporated in a continuous time framework, because the sum of correlated geometric Brownian motions does not follow a geometric Brownian motion, making it hard to derive analytic solutions. This is further complicated in the presence of growth options for the merged firms or the individual firms before the merger. Thus, Leland (2007) focuses on a discrete two stage setting, assuming normally distributed variables for the firm cash flows (so that also the sum remains normally distributed), without operational synergies or growth options.

Other authors have focused on purely horizontal mergers. Particularly two-factor models are constructed, such that the profit flow of the merged firm is a transformation of the two different, but correlated, diffusions of the bidder and target firms' cash flows. Lambrecht (2004) analyzes the terms and timing of horizontal (perfectly correlated) mergers motivated by economies of scale. Morellec and Zhdanov (2005) study a dynamic model of mergers, where the diffusion underlying the profit of the

[3] Diversification is often associated with economies of scale or economies of scope and increased market power (e.g., Chatterjee and Wernefelt, 1991; Singh and Montgomery, 1987, and Montgomery, 1994). Here, diversification relates only to the effect of correlation, where less than perfectly correlated firms merge, while operational synergies and growth options are considered separately.

merged firm is an arithmetic transformation of the two individual diffusions. Thijssen (2008) analyzes the diversification effect by assuming that the new merged firm is subject to a stochastic shock that is an iso-elastic transformation of the individual firms' shocks. This assumption is made for tractability reasons, because the transformation preserves the properties of the stochastic process describing the individual firms' profits. In contrast to Lambrecht (2004) and Lambrecht and Myers (2007), where mergers can take place only during economic booms, Thijssen (2008) shows that mergers can take place even in downswings and even if the operating synergies are negative, due to large potential diversification benefits. He shows that mergers are more likely in concentrated industries, when the correlation of cash flows is higher. Hackbarth and Morellec (2008) analyze the option to merge in the presence of follow-up options of the merged firm. Their main focus is on the effects of mergers on systematic risk. While in all of the above mentioned papers firms are unlevered, Morellec and Zhdanov (2008) analyze the interaction between leverage and merger activity. They determine the terms and timing of the merger endogenously, as the solution to an option exercise game between bidding and target shareholders. Their emphasis is on how bidders choose leverage in order to have better prospects of winning the bidding contest of acquisition both under perfect and imperfect information. One of their empirical predictions is that leverage is reduced before the acquisition and increased afterwards.

2.2. Leverage choice before and after the merger

Kayhan and Titman (2007) find that firms' capital structures tend to move towards target debt ratios in the long run. Their result supports the conjecture about a target capital level in trade-off theories. Graham and Harvey (2001) in their survey provide evidence of firms having optimal, target debt ratios. Consistent with the theory, various studies (Hovakimian, Opler and Titman 2001, Hovakimian, Hovakimian and Tehranian 2004; Fama and French, 2002) find that observed leverage ratios relate to firm characteristics, such as size, growth opportunities, collateral value of assets, marginal tax rate, and show that leverage deficit (i.e., the difference between the observed debt ratio and a target ratio) predicts whether firms raise new capital with debt or equity. There is evidence, however, that leverage is also affected by the prospects of making acquisitions. Kim and McConnel (1977) is among the first studies documenting an increase in book leverage ratio of the merged firm relative to acquirer and target values. Martynova and Renneboog (2009) explain how capital structure theories interact with merger specific issues, like risk sharing, in the determination of the means of

payment and the source of takeover financing. Fama and French (2005) analyze stock issues and place particular emphasis on how M&A affect the firm's capital structure, examining the average speed with which firms adjust to their target debt ratios. Asquith and Wizman (1990) discuss the impact of covenants and poison puts which may force a firm to repay debt at higher costs or prevent the firm from issuing new debt at merger event, and Billet et al. (2004) show that the target bond holders, on average, gain from mergers because of poison puts provisions. Ghosh and Jain (2000) – and before them Bruner (1988) – state that mergers may generate additional debt capacity: a more diversified firm makes debt holders' claims less risky and allows for more debt (thus, being a simple way to achieve the goal of moving towards the optimal financial structure).

Welch (2004) finds that firms that engaged in mergers increase leverage. Uysal (2011), Clayton and Ravid (2002), Leary and Roberts (2005) and Harford, Klasa and Walcott (2009) find that firms adjust their capital structures before mergers if they are overleveraged. In particular, Uysal (2011) finds empirical support that acquiring firms have lower leverage ratios relative to their target levels, and concludes that underleveraged firms seem more likely to make acquisitions. He uses a two-step estimation procedure similar to Hovakimian, Opler and Titman (2001), where in the first step the target leverage ratio is estimated by running annual regressions of leverage ratios on the main determinants of capital structures considered in the literature (e.g., see Kayhan and Titman, 2007; Lemmon, Roberts and Zender, 2008), and in the second step regressions are performed to examine whether the deviation from the predicted target capital structure affects a firm's acquisition choice. Their results suggest that estimated leverage deficits are strongly related to acquisitions. According to Gugler and Konrad (2002), firms with a low (high) debt-equity ratio increase (decrease) their debt-equity ratio during and in the year after the acquisition. They also suggest that firms with growth options may use equity financing, so as not to endanger the financing of future growth opportunities[4]. Yang (2009) empirically investigates the acquirer leverage choice before the merger, showing that acquirers reduce their leverage before and reduce leverage deficits after the transactions.

2.3. Dynamic investment, growth options and capital structure

[4] The initial leverage levels of the acquiring firms before the merger may also affect their means of payment. Firms with high debt-equity ratios seem to be more likely to choose cash than firms with low debt-equity ratios (see Gugler and Konrad, 2002) and overleveraged firms are more likely to finance acquisitions with equity instead of debt (Harford et al., 2009).

The importance of endogenous investment has been developed in various dynamic models investigating the interaction between investment and financing policies (e.g., Hennessy and Whited, 2005; Gamba and Triantis, 2007; Tsyplakov, 2008). Sundaresan and Wang (2006) study the leverage impact with a collection of growth options and show that existing debt may significantly distort investment decisions because of debt overhang and risk shifting effects. Anticipating these distortions, firms with greater growth options have lower leverage, that is, they optimally choose their initial investments and leverage decisions to mitigate such distortions. A similar conclusion is obtained also in Morellec and Schurhoff (2010) and Lobanov and Strebulaev (2007). Debt priority rules can have a role in balancing the tradeoffs of investment incentives and may virtually eliminate suboptimal investment incentives (Hackbarth and Mauer, 2012). This argument is the rationale behind a widely documented empirical regularity in the capital structure literature, concerning a negative relation between market-to-book ratio (a commonly used proxy for growth opportunities) and leverage ratio (Barclay, Morellec and Smith 2006; Rajan and Zingales, 1995; Hovakimian, Hovakimian and Tehranian 2004; Lang, Stultz and Walking 1996). Yet, the relation between future growth opportunities and financial policies is still controversial, and some empirical studies have also shown a positive relation between leverage and market-to-book ratios (e.g., Frank and Goyal, 2004; Fama and French, 2002). Moreover, using a measure of Tobin's Q to measure investment opportunities, Schlingemann (2004) found that bidder announcement period abnormal returns are positively and significantly related to the amount of ex ante equity financing and that this relation is particularly strong for high Q firms. If debt financing reduces managerial discretion for firms with good investment opportunities, then one would expect a negative relation for high Q firms and a positive relation for low Q firms.

DeAngelo, DeAngelo and Whited (2011) focus on financial flexibility in the form of unused debt capacity. They stress the role of inter-temporal dependency in financing activity. The opportunity cost of borrowing now is the potential inability to borrow in the future. Therefore, ex ante optimal financial policies allow to have access to the capital market also in case of unexpected earnings shortfalls or investment opportunities. As a result, firms use transitory debt that is systematically related to investment needs, and therefore they take deliberate, but temporary, deviations from their target capital structures. The recent empirical literature takes a similar view and investigates the determinants of changes in debt structure and leverage. Denis and McKeon (2012) focus on pro-active leverage increases and find that debt increases are used primarily to fund operating needs, and firms reduce their leverage in the years subsequent to the initial jump in leverage. Dudley (2009) studies the capital structure choice with lumpy investment projects. He finds that firms issue equity before debt

when they invest, because firms can earn tax benefits of new debt only when the new assets are in place and sequencing equity first mitigates the risk of underinvestment. For growth firms that require external financing, capital-structure adjustments are much quicker and firms adjust to their target leverage by the end of the financing period of a project. These studies imply that leverage targets conservatively embed the option to issue transitory debt, where the evolution of debt reflects the sequence of investment outlays. None of the papers, however, deal with mergers.

The empirical literature shows that mergers generate synergies and growth opportunities due to various reasons. Chatterjee (1986) finds that collusive synergy (arising from increased prices) is an important factor of merger gains. Ravenscraft and Scherer (1987), Bhagat et al. (1990), and Kaplan and Weisbach (1992) generally predict that operating synergies will be created only in mergers between firms in the same or related industries, and Healey, Palepu and Ruback (1992) document particularly strong performance improvements for mergers involving firms with overlapping businesses. Some studies have also established a positive relation between the stock returns at merger announcements and the changes in operating cash flows after mergers, which is interpreted as the market efficiently anticipating the improvements in merger performance (see for example, Healey, Palepu and Ruback, 1992 and Maloney, McCormick and Mitchell, 1993). Sundarsanam et al. (1996) show empirically that value creation may be linked to synergies from various sources, including financial and operational synergies. Jovanovic and Rousseau (2002) argue that mergers reflect positive reallocations of growth opportunities.

3. A trade-off model with financial synergies, operational synergies and growth options

3.1. Model assumptions and description

We assume that revenue levels for the potential Acquirer (A) and the Target (T) firms follow correlated geometric Brownian motion of the form:

$$\frac{dP_i}{P_i} = a_i dt + \sigma_i dZ_i \quad i = A,T \tag{1}$$

where a_i , $\sigma_i > 0$ are constant parameters, dZ_i is the increment of a standard Wiener process for firm i and the two firms revenue processes are correlated with $dZ_1 dZ_2 = \rho dt$, with $-1 \le \rho \le 1$. Let r

denote the risk-free interest rate. We shall assume risk-neutrality and so r is also the discount rate. C_i denotes the operational cost for firm i so that total earnings before interests and taxes for each firm at time t are $P_{i,t} - C_i$. Both firms are expected to operate for T_F periods unless bankruptcy is triggered in-between. We assume that the merged firm may also hold a growth option on the expanded sum of the cash flows of the two firms with maturity T_1. The expansion factor for the growth option is denoted by e_G , so at the time and following the exercise of the growth option, the merged firm may get $e_G(P_A + P_T)$ at a cost I_G. Between time zero (acquisition date) and T_F the merged firm will obtain $e(P_A + P_T)$, unless the growth option is exercised at T_1 , in which case the e_G factor will apply. The coefficient $e > 1$ captures operational synergies[5]. We use a two dimensional binomial tree to model the processes for revenues described in equation (1) following Boyle, Envine and Gibbs (1989). Decisions are taken at every time step Δt with Δt controlled by a variable N_{dec} that specifies the number of decision points within each unit period[6]. The parameters for up, down and jumps, and the joint probabilities for the revenue variables of the acquirer and target firm are:

$$u_i = \exp(\sigma_i\sqrt{\Delta t}), \quad d_i = \exp(\sigma_i\sqrt{\Delta t}), \quad i = A,T$$

$$p_{uu} = 0.25\left(1 + \rho + \sqrt{\Delta t}\left(\frac{\mu_A}{\sigma_A} + \frac{\mu_T}{\sigma_T}\right)\right), \quad p_{ud} = 0.25\left(1 - \rho + \sqrt{\Delta t}\left(\frac{\mu_A}{\sigma_A} - \frac{\mu_T}{\sigma_T}\right)\right) \qquad (2)$$

$$p_{du} = 0.25\left(1 - \rho + \sqrt{\Delta t}\left(-\frac{\mu_A}{\sigma_A} + \frac{\mu_T}{\sigma_T}\right)\right), \quad p_{dd} = 0.25\left(1 + \rho + \sqrt{\Delta t}\left(-\frac{\mu_A}{\sigma_A} - \frac{\mu_T}{\sigma_T}\right)\right)$$

with $\mu_i = (r - \delta_i) - \frac{1}{2}\sigma_i^2$, $i = A,T$.

Firm A and firm T current leverage is defined by the current coupon levels R_A , R_T respectively (optimal leverage is discussed subsequently). Let the corporate tax rate be denoted by τ >0, which is supposed to be equal for both firms. In the event of bankruptcy, proportional bankruptcy costs b_i ,

---

5 Operational synergies may also occur on the cost side when C_M<(C_A+C_T). This is also incorporated in our model.

6 Thus, $\Delta t = 1/Ndec$. Each Δt interval is approximated by a sub-tree $N_{\Delta t}$. To maintain accuracy, discounting occurs for the interval $dt = T_i/N_i$. In principle, the decisions can be made as dense as possible approximating the continuous decision limit when N_{dec} tends to infinity.

$i = A,T,M$, are to be incurred. Similarly to Scott (1977) and Leland (2007), we allow for different levels of bankruptcy costs for the different entities.

We keep track of the following information at each node of the two-dimensional binomial tree for the acquirer firm, the target firm and the merged entity: unlevered assets (V^U), tax benefits of debt (*TB*), bankruptcy costs (BC), equity (*E*), debt issues (D) and levered firm value (V^L).

We use backward induction starting from the end of the operating horizon T_F. At any time $t \le T_F$ the values of each of these variables for stand-alone values of the target and acquirer firm are calculated using equations (3a)-(3c) below.

$$E_{i,t} = \max\left[(P_{i,t} - C_i - R_i)(1-\tau)\Delta t + \widetilde{E}_{i,t}, 0\right], \quad i = A,T,M \tag{3a}$$

If $E_{i,t} > 0$, then

$$\begin{aligned} V^U_{i,t} &= (P_{i,t} - C_i)(1-\tau)\Delta t + \widetilde{V}^U_{i,t} \\ BC_{i,t} &= 0 + \widetilde{BC}_{i,t} \\ TB_{i,t} &= \tau R_i \Delta t + \widetilde{TB}_{i,t} \\ D_{i,t} &= R_i \Delta t + \widetilde{D}_{i,t} \\ V^L_{i.t} &= E_{i,t} + D_{i,t}, \quad i = A,T,M \end{aligned} \tag{3b}$$

whereas, if $E_{i,t} = 0$ then

$$\begin{aligned} V^U_{i,t} &= (P_{i,t} - C_i)(1-\tau)\Delta t + \widetilde{V}^U_{i,t} \\ BC_{i,t} &= b_i V^U_{i,t} \\ TB_{i,t} &= 0 \\ D_{i,t} &= (1-b_i)V^U_{i,t} \\ V^L_{i,t} &= E_{i,t} + D_{i,t}, \ i = A,T,M . \end{aligned} \tag{3c}$$

where $\tilde{x}(t)$ denotes the expected discounted value of variable x and equals $\tilde{x}_i(t) = (p_{uu}x_{t+dt,uu} + p_{ud}x_{t+dt,ud} + p_{du}x_{t+dt,du} + p_{dd}x_{t+dt,dd})e^{-rdt}$. For the last period T_F continuation values for all variables are equal to zero.

The value of equity for the merged entity involves a compound option due to the intermediate existence of the growth option (when this option does not exist we will set $e_G = 0$). First, one needs to calculate the value of the merged entity without the growth option using equations (3a)-(3c) and $C_M = C_A + C_T$. For a given R_M one works backwards from time T_F using equations (3a)-(3c) and calculates the value of the merged firm at t = 0 without the growth option. The same calculations using equations (3a)-(3c) are repeated starting from T_F and going backwards until T_1 when the option is assumed exercised, i.e., multiplying the cash flows by e_G instead of e , and subtracting the investment cost I_G .

The value of the compound option E_M^G as of time T_1 is then obtained for given R_M as follows:

$$E_{M,T_1}^G = \max\left[(E_{M,T_1}(P_M^G, R_M) - I_G, E_{M,T_1}(P_M, R_M)\right],$$
$$\text{with } P_M^G = e_G \cdot (P_A + P_T), \quad P_M = e(P_A + P_T) \tag{4a}$$

There are two observations that can be made regarding equation (4a). Firstly, notice that a decision not to exercise the option does not necessarily imply that the firm stops operating. Instead, the merged firm may choose to continue operations at the level of synergies e (and without incurring the growth option investment cost). We refer to this case as the positive downside. Notice that the firm could also default at T_1 in the case where the value of equity without growth is zero (see equation (3a)) while the value of the equity with growth net of the growth option investment cost is negative. Secondly, one can observe the potential debt overhang problem (Myers, 1977). When R_M is selected to be high, then the equity value with the growth option at the time of the exercise of the option will be lower, which may jeopardize the exercise of an otherwise (had R_M chosen to be lower) profitable growth option. On the other hand, a higher R_M would potentially create higher net benefits of debt,

both in the period before but also after the exercise of the option (assuming it is exercised). Thus, the merged firm should balance out these effects in selecting R_M at $t = 0$.

An alternative formulation of the growth option is described in equation (4b):

$$E^G_{M,T_1} = \max\left[(E_{M,T_1}(P^G_M, R_M) - I_G, 0\right] \quad \text{with } P^G_M = e_G \cdot (P_A + P_T), \quad P_M = e(P_A + P_T) \tag{4b}$$

Under the formulation of equation (4b) the firm cannot revert to the original no growth state if it does not exercise the growth option. This obviously reflects a riskier situation for the merged firm. This formulation is similar to Hackbarth and Mauer (2012), who use a continuous time analytic framework for dynamic optimal capital structure of stand-alone firms. We refer to this case as the zero downside case. We investigate both cases in our numerical simulations.

The optimal value of the merged conditional on the choice of R_M will then be determined by working backwards from T_1 following equations (3a)-(3c), but now using expected future values for all variables ($\tilde{x}$) that are determined based on the backward solution of equation (4).

The optimal coupon for each firm *i= A, T, M* is selected among alternative coupons from grids of coupon levels that are determined by the discretization accuracy parameter *k*, the number of search points N_k and the revenue level of the firm at the time of numerical search, as follows :

$$R_i = \{0, \frac{P_i}{k}, \frac{2 \cdot P_i}{k}, ..., N_k \frac{Pi}{k}\}, i = A, T, M \tag{5}$$

When N_k is set to be higher than k then coupon may even exceed the current revenue levels. The optimal solution is the one providing the maximum levered firm value $V^L_i, i = A, T, M$ at t =0.

Finally, we calculate both market and book leverage ratios, following the definitions of Hackbarth and Mauer (2012). Market leverage (ML) and book leverage (BL) for firm *i* are defined as:

$$ML_i = \frac{D_i}{V_i^L},$$
$$BL = \frac{D_i}{V_i^U} i = A, T, M \qquad (6)$$

3.2. Calculating merger gains

In order to calculate merger gains it is assumed (following Leland, 2007) that the merged firm may retire the debt and equity of the individual firms based on their pre-merger values. The acquirer is then engaged in the merger when merger gain (Δ) defined in equations (7a) or equivalently in equation (7b) are positive.

$$\begin{aligned}\Delta &= V_M^L - V_{A+T}^L = (E_M + D_M) - (E_{A+T} + D_{A+T}) \\ &= (E_M - E_{A+T}) - (D_M - D_{A+T}) \\ &= EE + DE\end{aligned} \qquad (7a)$$

where *EE* = equity effect and *DE*= debt effect.

This is equivalent to

$$\begin{aligned}\Delta &= V_M^L - V_{A+T}^L = (V_M^U + TB_M - BC_M) - (V_{A+T}^U + TB_{A+T} - BC_{A+T}) \\ &= (V_M^U - V_{A+T}^U) + [(TB_M - BC_M) - (TB_{A+T} - BC_{A+T})] \\ &= LL + LE\end{aligned} \qquad (7b)$$

where *LL* = limited liability effect and *LE* = leverage effect. x_{A+T} for variable x denotes $x_A + x_T$.

Leland (2007) has focused on the analysis of equation (7b) where the total merger financial benefits are summarized by the *LL* effect and *LE* effect. In our model these effects also take into consideration the growth option of the merged firm, as well as potential operational synergies (captured by the e parameter). Furthermore, we also investigate the effects of merger on equity and debt values separately, as described in equation (7a). We define *EE* as the difference between the equity value of the merged firm minus the sum of equity values of the two firms and *DE* as the difference between the debt value of the merged firm minus the sum of the debt values of the two firms. A comparison of

optimal D_M with the sum of the debt levels of the individual firms will give an indication of increased debt capacity of the merger. This could be achieved either by a higher level of net benefits of debt using the same coupon, i.e., $R_M = R_A + R_T$ and $D_M > D_A + D_T$ or by allowing the firm to increase its optimal R_M more than the sum of the two coupon levels of the individual firms. Diversification will result in $D_M > D_A + D_T$, and the intensity of this effect depends on the parameters and is discussed below. In contrast, the *EE* often appears negative since diversification (or coinsurance, because of reduced volatility) hurts equity value unless there are operational synergies or growth options for the merged entity.

The merger takes place when total merger gains Δ are positive[7]. The above formulation assumes that acquirer and target are not restricted by covenants (see also Leland, 2007) which allows the merged firm to retire debt prior to the acquisition using pre-merger values and issue new debt based on merged firm characteristics. In the presence of covenants and in order to avoid coinsurance effects, firms may have even higher incentives to reduce leverage in the period before the merger (e.g. a year before) in anticipation of the merger. The higher the expected merger gains, and, in particular DE, the greater the incentives for changing leverage prior to the acquisition. In our numerical results we also present the scaled measures of merger gains (similarly to Leland, 2007) as follows:

$$\Delta_1 = \frac{\Delta}{\left(V_A^U + V_T^U\right)},\ \Delta_2 = \frac{\Delta}{V_T^L},\ \Delta_3 = \frac{\Delta}{E_T} \tag{8}$$

4. Sensitivity analysis and hypotheses development

4.1. No growth case

Within this subsection we first analyze the purely financial effects of merger on equity and debt of the merged firm compared to the weighted sum of the individual firms, assuming no operational synergies

[7] The overall merger gains reflect the gains of both the target and the acquirer. Thus, one has to take into account the abnormal returns of both the acquirer and the target firm at the announcement of the merger. The takeover premium can be considered as the part of the merger gain that goes to the target. In general, the empirical evidence suggests that target companies gain in M&A and bidders returns are near zero or slightly positive (see for example, Mandelker, 1974 and Asquith, Bruner and Mullins, 1983).

or growth options. In comparison to Leland (2007) we also discuss the effects of merger on equity and debt values and leverage ratios. Furthermore, in contrast to Leland (2007), our focus is on the effect of a change in parameter values of the merged firm relative to pre-merger individual firm values and not on the impact on merger gains of the relative parameter values of acquirer and target firms. We summarize the results in the form of empirical hypotheses. The case where firms may have operational synergies and growth options will be examined in subsection 4.2.

The effect of correlation

Table I panel A shows the effect of correlation on merger gains. This is a case of low volatility of both the target and acquirer firm and where both firms are profitable (P is higher than C). We discuss the case of higher volatility and less profitable firms at the end of this subsection. Merger gains are broken down in various components which include the equity and debt effect (EE and DE), the effect on unlevered assets (LL) and the net benefits of debt (LE). The table also includes the scaled measures of merger gains.

[Enter Table I here]

The DE of the merged firm is lower the higher the correlation coefficient. This means that the debt capacity of the merged firm relative to the firms operating separately is higher at a lower correlation coefficient, which is in line with the intuition that diversification reduces risk. On the other hand, equity is negatively affected by diversification, as shown by the negative EE and the fact that EE is increasing in the correlation coefficient. The negative EE is less significant than positive DE and thus the total effect Δ is positive and decreasing in the correlation coefficient. In the limit, when the correlation between the merged firms' revenues becomes one, there are no merger benefits (Δ tends to zero). Thus, purely horizontal mergers are not expected to have any diversification benefits arising from enhanced debt capacity. All the scaled measures of the total merger benefits measures $\Delta 1$, $\Delta 2$ and $\Delta 3$ are decreasing in the correlation coefficient. Finally, we observe that the net benefits of debt (LE effect) are decreasing in the correlation coefficient, while the effect on unlevered assets (LL effect) is increasing in the correlation coefficient. These results are similar to Leland (2007) for relatively low and symmetric volatility of the individual firms (see Leland, 2007, proposition 1, p.792).

Panel B shows information about the values of the merged firm as well as the individual firms (acquirer and target). It also presents information regarding the optimal coupon levels and leverage ratios. We observe that both market and book leverage ratios of the merged firm are decreasing in the correlation coefficient. On the other hand, the coupon level of the merged firm appears not to change significantly compared to the sum of coupon levels of the two firms when correlation changes. This means that merged firms exploit diversification mostly by keeping coupon levels and exploiting enhanced debt capacity due to the diversification effect.

We have performed additional sensitivity results in the case merging firms with lower profitability or profitable firms with high volatility. When merging firms' costs are high relative to revenues, merger gains become negative, are enhanced the higher the correlation of the revenues of the two firms and tend to zero when the correlation becomes close to one. A similar result emerges in the case where both firms are profitable but have high volatilities. In this case we also observe that merger gains are negative and enhanced by higher correlation. It is expected that for intermediary values of volatilities or operating costs merger gains may exhibit a U-shape with respect to correlation[8].

The effect of change in volatility and bankruptcy cost of the merged firm

It has been shown empirically (see Haw, Jung and Ruland, 1994 and Thomas, 2002) that volatility of the merged firm may be higher due to the uncertainty of realized merger gains. Similarly, following the mergers, bankruptcy costs of the merged firm may be different from the simple weighted average of the two firms due to restructuring of the firm and a change in composition of a firm's assets between intangible and tangible assets. Table II shows the results of varying volatility of the merged firm. Sensitivity with respect to the volatility of the merged firm is performed through an increase in the volatility of both the acquirer and target firm volatilities while still retaining the correlation (diversification) effect.

[Insert Table II here]

[8] The U-shape of correlation at higher volatilities appears to hold in Leland (2007), p. 784.

One observes that the leverage ratio of the merged firm decreases relative to the value-weighted of the two firms. The observed U-shape of the merged firm value with respect to the volatility implies that abnormal merger returns (merger gains) have a U-shape with respect to the change in volatility of the merged relative to value-weighted of the volatility of individual firms[9].

Table III shows the results of varying the bankruptcy costs of the merged firm. The sensitivity results show that higher bankruptcy costs of the merged firm reduce merger gains and leverage decreases relative to the value-weighted of the acquirer and target firms.

[Insert Table III here]

Leland (2007) shows a different behavior of the leverage ratio as a function of volatility of the individual firms (prior to merger) for low versus high bankruptcy costs. In particular, he shows (see figure 1, p.776) that the leverage ratio of a firm may be U-shaped with respect to volatility for low bankruptcy costs while it is strictly decreasing in the case of high bankruptcy costs. Our results regarding this effect are different from Leland (2007) since we observe a strictly decreasing relationship of market leverage and volatility irrespective of bankruptcy costs. This is consistent with our benchmark model for individual firms which is Leland (1994)[10].

Operational synergies

[9] Additional sensitivity analysis in the case of high operating costs (firms with low or negative profits) revealed that there is a positive relationship between merger gains and volatility. However, the negative relationship between leverage and volatility remains.

[10] Indeed, using the analytic solution of Leland (1994) with revenue as the value driver the U-shape of leverage ratios for low bankruptcy costs with respect to volatility is not observed (these results are not tabulated). Instead, one observes a decreasing pattern of leverage with respect to volatility that flattens for medium to high volatility levels. One also observes a U-shape of firm value with respect to volatility for firms with high revenue relative to operating costs while for firms with low revenue relative to operating costs firm value is increasing in volatility. For high bankruptcy costs, the effect of volatility on leverage is more significantly negative. All these results are in line with our numerical model's prediction which is a finite horizon implementation of Leland (1994) for individual firms. We have also conducted accuracy tests against Leland (1994) analytic solution with long firm horizon which confirms the accuracy of the model. The confirmation of the results for individual firms provides us with further confidence on the observed results based on our numerical model regarding the merged firm values (which cannot be captured analytically).

Table IV shows the merger gains in the case of operational synergies (in the absence of growth options). As expected, both the EE and DE are positive and merger gains (including scaled measures) increase the higher operational synergies.

[Insert Table IV here]

Panel B of the same table shows the values of the merged firm and the individual firms. It can be seen that leverage ratios of the merged firm relative to the weighted values of the two firms should exhibit an increase.

4.2. Growth options

The effect of correlation

In Subsection 4.1 it was shown that in the absence of growth options merger gains are decreasing in the correlation coefficient for firms with relatively low volatility. In that case merger gains are purely due to diversification gains which increase debt capacity and these gains are decreasing in the correlation. We consider a similar case in this subsection, now in the presence of growth options. The diversification benefits are also expected to exist in the presence of growth options. In fact, the potential of enhanced revenues due to the potential exercise of growth options may further enhance the debt capacity and result in more tax benefits (in particular for growth options with positive downside). However, in the case of growth options two problems may arise. The first is the well-known debt overhang problem (see Myers, 1977), such that increasing debt today may jeopardize the exercise of future growth opportunities. Thus, while debt capacity may be higher with growth prospects available, increasing debt too much today may result in these options not being exercised. In the positive downside case it may result in sub-optimally high leverage in case the firm reverts to no growth state if the growth option is not exercised. Secondly, diversification also creates a negative impact on equity values, because equity holders would like to exploit higher volatility in the presence of growth options.

Table V presents the sensitivity results in the presence of growth options for firms with low initial volatility, low operating costs relative to revenues, and positive downside equal to no-growth value in the case of not exercising the option. We discuss the different implications that may exist under alternative parametization at the end of the subsection. Panel A assumes that individual firms have no growth options prior to the acquisition and that growth options are created due to the merger, for example when complementary resources of the two firms are combined.

[Insert Table V here]

In this case, total merger gains remain positive irrespective of the correlation coefficient. The EE effect is negative only for very low correlation values and becomes positive above certain correlation levels. The DE effect remains positive both because of diversification, and also because debt values increase due to the potential enhanced cash flows in case the growth option is exercised (which would enhance revenue levels, while the downside risk in the case of not exercising the option does since the cash flows remain the same as before, i.e., e = 1). The latter effect becomes apparent when one observes that even for perfect correlation DE is positive. Despite the fact that the total merger gains are positive irrespective of correlation, we still observe (like in the case of no growth options) that total merger gains are decreasing in the correlation coefficient (this also applies for the scaled measures). Thus, in this case the total merger gains continue to have a negative relationship with correlation, which are driven by a large decrease in the LE effect when correlation is high. LL also decreases but to a much lesser extent.

In Panel B we investigate the merger gains assuming growth options were available prior to the merger. We assume that the both the acquirer and target firm are symmetric and each holds a growth option to expand revenues. The merged firm is assumed to have the option to expand the joint revenues at a cost which is the sum of the individual costs. In this case, diversification hurts merged equity values compared to the sum, and as correlation tends to one, EE tends to zero. DE now is less important and thus overall gains are reduced. Thus, for merging firms with existing growth options, total merger gains are positive only for low correlation coefficients and they approach zero as correlation becomes close to one. Panel B also shows that the leverage ratio of the merged firm appears decreasing in the correlation coefficient.

Additional sensitivity results using the positive downside case showed that at high initial volatility merger gains may be increasing in the correlation. Furthermore, the zero downside growth option case (using equation 4b) revealed a similar pattern with the positive downside case with respect to volatility, i.e., merger gains are decreasing in correlation for low volatility and increasing in correlation for high volatility.

The effect of change in volatility of merged firm in the presence of growth options

In this subsection we analyze the impact of a change in the volatility of the merged firm relative to the volatilities of the individual firms in the presence of growth options. Table VI shows the results of varying merged firm volatility for the case of low investment cost and positive downside in case options are not exercised (using equation 4a). We discuss the possible different implications under high investment costs and for zero downside case (using equation 4b) at the end of this subsection.

[Insert Table VI here]

An increase in the volatility of the merged firm in this case results in a decrease in the leverage ratio of the merged firm relative to the weighted value of the two firms. Interestingly, a U-shape of merger gains with respect to the volatility of the merged firm emerges similarly to the no-growth case. In untabulated results we find that in the case of zero downside and with high investment costs, the effect of volatility on merger gains may appear strictly increasing in the volatility of the merged firm.

Q values and leverage

Let us now investigate the effect of a change in the expansion factor (growth options) on merger gains and leverage ratios of the firm. In the numerical simulations we have used the zero downside case in the case of firm's not exercising the option (using equation (4b)). We use this approach since we would like our results to be comparable with other models of the capital structure of the firm that do not investigate merger issues (see Hackbarth and Mauer, 2012 and Sundaresan and Wang, 2006). The results are not materially altered in the case of positive downside and are discussed at the end of the subsection. In calculating the merger gains, we assume that the merger creates new growth opportunities which are not available for the individual firms. We thus compare the merged firm values

with growth (e_G>1) with the weighted sum of individual firm values of the acquirer and target (assumed to be symmetric) with no growth. Table VII, Panel A, shows the effect of varying the expansion factor (growth options) on merger gains.

[Insert Table VII here]

As expected, higher growth opportunities enhance the values of equity and debt relative to the weighted sum of values of the individual firms. This is also reflected in a positive LL and LE effect. All scaled measures are increasing in the expansion factor e_G. Thus, the abnormal returns around mergers are expected to be positively associated with changes in Q values. Interestingly, Lang, Stulz and Walking (1989) have shown that the shareholders of bidders with large Qs gain more at the time of the merger compared to shareholders of low Q bidders. In their study they also show that bidders and targets have low Q prior to the acquisition (which may indicate that mergers may be an effort to enhance growth opportunities for both firms). These authors suggest that their results are consistent with the view that takeovers of poorly managed firms (low growth firms) by high Q firms result in both higher bidder, target and thus overall gains (see also Servaes, 1991). The DE in panel A shows a U-shape in relationship to changes in Q (represented as the difference of Q of the merged firm relative to weighted average of Qs of the two firms).

Panel B shows the effect of growth options on merger values, market leverage and book leverage ratios, and Q values. This panel also includes the expected change of leverage of the merged firm compared to weighted values between the two firms. We first note that as expected a higher e_G factor is associated with higher Q values. Q values are calculated by taking the ratio of the levered firm value with the value of unlevered assets with no growth (e_G=1). Note that even in the case were e_G =1, Q has a value higher than 1 which reflects the expected benefits arising from the enhanced tax benefits of using debt (not captured by the unlevered value of assets). We first observe that equity values of the merged firm are increasing in the expansion factor (Q). Surprisingly, debt values of the merged firm may exhibit an initial decrease for low expansion factors (Q) and then an increase, i.e., debt values exhibit a U-shape with respect to the expansion factor (Q). This is the driver of the observed U-shape of DE with respect to changes in Q observed earlier. This effect is also reflected in the market and book leverage ratios of the merged firm and in the corresponding change in the leverage ratios of the merged

firm relative to the weighted average of the leverage ratios of the two firms. It is thus expected that the effect of leverage changes will have a negative relationship with Q and positive with Q^2 (capturing the U-shape relationship of leverage change with Q). Hackbarth and Mauer (2012) model predicts a similar U-shape relationship of market leverage with Q for stand-alone firms (not in a merger context) and a positive relationship of book leverage with Q. The U-shape relationship of book leverage found in our case may exist because of the high cost of investment used; when investment costs are lower book leverage has a strictly increasing relationship with Q as in Hackbarth and Mauer (2012). Thus, the U-shape may appear in the more general case for both the market and book leverage and its extent depends on the relative values of e_G and I_G[11].

In the case of positive downside (not tabulated), the U-shape of market and book leverage also appears for high enough investment costs. In this case, initially (for low e_G factors or Q) leverage remains constant due to the high possibility that the option will not be exercised (reverting to the no growth value). As the growth factor increases, leverage drops initially and then increases at high enough expansion factors (Q values).

Empirical predictions of the model

Table VIII summarizes the empirical predictions of our model.

[Insert Table VIII]

The column showing the predicted sign of the effect of different parameters on leverage levels are generally consistent with trade-off theory models (see for example, Leland, 1994, and Hackbarth and Mauer, 2012). The model predicts a negative effect of correlation, volatility, bankruptcy costs and relatively small value of growth options and a positive effect of profitability and large increases in the value of growth options.

The column corresponding to the predicted effects before the merger reflect the predictions of the model regarding expected leverage changes of the merged firm relative to leverage levels of the two firms and the DE effect. The higher the expected increase in the leverage of the merged firm and the DE effect the greater the incentive to reduce debt before the merger and increase debt at and after the

[11] Similarly to Hackbarth and Mauer (2012) the U-shape appears if one varies the investment cost I_G instead of e_G.

merger. For example, at higher correlation the DE effect and leverage of the merged firm drops, thus firms have no incentive to decrease leverage before the merger and the predicted sign would be zero or positive. Similarly, an increase in the volatility, bankruptcy costs or a small enhancement in the growth option value of the merged firm relative to individual firms is not expected to give incentives for leverage decreases before the merger with the predicted sign being zero or positive. An expected increase in operational synergies or high levels of value-enhancement arising from new growth options are expected to provide incentives for debt reduction before the merger. As noted above, the predicted signs of the column reflecting leverage changes after the merger will in generally be the opposite of those before. For example, if the correlation between the two firms' cash flows is low, firms are expected to reduce leverage before the merger and exploit diversification benefits issuing cheaper debt after. The last column shows the predicted signs of parameters on merger gains. The predicted signs reflect the direction of the scaled merger gains measures shown in our numerical sensitivity analysis above.

5. Testing the model

5.1. Data and Sample Selection

Our initial sample of mergers and acquisition consists of all public US acquisitions in ThomsonReuters SDC Platinum completed between 1 January 1980 and 31 December 2009. We exclude financial firms, utilities, REITS, LBOs, buybacks and recapitalizations and further restrict our sample to acquisitions of majority stakes in the target for a transaction value of at least US$ 100 million. The size restriction of the sample allows for the acquisition to have a measurable impact on the acquirer's balance sheet and capital structure. We further limit our sample to acquirers that engaged in only one acquisition of such size within five years and require at least two years of pre and post-acquisition financial data for the acquirer and target to be available in Compustat. Stock returns for the sample firms are obtained from CRSP. The final sample consists of 11095 acquisition years (1113 acquisitions) with accounting and stock return data for acquirer and target firms. A detailed description of the variables used in the empirical analysis is provided in Appendix A.

The main variables of interest in our analysis are the leverage ratios (book and market leverage) and various proxies for growth options. All accounting variables are winsorized at the 1%-level and market and book leverage are constrained to lie in the closed unit interval. We are aware that Tobin's Q proxies are likely to contain measurement errors and therefore are poor measures of growth opportunities (see Erickson and Whited, 2006). Therefore, as proxies for growth options besides *Q* (the

ratio of market value of assets to their book value), we also employ *RKV (*a growth opportunities measure borrowed from Rhodes-Kropf, Robinson and Viswanathan (2005) decomposition of the market to book equity ratio described in Appendix B), *CAPEX* (the ratio of capital expenditure to total assets) and *RND* (the ratio of research and development expense to sales). One widely discussed problem with using *Q* as a proxy for growth opportunities is a likely correlation with stock overvaluation, a problem we think is potentially more prevalent in a merger context. Previous evidence suggest a positive association between merger waves and stock market valuation highs, in which firm's issue more equity (Rhodes-Kropf, Robinson and Viswanathan 2005; Rau and Stouraitis 2011; Dong et al 2006; Baker and Wurgler 2002). This in turn reduces book and market leverage. The negative relationship of *Q* with market leverage found in previous empirical studies might thus also be partly of mechanical nature since both market leverage and Q are affected by higher market values of equity.

Table IX presents summary statistics for the acquirer (Panel A), target (Panel B) and merged firm (Panel C). Acquirer and target variables refer to stand alone values before the merger. The acquirers in our sample are relatively large firms with average total assets of US$ 2.3bn and market value of equity of around US$ 3bn. Their mean book (market) leverage is around 0.52 (0.35). The target firms have total assets of almost US$ 550mm and a market value of equity of about US$ 560mm. Their mean book (market) leverage is around 0.51 (0.36). These figures are somewhat larger than leverage ratios in prior capital structure studies (e.g., Lemmon, Roberts and Zender 2008; Morellec and Zhdanov 2008), but consistent with the finding that larger firms tend to have higher leverage ratios (Titman and Wessels 1988) and with leverage ratios in Rhodes-Kropf, Robinson and Viswanathan (2005). Total assets and the market value of equity for the merged firm increase to an average of US$ 4.6bn and US$ 5.6bn, respectively. The book (market) leverage of the combined firm is 0.60 (0.43) and higher than the ratios of the stand-alone firms. Our growth option measures are broadly consistent with the prior literature (e.g., Rhodes-Kropf, Robinson and Viswanathan 2005; Brav 2009; Frank and Goyal 2009). The summary statistics of our sample are generally consistent with expectations and the previous literature.

Table X presents differences in characteristics between acquirer and target firms before the merger and compares the merged entity post-merger with the pro-forma combined firm pre-merger. Pro-forma variables are calculated as the value-weighted averages (by total assets) of the respective pre-merger target and acquirer variables. Unsurprisingly, acquiring firms are significantly larger (in terms of sales and market value of equity) than target firms. Acquiring firms in our sample also tend to have higher market-to-book and Q ratios than their targets consistent with the findings of Dong et al.

(2006) and Rhodes-Kropf, Robinson and Viswanathan (2005). Consistent with higher market-to-book ratios and insignificant differences in book leverage ratios between acquirer and target, acquiring firms have as a result on average significantly lower market leverage ratios than targets. Acquirers are on average also more profitable (measured by their return on assets and net profit margins) and have lower bankruptcy costs than their target firms.

Furthermore, the comparison of the merged firm with the pro-forma acquirer and target firm combined before the merger in the right-hand columns of Table X reveals several differences worth noting. The merged firms show significantly higher sales and market capitalization suggesting that on average these acquisitions are successful in creating sales growth and shareholder value in the five years after the acquisition. On the other hand, profitability measures for these firms (measured by their return on assets *ROA* and net profit margin *NPM*) and the majority of the growth option proxies are significantly lower for acquiring firms compared to targets. Moreover, book and market leverage ratios are significantly higher after the merger than the pre-merger combined pro-forma values consistent with the predictions of our model. The bankruptcy cost measure and revenue volatility are significantly lower which is also consistent with model predictions and theory (i.e., co-insurance and diversification effects).

5.2. Merger characteristics and leverage: univariate analysis

This section reports empirical differences in leverage levels and changes in leverage before and after the merger conditional on the merger related and firm-specific characteristics identified in our theoretical model using univariate analysis. Findings of multivariate analyses are presented in the next section.

Table XI presents cross-sectional differences in leverage and changes in leverage with respect to differences in merger and firm-specific characteristics. Panel A shows values for the pro-forma combined acquirer and target prior to the merger. The pro-forma merged firms are sorted into whether their pre-merger growth options are higher or lower than the time-varying sample median (columns) and further sorted into quintile portfolios with respect to several characteristics (correlation, volatility, bankruptcy costs, profitability, synergies), where both the two lowest quintiles of the respective variable (low) and the two highest quintiles (high) are combined. The panel reveals significant differences in average market leverage (*ML*) and book leverage (*BL*) broadly consistent with our model predictions and theory. Irrespective of the level of growth opportunities, merging firms with high correlation, high volatility, high bankruptcy costs and high profitability/ profit margins have

significantly lower *ML* and *BL* before the merger. Moreover, across the different firm characteristics *ML* (*BL*) is significantly higher (lower) for firms with low pre-merger growth options compared to firms with high pre-merger growth options (t-statistics of differences in right hand columns of Panel A). The results on changes in ML after the merger (-1,+3) are somewhat less strong. Merging firms with highly correlated activities increase their leverage more than firms with low correlation irrespective of the pre-merger value of growth opportunities. Consistent with our prediction firms with low bankruptcy costs and high growth opportunities increase leverage relatively more and firms with high ROA and profit margins increase leverage less (irrespective of the value of pre-merger growth options).

Panel B presents differences in leverage levels and changes with respect to the merger characteristics and conditioned on whether growth options are created with the merger or destroyed measured as a change in *GROWTH* pre to post merger. Again the merging firms are sorted into high and low groups based on the two highest and lowest quintiles of the respective variables and mean leverage levels and mean changes in leverage are shown for high and low groups with respect to whether the merging firms created or destroyed growth options with the merger. The evidence presented in this Panel broadly suggest that merging firms with an increase in growth options have significantly higher leverage levels post-merger, but significantly smaller increases in leverage compared to merging firms with a decrease in growth options. Panel B also confirms the pre-merger evidence from Panel A that irrespective of whether growth opportunities are created, merging firms with high correlation, high volatility, high bankruptcy costs and high profitability/ profit margins have significantly lower *ML* and *BL* after the merger.

5.3. Merger characteristics and leverage: multivariate analysis

In this section we test our model predictions in a multivariate setting. First we run regressions on market and book leverage *levels* using annual pooled cross-sectional regressions over the panel of mergers from five years before the year of merger completion to five year after. We then run regressions on market and book leverage *changes* pooled over annual three year rolling windows ((-3,+1); (-2,+2); and (-1,+3)) pre to post merger. Except for the correlation measure between acquirer and target and indicator variables all variables are calculated as the pro-forma weighted average values of acquirer and target pre-merger and the values of the merged entity post-merger winsorized at the 1%-level. The explanatory variables are employed with a one-year lag in the levels regressions and as pre-to post merger difference in the changes regressions. Due to space limitations regression results for

book leverage are not reported separately and, unless stated otherwise, are qualitatively consistent with the results on market leverage. The main variables of interest are *CORR*, the stock return correlation between acquirer and target, and *GROWTH,* the measure of growth options of the firms. Consistent with prior theoretical evidence (e.g., Leland 2007) and the predictions of our model *CORR* is expected to be negatively associated with leverage due to co-insurance effects and higher debt capacity of a more diversified merged entity. Growth options of the firm are expected to have a U-shaped relationship with leverage and thus the coefficient on *GROWTH* is expected to be negative while the coefficient on *GROWTH2* is expected to be positive.

Table XII presents regression results of pooled cross-sectional regressions on the dependent variable market leverage. The regression coefficients are estimated using pooled OLS with industry fixed effects (left-hand columns) and random effects GLS (right-hand columns). Models (1) to (4) use the different proxies for growth opportunities discussed. In order to capture the U-shaped relationship of *GROWTH* with leverage a quadratic term of *GROWTH* is also included. Due to the usual high correlation between explanatory variables and their squared term, *GROWTH* and *GROWTH2* enter all regressions with their centered (de-meaned) values. We also incorporate pre-event year indicator variables to capture any changes in leverage in the years preceding the acquisition and the years after. In addition to the main variables of interest several determinants of leverage are included in the specification consistent with our model parameters and prior empirical studies (e.g., Lemmon, Roberts and Zender 2008; Rajan and Zingales 1995; Frank and Goyal 2004; Baker and Wurgler 2002).

The results in Table XII confirm a significantly negative relationship between the correlation of the acquirer and target and the merged firm's market leverage (coefficient on average around -0.03 across specification, p-value<0.01). The coefficient of *GROWTH* is also significantly negative in all specifications, but one, (p-values<0.01), while its quadratic term is significantly positive (p-values<0.01) except for in the specification with *Q* as proxy for *GROWTH*. As discussed, the mixed results on *Q* might be due to the possible correlation with market misvaluation. In fact, the coefficient on *MISVAL* is consistently negative across specifications (p-values<0.01) capturing the negative correlation between market leverage and higher equity valuation. The results confirm our model predictions on a U-shaped relationship between growth options and leverage. Market leverage is inversely related to growth for firms with low to medium growth opportunities, but turns positive for firms with large growth opportunities. These results remain robust for the different proxies for growth and when misvaluation is controlled for, which has a significantly negative effect on leverage. This might reflect the mechanical inverse relationship between market equity and market leverage, but also

the prior evidence that highly valued firms are more likely to pay acquisitions with stock and thereby reduce their leverage.

The coefficient estimates on all other variables are generally consistent with model predictions and the previous evidence in the literature. The coefficients on volatility and bankruptcy costs are significantly negative and the coefficients on the tangible asset ratio and size are significantly positive. The coefficient on profitability is significantly negative which is consistent with the prior literature, but contrary to our model predictions. We control for the dynamics of leverage around mergers using yearly indicator variables. The significantly negative coefficients on the pre-merger years (*BEFORE1-4*) are consistent with the prediction that leverage levels are lower in the pre-merger years and decreasing in the run-up years to the merger (starting from 2 years prior to the merger). Other things equal, market leverage ratios decrease from around 4% points below post-merger leverage ratios three years before the merger to almost 7% points below in the immediate year before merger completion. Post-merger leverage ratios of the merged firms are significantly higher than pre-merger pro-forma combined ratios. Moreover, our model predicts up to almost half of the cross-sectional variation in leverage ratios of merging firms.

Table XIII reports results on the changes in market leverage before and after the merger completion. The regression coefficients are estimated using pooled OLS with industry fixed effects (left-hand columns) and Prais-Winston FGLS (right-hand columns). Standard errors are clustered by mergers. Models (1) to (4) use the same varying proxies for growth opportunities as before measured as changes, *DGROWTH*, and their quadratic terms *DGROWTH2*. To examine the dynamics of leverage more closely we introduce interaction terms with the indicator variable for the year before the merger (*BEFORE1*). The interaction terms capture the effect of the interacted variables on leverage changes in the year before the merger. The coefficients on the not interacted variables capture the effect of these variables on leverage changes after the merger.

The coefficients on the indicator variables confirm our previous results and show a significant decrease in leverage in the year just prior to the merger (*BEFORE1*) and significant increases in leverage in years two and three (*AFTER2* and *AFTER3*). Consistent with our predictions *CORR* is generally significantly negatively associated with post-merger changes in market leverage across specifications and significantly positively associated with pre-merger changes. Merging firms that are less correlated in their activities decrease their leverage just before the merger and increase their leverage in the years after. This result is consistent with model predictions that merging firms with less correlated activities are able to increase leverage relatively more due to the higher debt capacity of the

diversified firm. The results on changes in growth options and its quadratic term are somewhat weaker, but also broadly corroborating model predictions. Again, using *Q* as growth measure delivers conflicting results, while using the other growth proxies confirms the negative coefficient with *DGROWTH* and the positive coefficient with *DGROWTH2*. Merging firms with large growth options increase their leverage post-merger. The results on premerger changes are somewhat mixed, however.

Changes in *ROA* are negatively associated with changes in market leverage across specifications which is consistent with the literature, but not what we expected based on our model. The coefficient on *SYN*, on the other hand, is generally positive, which is consistent with the predictions of our model that synergies between the merging firms increase market leverage due to higher interest coverage and a higher potential credit rating. With respect to changes in bankruptcy costs, the regression results on *DBC* are consistent with model predictions and theory. Other things equal increases in bankruptcy costs are negatively associated with post-merger changes in leverage. They are also negatively associated with pre-merger leverage changes. Changes in the tangible asset ratio are also negatively correlated with post-merger changes in market leverage and positively correlated with pre-merger changes. This might be explained by a possible negative correlation between *DTAN* and expected synergies of the acquisition. Expected synergies will be captured in the goodwill created in the acquisition which in turn will reduce the tangible asset ratio of the merged firm compared to the individual firms pre-merger. Thus, a decrease in *DTAN* might reflect an increase in *SYN* and therefore might motivate the merging firms to decrease leverage before the merger and increase leverage after as predicted by our model. Other control variables included in the regressions do not show any significance.

5.4. Merger gains

Table XIV presents the results of a univariate (Panel A) and multivariate analysis (Panel B) of acquirer, target and combined firm cumulative abnormal announcement returns for the three days around the acquisition announcement. Panel A shows cumulative abnormal returns (CARs) conditioned on various merger characteristics (rows) for acquirer, target and the combined firm based on the two lowest (low) and the two highest (high) quintile portfolios of the respective variables. Total merger gains in the right column are calculated as the market value weighted CARs of acquirer and target.

Consistent with model predictions, total merger gains are higher with an increase in growth options and an increase in profitability with the merger and lower with high correlation, high volatility, high bankruptcy costs. The results on synergies are not that clear cut.

Table XIV, Panel B presents the results of cross-sectional regressions on total merger gains measured as the value-weighted sum of the announcement CARs of bidder and target. Consistent with our model predictions and the previous univariate results total merger gains are negatively associated with *CORR*. Diversification decreases the gains to equity holders unless it enables the firms to increase leverage. The coefficients on *ML* and *HIGHML* are significantly positive (see also Maloney, McCormick and Mitchell 1993). Consistent with prior evidence large mergers and mergers that involve highly valued acquirers are on average value destroying (e.g., Moeller, Schlingemann and Stulz 2005; Fu, Lin and Officer 2012). Merger gains are also positively associated with *ROA* and with *FOCUS* (see also DeLong 2001) while merging firms with high bankruptcy costs have significantly lower CARs.

6. Conclusions

This paper develops a dynamic trade-off model for the analysis of the optimal capital structure in mergers and acquisitions. The model accommodates operational synergies and growth options in mergers and generates new predictions on the cross-sectional differences in leverage and merger gains in connection with diversification effects and merger related growth options as well as firm-specific differences in volatility, bankruptcy costs and growth options of the acquirer and target firms. In particular, the model predicts that merging firms that have lower correlation of cash flows, have larger merger gains, reduce debt before the merger and increase leverage more significantly after the merger. We further find that firms with decreases in volatilities and bankruptcy costs due to the merger, have higher merger gains, are more likely to reduce debt prior to acquisition and have higher increases in leverage after the merger. Moreover, the model predicts that positive changes in growth options of the merged firm relative to the growth options of the acquirer and target firms will monotonically enhance merger gains and have a U-shaped relationship with leverage. The implications of the model are generally consistent with the available theoretical and empirical evidence.

We further empirically test a number of new predictions of our model on a large sample of US acquisitions between 1980 and 2010. The empirical results corroborate the model's prediction on cross-

sectional differences in leverage ratios of merging firms and changes in leverage around mergers. Firms with less correlated activities, higher growth options, lower volatilities of cash flows and lower bankruptcy costs have higher leverage, decrease leverage before the merger and increase leverage after the merger. These firms also enjoy higher stock returns around merger announcements. Our findings are consistent with a dynamic capital structure theory, where investment and growth opportunities play an important role in capital structure choices.

References

Asquith, P., R.F. Bruner, D. Mullins Jr., 1983, The gains to bidding firms from merger, *Journal of Financial Economics* 11, 121-139.

Asquith, P., T. A. Wizman, 1990, Event Risk, Covenants, and Bondholder Returns in Leveraged Buyouts, *Journal of Financial Economics* 27, 1, 195-213.

Baker, M and Wurgler, J, 2002, Market timing and capital structure, *The Journal of Finance* 57, 1-31

Barclay, M.J., Smith Jr, C.W., 1995, The priority structure of corporate liabilities, *Journal of Finance* 50, 899-917

Barclay, M.J., Morellec, E., Smith Jr, C.W., 2006, On the debt capacity of growth options, *Journal of Business*, 79, 37-59

Bhagat et al , 1990

Boyle, PP., Envine J. and S. Gibbs, 1989, Numerical evaluation of multivariate contingent claims, *Review of Financial Studies* 2, 241-250.

Billett, M. T., King, Tao-Hsien D., and Mauer, D. C., 2004, Bondholder Wealth Effects in Mergers and Acquisitions: New Evidence from the 1980s and 1990s, *The Journal of Finance* 59, 1, 107-135.

Brav, A., Michaely, R., Roberts, M.R., Zarutskie, R, 2009, Evidence on the trade-off between risk and return for IPO and SEO firms, *The Journal of Finance*

Bruner, R. F., 1988, The Use of Excess Cash and Debt Capacity as a Motive for Merger, *Journal of Financial and Quantitative Analysis* Vol. 23, pp. 199-217.

Cai, J. and Zhang, Z., 2011, Leverage change, debt overhang, and stock prices, *Journal of Corporate Finance* 17, 3, 391-402.

Chatterjee, S., 1986, Types of synergy and economic value: The impact of acquisitions on merging and rival firms, *Strategic Management Journal* 7, 119-139.

Chatterjee, S. and Wernerfelt, B, 1991, The link between resources and type of diversification: Theory and evidence, *Strategic Management Journal*, 12, 1, 33-48.

Chen, L. and Zhao, X, 2005, On the relation between the market-to-book ratio, growth opportunity and leverage ratio, *Finance Research Letters*, 3, 253-266

Clayton, M.J., and Ravid, S.A., 2002, The Effect of Leverage on Bidding Behavior: Theory and Evidence from the FCC Auctions, *Review of Financial Studies* 15 (3), 723-750.

DeAngelo, H., DeAngelo, L., Whited, T.M., 2011, Capital Structure Dynamics and Transitory Debt, *Journal of Financial Economics* 99, 235-261.

DeLong, G., 2001, Stockholder gains from focusing versus diversifying bank mergers, *Journal of Financial Economics* 59, 221-252.

Denis, David J. and McKeon, Stephen B., 2012, Debt Financing and Financial Flexibility: Evidence from Pro-active Leverage Increases. *Review of Financial Studies*, forthcoming.

Dong, M, Hirshleifer, P.K., Richardson, S. and Teoh, S, 2006, Does investor misevaluation drive the takeover market? *The Journal of Finance*

Dudley, E, 2009, Capital structure and large investment projects, mimeo, University of Florida

Erickson, T. and Whited, T.M., 2006, On the accuracy of different measures of q, *Financial Management*, 5-33

Fama, E.F., French, K.R., 2002, Testing Trade-Off and Pecking Order Predictions About Dividends and Debt, *The Review of Financial Studies* 15, 1-33.

Fama, E.F. and French, K.R, 2005, Financing decisions: who issues stock? *Journal of Financial Economics,*76, 549-582

Frank, M.Z., Goyal, V. K. 2009, Capital structure decisions: Which factors are reliably important. *Financial Management* 38, 1-37.

Franks, J.R. Harris, R.S. and Mayer, C., 1988, Means of Payment in Takeovers: Results for the United Kingdom and the United States in Corporate Takeovers: Causes and Consequences, Editor: Alan J. Auerbach, National Bureau of Economic Research, 221 – 264.

Fu, F., L. Lin, and M. Officer, 2010, Acquisitions driven by stock overvaluation: Are they good deals? Working paper.

Galai, D. and Masulis, R.W., 1976, The option pricing model and the risk factor of stock, *Journal of Financial Economics* 3, 53-81.

Gamba, A. and Triantis, A, 2008, the value of financial flexibility, *The Journal of Finance* 63, 2263-2296.

Ghosh, A. and Jain, P., 2000, Financial leverage changes associated with corporate mergers, *Journal of Corporate Finance* 6, 377–402.

Graham, J. R., and C. R. Harvey, 2001, The theory and practice of corporate finance: evidence from the field, *Journal of Financial Economics* 60, 187-243.

Gugler, K. and K. A. Konrad, 2002, Merger Target Selection and Financial Structure, University of Vienna and Wissenschaftszentrum Berlin (WZB).

Hackbarth, D. and Mauer, D., 2012, Optimal Priority Structure, Capital Structure, and Investment, Review of Financial Studies 25, 747-796.

Hackbarth, D. and Morellec E, 2008, Stock Returns in Mergers and Acquisitions, *Journal of Finance*, 63, 1213-1252.

Harford, J., 2005, What drives merger waves? *Journal of Financial Economics* 77, 529-560.

Harford, J., S. Klasa, and N. Walcott, 2009, Do firms have leverage targets? Evidence from acquisitions, *Journal of Financial Economics* 93, 1-14.

Haw, I., Jung, K., and W. Ruland, 1994, The Accuracy of Financial Analysts' Forecasts After Mergers, *Journal of Accounting, Auditing and Finance* 9, 465−483.

Healey, P.M., Palepu, K.G. and Ruback, R.S, 1992, Does corporate performance improve after mergers? *Journal of Financial Economics*, 31, 135-175

Hennessy, C. and Whited, T. 2005, Debt dynamics, *The Journal of Finance* 60, 1129-1165

Hovakimian, A., Opler, T. Titman, S, 2001, The debt-equity choice, *Journal of Financial and Quantitative Analysis,* 36, 1-24

Hovakimian, A., Hovakimian, G., Tehranian, H, 2004, Determinants of target capital structure: the case of combined debt and equity financing, *Journal of Financial Economics,* 71, 517-541

Jensen, M.C., 1986, Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review*, 76, 2, 323-329.

Jensen, M. C. and Meckling, W. H., 1976, Theory of the firm: managerial behavior, agency costs and ownership structure, *Journal of Financial Economics*, 3, 305–360.

Jovanovic, B. and Rousseau, P.L., 2002, The Q-Theory of Mergers. *The American Economic Review* 92(2), 198–204.

Kayhan, A., and S. Titman, 2007, Firms' histories and their capital structure, *Journal of Financial Economics* 83, 1-32.

Kaplan, S.N and Wiesbach, M.S., 1992, The success of acquisitions: evidence from disvestitures, NBER WP w3484

Kim, H.E. and McConnell, J.J., 1977, Corporate Mergers and the Co-Insurance of Corporate Debt, *The Journal of Finance* 32, 2, 349-365.

Kraus, A. and Litzenberger, R.H., 1973, A State-Preference Model of Optimal Financial Leverage, *The Journal of Finance*, 28, 4, 911-922.

Lambrecht, B. M., 2004, The timing and terms of mergers motivated by economies of scale, *Journal of Financial Economics* 72, 41–62.

Lambrecht, B.M. and Myers, S, 2007, A theory of takeovers and disinvestment, *The Journal of Finance*, 62, 809-845

Lang, L.H.P., Ofek, E., Stulz, R, 1996, Leverage, investment and firm growth, *Journal of Financial Economics* 40, 3-29

Lang, L.H.P, Stulz, R.M, and Walkling,R.A.,1989, Managerial performance, Tobin's Q, and the gains from successful tender offers, *Journal of Financial Economics* 24,1, 137-154.

Leary, M.T. and Roberts, M.R. 2005, Do firms rebalance their capital structures? *The Journal of Finance* 60, 2575-2619

Leland, H.E., 1994, Corporate Debt Value, Bond Covenants, and Optimal Capital Structure, *Journal of Finance* 49, 1213-1252

Leland, H. E., 2007, Financial synergies and the optimal scope of the firm: Implications for mergers, spinoffs, and structured finance, *Journal of Finance* 62, 765–807.

Lemmon, M., M. Roberts, J.F. Zender, 2008, Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure, *Journal of Finance* 63, 1575-1608.

Lewellen, W., 1971, A pure financial rationale for the conglomerate merger, *Journal of Finance* 26, 521–537.

Lobanov, S. and Strebulaev, Y.A, 2007, A Theory of Dynamic Corporate Financing and Investment, mimeo, Stanford University

Makri, M., Hitt, M.A. and Lane, P.J., 2010, Complementary technologies, knowledge relatedness, and invention outcomes in high technology mergers and acquisitions. *Strategic Management Journal* 31, 602–628.

Maloney, M.T., R.E. McCormick, and M.L. Mitchell,1993, Managerial decision making and capital structure, *Journal of Business* 66, 198-217.

Mandelker, G., 1974, Risk and Return: the case of merging firms, *Journal of Financial Economics* 1, 303-335.

Martynova, M. and Renneboog, L., 2009, What determines the financing decision in corporate takeovers: Cost of capital, agency problems, or the means of payment?, *Journal of Corporate Finance*, 15(3), 290-315.

Modigliani, F. and M. Miller, 1958, The cost of capital, corporation finance and the theory of investment, *American Economic Review* 48, 261-297.

Montgomery, C.A., 1994, Corporate Diversification, *The Journal of Economic Perspectives* 8, 3,163-178.

Morellec, E. and Schurhoff, N, 2010, Dynamic investment and financing under personal taxation, *The Journal of Finance*, 23, 101-146

Morellec, E. , Zhdanov, A., 2005, The dynamics of mergers and acquisitions, *Journal of Financial Economics* 77, 649-672.

Morellec, E., Zhdanov, A., 2008, Financing and takeovers, *Journal of Financial Economics*, 87, 556–581.

Myers, S.C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 2, 147-175

Myers, S.C., Majluf, N.S., 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 2, 187-221.

Rajan, R. Zingales, L., 1995, What do we know about capital structure? Some evidence from international data. *Journal of Finance*, 50, 1421-1460

Rau, R. and Stouratis, 2011, Patterns in the timing of corporate event waves, *The Journal of Financial and Quantitative Analysis*, 46, 209-246

Ravenscraft, D.J., and Scherer, F.M., 1987, Life After Takeover, *The Journal of Industrial Economics* 36, 147-156.

Rhodes-Kropf, M. and Viswanathan, S., 2004, Market valuation and merger waves. *Journal of Finance* 59, 2685–2718.

Rhodes-Kropf, M., Robinson, D. and Viswanathan, S., 2005, Valuation waves and merger activity: The empirical evidence, *Journal of Financial Economics* 77, 561-603.

Schlingemann, F.P., 2004, Financing Decisions and. Bidder Gains, *Journal of Corporate Finance* 10, 683-701.

Scott, J.H., 1977, On the theory of conglomerate mergers, *Journal of Finance* 32, 1235-1250.

Servaes, H., 1991, Tobin's Q and the Gains from Takeovers, *The Journal of Finance* 46,1,409-419.

Singh, H. and Montgomery, S., 1987, Corporate acquisition strategies and economic performance, *Strategic Management Journal* 8, 377-386.

Sundaresan, S. and Wang, N., 2007, Dynamic investment, capital structure, and debt overhang, Working paper, Columbia University.

Thijssen, J.J.J., 2008, Optimal and strategic timing of mergers and acquisitions motivated by synergies and risk diversification, *Journal of Economic Dynamics and Control*, 32, 5, 1701-1720.

Thomas, S. 2002, Firm Diversification and Asymmetric Information: Evidence From Analysts' Forecasts and Earnings Announcements, *Journal of Financial Economics*, 64 373-396.

Titman, S., and R. Wessels, 1988, The determinants of capital structure, *Journal of Finance* 43, 1-19.

Travlos, N.G., 1987, Corporate Takeover Bids, Methods of Payment, and Bidding Firms' Stock Returns, *The Journal of Finance* 42, 4, 943-963

Tsyplakov, S, 2008, Investment frictions and leverage dynamics, *Journal of Financial Economics*, 89, 423-443

Uysal, V. B., 2011, Deviation from the Target Capital Structure and Acquisition Choices, *Journal of Financial Economics* 102, 602-620.

Yang, T.-H., 2009, The adjustment of capital structure in mergers and acquisitions: Re-visit the theory of optimal capital structure, Working paper.

Welch, I. 2004, Capital structure and stock returns, *Journal of Political Economy*, 112, 106-131.

APPENDIX A – Variable Definitions [Compustat items in parenthesis]

AFTERt	Indicator variable equal to 1 for each year t after merger completion with t=1..5
BC	Bankruptcy cost following Berger at al. (1995) calculated as 1-([che]/[at])+0.715*(([act]-[invt])/[at])+0.547*([invt]/[at])+0.535*([ppent]/[at])
BEFOREt	Indicator variable equal to 1 for each year t before merger completion with t=1..5
BL	Book Leverage = *TL/TA*
BE	Book value of equity [ceq]
CAPEX	Capital expenditure to total assets ratio = [capx]/[at]
CORR	Correlation coefficient of pre-merger acquirer and target stock returns
D-prefix	Indicates change in variable measured in difference of post- to pre-merger values in four year lagged rolling windows (-3,+1); (-2,+2); (-1, +3)
EBITVOL	5-year pre-merger standard deviation of [ebit]
FOCUS	Indicator variable if acquirer and target in the same industry according to Fama-French 12 industry classification
GROWTH	Growth options proxy defined as labelled using *Q*, *RKV*, *CAPEX* or *RND*
GROWTH2	*GROWTH* squared
HIGHBC	Indicator variable equal to 1 if firm in two highest bankruptcy cost quintiles in the respective year
HIGHML	Indicator variable equal to 1 if firm in two highest market leverage quintiles in the respective year
MB	Market-to-book equity = *MVE/BVE*
MISVAL	Rhodes-Kropf et al. (2005) misvaluation measure calculated as explained in Appendix B
ML	Market Leverage = 1-(*MVE/MVA*), where *MVA*
MVA	Market value of assets calculated as market value of equity (*MVE*) plus book value of total assets [at] minus book value of equity [ceq] minus deferred taxes [txndb]
MVE	Market value of equity [prcc_c*csho]
NPM	Net profit margin calculated as net income divided by sales [ni/at]
PREGROWTH	5-year mean pre-merger *GROWTH*

PSVOL	Portfolio standard deviation of sales of merged firm measured as the square root of $SVOL_A^2 \times w_A^2 + SVOL_T^2 \times w_T^2 + 2w_A w_T SCORR \times SVOL_A \times SVOL_T$, where *w* is the respective total asset weight of acquirer and target
Q	Tobin's Q measured as the sum of market value of equity (*MVE*) plus book value of total assets (*TA*) minus book value of equity (*BVE*) divided by the book value of total assets (*TA*)
Q2	*Q* squared
RDD	Indicator variable equal to 1 if RND unequal to zero
RKV	Rhodes-Kropf et al. (2005) growth opportunities measure calculated as explained in Appendix B
RND	Research & development expense to sales ratio [xrd/sale]
ROA	Return on assets calculated as earnings before interest and taxes divided by total assets [ebit/at]
SALES	Natural logarithm of Sales [sale]
SCORR	Correlation coefficient of pre-merger sales of acquirer and target
SYN	Realised cost synergies measured as changes in net profit margin *NPM* pre- to post merger
TA	Book value of total assets [at]
TAN	Tangible asset ratio measured as 1-(([intan]+[gwdl])/[at])
TL	Book value of total liabilities [lt]
VOL	5-year pre-merger standard deviation of sales

APPENDIX B – Rhodes-Kropf et al (2005) misvaluation and growth measures

The main misvaluation measure we use follows Rhodes-Kropf et al's (2005) decomposition of the market-to-book ratio into two misvaluation components and one long-run value to book (growth opportunities) component. We use their model 3 which links the market value of equity to book value, net income and leverage in a residual income type valuation model developed by Ohlson (1995) and Feltham and Ohlson (1995). In specific, we run following annual cross-sectional regressions on the entire universe of Compustat firms in our sample period for each industry within the 12 Fama-French industry groups:

$$ln(M_{it}) = \alpha_{0it} + \alpha_{1it} \ln(B_{it}) + \alpha_{2it} \ln(|NI|_{it}) + \alpha_{3it} I * ln(|NI|_{it}) + \alpha_{4it}(ML_{it}) + \varepsilon_{it} \quad \text{(B1)}$$

M is the market value of equity, *B* the book value of equity, *NI* stands for net income (in absolute values), *I* is an indicator if *NI* is negative and *ML* is the market leverage ratio. The coefficients can be interpreted as annual industry multiples capturing time-varying risk-premia and growth rates. As in Rhodes-Kropf , Robinson and Viswanathan (2005) the coefficients are used to obtain predicted values for each firm, which in turn are used to decompose the market to book ratio into a valuation error (*MISVAL)* and a long-run value to book as a proxy of growth opportunities (*RKV*). The valuation error (*MISVAL*) captures the misvaluation component of the firm which is due to contemporaneous firm-specific and industry-wide misvaluation relative to long-run valuations. *RKV* captures the residual component of the market-to-book ratio which is not influenced by temporary firm-specific or industry-wide market valuation errors.

Table I

The effect of correlation

Notes: Symmetric acquirer (A) and target (T) firms considered with revenues $P_i = 10$, operating cost $C_i = 5$, volatility $\sigma_i = 0.1$, opportunity cost $\delta_i = 0.05$, tax rate $\tau_i = 0.3$ and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. Case with no growth options or operational synergies e_G=e=1, $I_G = 0$. Firms horizon $T = 20$ years. Lattice steps $N = 200$ steps with dt = 0.1. Coupon optimization based on coupon increments of 0.1 with maximum level at 2 times P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE) is the difference between the value of equity of the merged firm based on new optimally determined capital structure (coupon level) with the sum of equity values of the acquirer and target (at their optimal capital structure levels). The debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect is similarly defined as the corresponding value for the merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Panel A: The effect of correlation on merger gains

	Correlation (ρ)										
	-1	-0.8	-0.6	-0.4	-0.2	0	0.2	0.4	0.6	0.8	1
Equity effect (EE)	-16.57	-8.58	-6.75	-4.33	-2.78	-3.43	-1.3	-1.97	-2.6	-3.2	0
Debt effect (DE)	27.64	14.73	11.05	7.48	5.06	5.12	2.46	2.77	3.07	3.39	0.01
Unlevered effect (LL)	-0.22	-0.22	-0.22	-0.22	-0.21	-0.2	-0.18	-0.14	-0.11	-0.06	0
Tax benefits effect	9.93	5.48	3.98	2.85	2.05	1.73	1.06	0.89	0.73	0.59	0
Bankrupcy Cost effect	-1.36	-0.89	-0.55	-0.51	-0.44	-0.16	-0.27	-0.05	0.16	0.35	0
Net benefits effect (LE)	11.29	6.37	4.53	3.36	2.49	1.88	1.33	0.94	0.58	0.24	0
Total effect (Δ)	11.07	6.15	4.31	3.14	2.28	1.69	1.16	0.8	0.47	0.18	0
Δ1 (scaled unlevered sum)	0.12	0.07	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0	0
Δ2 (scaled levered T)	0.2	0.11	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0	0
Δ3 (scaled equity T)	0.8	0.45	0.31	0.23	0.17	0.12	0.08	0.06	0.03	0.01	0

(continued)

Table I - *continued*

Panel B: The effect of correlation on merged firm values

	Correlation (ρ)												
	-1	-0.8	-0.6	-0.4	-0.2	0	0.2	0.4	0.6	0.8	1	A or T	Sum (A+T)
Equity	10.97	18.96	20.79	23.21	24.76	24.11	26.24	25.57	24.94	24.34	27.54	13.77	27.54
Debt	108.72	95.81	92.14	88.56	86.14	86.2	83.54	83.85	84.16	84.47	81.09	40.54	81.08
Levered (E+D)	119.7	114.77	112.93	111.77	110.9	110.31	109.78	109.42	109.1	108.81	108.63	54.31	108.62
Unlevered	88.98	88.98	88.98	88.98	88.98	89	89.02	89.05	89.09	89.14	89.2	44.6	89.2
Tax benefits	31.58	27.14	25.63	24.51	23.7	23.38	22.72	22.55	22.39	22.25	21.66	10.83	21.65
Bankruptcy Cost	0.86	1.34	1.67	1.72	1.78	2.07	1.96	2.17	2.38	2.58	2.22	1.11	2.23
Coupon	8.8	8	7.9	7.7	7.6	7.8	7.6	7.8	8	8.2	7.8	3.9	7.8
Market Lev (ML)	0.91	0.83	0.82	0.79	0.78	0.78	0.76	0.77	0.77	0.78	0.75	0.75	0.75
Book lev (BL)	1.22	1.08	1.04	1	0.97	0.97	0.94	0.94	0.94	0.95	0.91	0.91	0.91

Table II. The effect of a change in the volatility of the merged firm

Panel A: Merger gains

	Merged firm volatility				
	0.1	0.2	0.3	0.4	0.5
Equity effect (EE)	-1.30	1.80	6.44	7.04	14.77
Debt effect (DE)	2.46	-2.02	-3.31	1.57	-0.02
Unlevered effect (LL)	-0.18	1.45	5.50	10.91	16.82
Tax benefits effect	1.06	-1.19	-1.74	-1.04	-1.13
Bankrupcy Cost effect	-0.27	0.48	0.63	1.26	0.94
Net benefits effect (LE)	1.33	-1.67	-2.37	-2.30	-2.06
Total effect (Δ)	1.16	-0.22	3.13	8.61	14.75
Δ1 (scaled with total unlevered)	0.01	0.00	0.04	0.10	0.17
Δ2 (scaled with levered target)	0.02	0.00	0.06	0.16	0.27
Δ3 (scaled with equity target)	0.04	-0.01	0.11	0.31	0.54

Panel B: Merged firm values

	Merged firm volatility				
	0.1	0.2	0.3	0.4	0.5
Equity	26.24	29.34	33.98	34.58	42.32
Debt	83.54	79.06	77.78	82.66	81.06
Levered (E+D)	109.78	108.40	111.76	117.23	123.38
Unlevered	89.02	90.64	94.70	100.11	106.01
Tax benefits	22.72	20.47	19.91	20.61	20.53
Bankruptcy Cost	1.96	2.71	2.85	3.49	3.16
Coupon	7.60	8.80	10.20	13.00	14.20
Leverage ratio	0.76	0.73	0.70	0.71	0.66
Book Lev	0.76	0.73	0.70	0.71	0.66

Panel C: Individual acquirer and target values

	Equity	Debt	Levered (E+D)	Unlevered	Tax benefits	Bankruptcy Cost	Coupon	Market Lev (ML)	Book Lev (BL)
A or T	13.77	40.54	54.31	44.60	10.83	1.11	3.90	0.75	0.91
Sum of A and T	27.54	81.08	108.62	89.20	21.65	2.23	7.80	0.75	0.91

Notes: Symmetric acquirer (A) and target (T) firms with revenues P_i = 10, operating cost C_i = 5, volatility σ_i = 0.1, opportunity cost δ_i = 0.05, tax rate τ_i = 0.3 and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. For the merged firm the volatility is varied by simultaneously changing σ_i , i = A, T while keeping the correlation effect. Case with no growth options or operational synergies e_G=e=1, I_G = 0. Firms horizon T = 20 years. Lattice steps N = 200 steps with dt = 0.1. Coupon optimization with coupon increments of 0.1 with maximum level at 2 times P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE), debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect define the difference in corresponding merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Table III. The effect of a change in bankruptcy costs of the merged firm

Panel A: Merger gains

	Merged firm bankruptcy cost					
	0	0.2	0.4	0.6	0.8	1
Equity effect (EE)	-8.58	-1.30	2.98	6.69	8.21	12.08
Debt effect (DE)	12.33	2.46	-3.62	-8.71	-11.32	-16.09
Unlevered effect (LL)	-0.18	-0.18	-0.18	-0.18	-0.18	-0.18
Tax benefits effect	1.69	1.06	0.26	-0.63	-1.03	-2.16
Bankrupcy Cost effect	-2.23	-0.27	0.72	1.21	1.90	1.68
Net benefits effect (LE)	3.92	1.33	-0.46	-1.85	-2.93	-3.83
Total effect (Δ)	3.75	1.16	-0.64	-2.02	-3.10	-4.01
Δ1 (scaled with total unlevered)	0.04	0.01	-0.01	-0.02	-0.03	-0.04
Δ2 (scaled with levered target)	0.03	0.01	-0.01	-0.02	-0.03	-0.04
Δ3 (scaled with equity target)	0.14	0.04	-0.02	-0.07	-0.11	-0.15

Panel B: Merged firm values

	Merged firm bankruptcy cost					
	0	0.2	0.4	0.6	0.8	1
Equity	18.96	26.24	30.52	34.23	35.75	39.62
Debt	93.41	83.54	77.47	72.37	69.77	64.99
Levered (E+D)	112.37	109.78	107.99	106.60	105.52	104.61
Unlevered	89.02	89.02	89.02	89.02	89.02	89.02
Tax benefits	23.35	22.72	21.91	21.02	20.62	19.50
Bankruptcy Cost	0.00	1.96	2.95	3.44	4.12	3.90
Coupon	8.70	7.60	7.00	6.50	6.30	5.80
Leverage ratio	0.83	0.76	0.72	0.68	0.66	0.62
Book Lev	1.05	0.94	0.87	0.81	0.78	0.73

Panel C: Individual acquirer and target values

Equity	Debt	Levered (E+D)	Unlevered	Tax benefits	Bankruptcy Cost	Coupon	Market Lev (ML)	Book Lev (BL)

A or T	13.77	40.54	54.31	44.60	10.83	1.11	3.90	0.75	0.91
Sum of A and T	27.54	81.08	108.62	89.20	21.65	2.23	7.80	0.75	0.91

Notes: Symmetric acquirer (A) and target (T) firms with revenues P_i = 10, operating cost C_i = 5, volatility σ_i = 0.1, opportunity cost δ_i = 0.05, tax rate τ_i = 0.3 and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. For the merged firm bankruptcy costs are varied between 0 and 1. Case with no growth options or operational synergies e_G=e=1, I_G = 0. Firms horizon T = 20 years. Lattice steps N = 200 steps with dt = 0.1. Coupon optimization with coupon increments of 0.1 with maximum level at 2 times P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE), debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect define the difference in corresponding merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Table IV
The effect of operational synergies

Notes: Symmetric acquirer (A) and target (T) firms considered with revenues P_i = 10, operating cost C_i = 5, volatility σ_i = 0.1, opportunity cost δ_i = 0.05, tax rate τ_i = 0.3 and bankruptcy cost b_i=0.2, i =A, T. Correlation between revenues of A and T firm is set to 0.2. Risk-free rate r = 0.05. Case with no growth options e_G=0 and positive operational synergies by varying e. Firms horizon T = 20 years. Lattice steps N = 200 steps with dt = 0.1. Coupon optimization based on coupon increments of 0.1 with maximum level at 2 times P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE) is the difference between the value of equity of the merged firm based on new optimally determined capital structure (coupon level) with the sum of equity values of the acquirer and target (at their optimal capital structure levels). The debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect is similarly defined as the corresponding value for the merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text..

Panel A: The effect of synergies on merger gains

	Operational synergies e									
	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Equity effect (EE)	-1.3	1.74	4.79	12.14	15.92	18.97	22.76	31.79	34.84	39.4
Debt effect (DE)	2.46	21.89	41.36	56.62	75.5	95.12	114	127.7	147.4	165.6
Unlevered effect (LL)	-0.18	17.59	35.38	53.17	70.96	88.76	106.6	124.4	142.1	159.9
Tax benefits effect	1.06	6.28	11.51	16.22	21.46	26.79	32.03	36.57	41.96	47.15
Bankrupcy Cost effect	-0.27	0.24	0.75	0.63	0.99	1.45	1.81	1.44	1.88	2.1
Net benefits effect (LE)	1.33	6.04	10.77	15.59	20.46	25.34	30.22	35.12	40.09	45.05
Total effect (Δ)	1.16	23.63	46.14	68.76	91.43	114.1	136.8	159.5	182.2	205
Δ1 (scaled with total unlevered)	0.01	0.26	0.52	0.77	1.03	1.28	1.53	1.79	2.04	2.3
Δ2 (scaled with levered target)	0.02	0.44	0.85	1.27	1.68	2.1	2.52	2.94	3.36	3.77
Δ3 (scaled with equity target)	0.08	1.72	3.35	4.99	6.64	8.29	9.93	11.58	13.23	14.89

(continued)

Table IV - *continued*

Panel B: The effect of synergies on merged firm values

	Operational synergies e										
	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	A or T
Equity	26.24	29.28	32.33	39.68	43.46	46.52	50.3	59.33	62.38	66.94	13.77
Debt	83.54	102.98	122.44	137.7	156.59	176.21	195.09	208.76	228.48	246.67	40.54
Levered (E+D)	109.78	132.26	154.77	177.38	200.05	222.72	245.39	268.09	290.85	313.61	54.31
Unlevered	89.02	106.79	124.57	142.36	160.16	177.95	195.75	213.54	231.34	249.13	44.6
Tax benefits	22.72	27.94	33.17	37.88	43.11	48.45	53.68	58.22	63.62	68.81	10.83
Bankruptcy Cost	1.96	2.46	2.97	2.86	3.22	3.68	4.04	3.67	4.1	4.33	1.11
Coupon	7.6	9.3	11	12.1	13.7	15.4	17	17.9	19.6	21.1	3.9
Leverage ratio	0.76	0.78	0.79	0.78	0.78	0.79	0.8	0.78	0.79	0.79	0.75
Book Lev	0.94	1.16	1.38	1.55	1.76	1.98	2.19	2.35	2.57	2.77	

Table V
Effect of correlation in the presence of growth options

Notes: Symmetric acquirer (A) and target (T) firms considered with correlation values ρ = -1, 0, and 1. Revenue levels P_i = 10, operating cost C_i = 5, volatility σ_i = 0.1, opportunity cost δ_i = 0.05, tax rate τ_i = 0.3 and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. Case with growth options e_G= 1.2, e=1, I_G = 10 for merged firm and e_G= 1.2 e=1, I_G = 5 when present for individual A and T firms. Growth option horizon T_1 = 5. Firms horizon T = 20 years. Lattice steps N = 200 steps with dt = 0.1. Coupon optimization based on coupon increments of 0.1 with maximum level at P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE) is the difference between the value of equity of the merged firm based on new optimally determined capital structure (coupon level) with the sum of equity values of the acquirer and target (at their optimal capital structure levels). The debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect is similarly defined as the corresponding value for the merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Panel A: Effects of growth options on merger gains

	Individual firms no growth/ merged firm with growth			**Individual firms with growth/ merged firm with growth**		
	Correlation (ρ)			Correlation (ρ)		
	-1	0	1	-1	0	1
Equity effect (EE)	-20.98	1.86	6.45	-26.72	-3.88	0.71
Debt effect (DE)	56.92	20.34	12.62	43.66	7.09	-0.63
Unlevered effect (LL)	15.07	14.39	14.34	0.72	0.04	-0.01
Tax benefits effect	19.15	7.04	4.3	14.8	2.7	-0.04
Bankrupcy Cost effect	-1.73	-0.78	-0.43	-1.42	-0.47	-0.12
Net benefits effect (LE)	20.87	7.81	4.73	16.23	3.17	0.08
Total effect (Δ)	35.94	22.21	19.07	16.94	3.21	0.08
Δ1 (scaled with total unlevered)	0.4	0.25	0.21	0.51	0.1	0
Δ2 (scaled with levered target)	0.66	0.41	0.35	0.27	0.05	0
Δ3 (scaled with equity target)	2.61	1.61	1.38	1.02	0.19	0

Panel B: Effects of growth options on firm values

	Merged firm with growth			**Individual firms**	
	Correlation (ρ)			No growth	With growth
	-1	0	1	(e_G =0, I_G =0)	(e_G =1.2, I_G =5)
Equity	6.56	29.4	33.99	13.77	16.64
Debt	138	101.43	93.71	40.54	47.17
Levered firm (E + D)	144.56	130.83	127.7	54.31	63.81
Unlevered	104.26	103.59	103.54	44.6	51.77
Tax benefits	40.8	28.69	25.95	10.83	13
Bankruptcy costs	0.5	1.45	1.8	1.11	0.96
Coupon	11	8.7	8.5	3.9	4.3
Leverage ratio	0.95	0.78	0.73	0.75	0.74

Table VI. The effect of a change in the volatility of the merged firm in the presence of growth options

Panel A: Merger Gains

	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45
Equity effect (EE)	-6.34	3.27	3.98	5.64	13.50	11.31	15.66	11.07	15.38
Debt effect (DE)	34.92	17.91	13.83	11.13	3.84	7.91	5.87	13.66	12.80
Unlevered effect (LL)	14.81	14.22	14.00	14.71	16.55	18.66	21.35	24.29	27.62
Tax benefits effect	12.28	6.23	3.96	2.64	0.95	1.39	0.90	2.10	2.04
Bankrupcy Cost effect	-1.50	-0.72	0.15	0.58	0.17	0.82	0.72	1.66	1.50
Net benefits effect (LE)	13.78	6.95	3.81	2.06	0.79	0.56	0.18	0.44	0.55
Total effect (Δ)	28.58	21.17	17.81	16.77	17.33	19.22	21.54	24.73	28.17
Δ1 (scaled with total unlevered)	0.32	0.24	0.20	0.19	0.19	0.22	0.24	0.28	0.32
Δ2 (scaled with levered target)	0.53	0.39	0.33	0.31	0.32	0.35	0.40	0.46	0.52
Δ3 (scaled with equity target)	2.08	1.54	1.29	1.22	1.26	1.40	1.56	1.80	2.05

Panel B: Merged firm values

	Merged firm volatility								
	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45
Equity	21.20	30.81	31.52	33.18	41.04	38.85	43.20	38.61	42.92
Debt	116.01	98.99	94.91	92.21	84.92	88.99	86.96	94.75	93.88
Levered (E+D)	137.20	129.80	126.43	125.39	125.96	127.85	130.16	133.36	136.80
Unlevered	104.00	103.42	103.19	103.91	105.74	107.85	110.55	113.49	116.82
Tax benefits	33.93	27.89	25.62	24.30	22.61	23.04	22.55	23.76	23.70
Bankruptcy Cost	0.73	1.51	2.38	2.81	2.39	3.05	2.94	3.89	3.72
Coupon	9.40	8.60	9.20	9.90	9.60	11.30	11.80	14.60	15.30
Leverage ratio	0.85	0.76	0.75	0.74	0.67	0.70	0.67	0.71	0.69
Book Lev	1.12	0.96	0.92	0.89	0.80	0.83	0.79	0.83	0.80

Panel B: Individual firm values with no growth

	Equity	Debt	Levered (E+D)	Unlevered	Tax benefits	Bankruptcy Cost	Coupon	Market Lev (ML)	Book Lev (BL)
A or T	13.77	40.54	54.31	44.60	10.83	1.11	3.90	0.75	0.91
Sum of A and T	27.54	81.08	108.62	89.20	21.65	2.23	7.80	0.75	0.91

Notes: Symmetric acquirer (A) and target (T) firms with revenues $P_i = 10$, operating cost $C_i = 5$, volatility $\sigma_i = 0.1$, opportunity cost $\delta_i = 0.05$, tax rate $\tau_i = 0.3$ and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. For the merged firm the volatility is varied by simultaneously changing σ_i , i = A, T while keeping the correlation effect. Case with growth options or operational synergies e=1, e_G=1.2 , $I_G = 10$. Firms horizon $T = 20$ years. Lattice steps $N = 200$ steps with dt = 0.1. Coupon optimization with coupon increments of 0.1 with maximum level at 2 times P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE), debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect define the difference in corresponding merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Table VII
The effect of growth options on merger gains and leverage

Notes: Symmetric acquirer (A) and target (T) firms considered with correlation of revenues ρ = 0.2. Revenue levels P_i = 10, operating cost C_i = 5, volatility σ_i = 0.1, opportunity cost δ_i = 0.05, tax rate τ_i = 0.3 and bankruptcy cost b_i=0.2, i =A, T. Risk-free rate r = 0.05. Case with growth options with zero downside (see equation4b) by varying e_G and with I_G = 100 for merged firm and e_G= 1 (no growth), I_G = 50 for individual A and T firms. Growth option horizon T_1 = 5. Firms horizon T = 20 years. Lattice steps N = 200 steps with dt = 0.1. Coupon optimization based on coupon increments of 0.1 with maximum level at P_i , i = A, T, M (where M indicates the merged firm starting revenues being the sum of P_A and P_T). The equity effect (EE) is the difference between the value of equity of the merged firm based on new optimally determined capital structure (coupon level) with the sum of equity values of the acquirer and target (at their optimal capital structure levels). The debt effect (DE), unlevered effect (LL), tax benefit effect, and bankruptcy cost effect is similarly defined as the corresponding value for the merged firm minus the sum of values of acquirer and target firms. Net benefits effect (LE) is the sum of the tax benefit and bankruptcy cost effect. Total effect Δ equals EE plus DE (or equivalently LL plus LE). Scaled effects Δ1, Δ2 and Δ3 are defined in equations 8 of the main text.

Panel A: Merger gains

	Growth option factor e_G										
	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Equity effect (EE)	-6.18	-3.03	12.94	15	19.46	20.48	22.56	25.01	28.48	32.98	30.53
Debt effect (DE)	5.19	3.38	-7.51	-0.53	6.23	18.01	29.69	41.74	53.31	64.03	81.86
Unlevered effect (LL)	-1.88	-0.57	7.33	14.29	23.47	32.78	43.13	54.14	65.89	77.87	88.18
Tax benefits effect	1.19	0.96	-2.06	0.03	2.05	5.57	9.02	12.57	15.94	19.17	24.37
Bankrupcy Cost effect	0.3	0.04	-0.16	-0.16	-0.16	-0.14	-0.1	-0.04	0.04	0.03	0.16
Net benefits effect (LE)	0.89	0.92	-1.9	0.19	2.21	5.7	9.12	12.61	15.9	19.14	24.21
Total effect (Δ)	-0.99	0.36	5.43	14.47	25.68	38.48	52.25	66.75	81.79	97.01	112.39
Δ1 (scaled with total unlevered)	-0.03	0.01	0.16	0.44	0.77	1.16	1.58	2.01	2.47	2.92	3.39
Δ2 (scaled with levered target)	-0.05	0.02	0.27	0.71	1.25	1.88	2.55	3.26	3.99	4.74	5.49
Δ3 (scaled with equity target)	-0.14	0.05	0.79	2.09	3.72	5.57	7.56	9.66	11.83	14.04	16.26

(continued)

Table VII– *(continued)*

Panel B: Merged firm values

	Growth option factor e_G										
	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Equity	7.64	10.8	26.77	28.83	33.28	34.3	36.39	38.84	42.31	46.8	44.36
Debt	32.32	30.52	19.63	26.61	33.36	45.15	56.83	68.87	80.45	91.17	108.99
Levered (E+D)	39.97	41.32	46.39	55.43	66.64	79.44	93.21	107.71	122.75	137.97	153.35
Unlevered	31.29	32.61	40.51	47.46	56.65	65.96	76.31	87.31	99.06	111.04	121.36
Tax benefits	9.14	8.91	5.89	7.98	10	13.51	16.97	20.52	23.89	27.12	32.31
Bankruptcy Cost	0.46	0.2	0	0	0.01	0.03	0.06	0.12	0.2	0.19	0.32
Coupon	7.7	6.7	2.9	3.4	3.7	4.7	5.6	6.5	7.3	8	9.6
Market Lev (ML)	0.81	0.74	0.42	0.48	0.5	0.57	0.61	0.64	0.66	0.66	0.71
Book Lev (BL)	1.03	0.94	0.48	0.56	0.59	0.68	0.74	0.79	0.81	0.82	0.9
Q	1.28	1.32	1.48	1.77	2.13	2.54	2.98	3.44	3.92	4.41	4.9
ch. In ML	0.15	0.08	-0.24	-0.18	-0.16	-0.09	-0.05	-0.02	-0.01	0	0.05
ch. In BL	0.21	0.12	-0.33	-0.26	-0.23	-0.13	-0.07	-0.03	-0.01	0	0.08

Panel C: Individual firm values

	Growth option factor e_G										
	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Equity	6.91	9.18	8.77	13.81	16.16	19.07	16.59	21.33	19.52	24.75	23.64
Debt	13.57	13.13	16.81	16.13	18.91	21.86	30.89	32.8	41.53	43.56	51.97
Levered (E+D)	20.48	22.31	25.59	29.94	35.07	40.93	47.48	54.13	61.05	68.32	75.61
Unlevered	16.59	18.45	20.7	25.15	29.46	34.44	38.52	44.52	49.11	55.71	60.71
Tax benefits	3.97	3.9	4.96	4.81	5.64	6.52	9.1	9.71	12.17	12.82	15.21
Bankruptcy Cost	0.08	0.04	0.07	0.02	0.03	0.03	0.14	0.11	0.24	0.21	0.32
Coupon	2.9	2.4	2.8	2.1	2.2	2.3	3.3	3.2	4.1	4	4.8
Market Lev (ML)	0.66	0.59	0.66	0.54	0.54	0.53	0.65	0.61	0.68	0.64	0.69
Book Lev (BL)	0.82	0.71	0.81	0.64	0.64	0.63	0.8	0.74	0.85	0.78	0.86

Table VIII
Summary of model predictions

Variable	Predicted effect			
	Leverage levels	Leverage changes (before merger)	Leverage changes (after merger)	Merger gains
Correlation	(-)	(0/+)	(-)	(-)
Volatility	(-)			
Bankruptcy cost	(-)			
Profitability	(+)			
Growth Options	(-)			
Growth Options Squared	(+)			
Change in volatility		(0/+)	(-)	(-/+)
Change in Bankruptcy costs		(0/+)	(-)	(-)
Operational synergies		(-)	(+)	(+)
Change in growth options		(0/+)	(-)	(+)
Change in growth options squared		(-)	(+)	?

Table IX
Sample descriptive statistics

The table presents descriptive statistics for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2009 drawn from Thomson Financial SDC Mergers and Acquisitions Database. The table describes the mean, standard deviation, median, 1. Quartile and 3. Quartile for acquiring firms before the acquisition (Panel A), target firms before the acquisition (Panel B) and the merged firm after the acquisition (Panel C) in the sample pooled for up to 5 years.

Panel A: Acquirer (before merger)

Variables	N	Mean	SD	1. Quartile	Median	3. Quartile
TA	5217	2303.70	5218.07	201.83	668.76	1929.92
TL	5209	1312.14	3048.66	75.53	334.12	1064.02
SALES	5197	2416.33	5421.98	159.31	616.21	2075.87
BVE	5211	963.59	2629.04	82.97	280.57	800.85
MVE	4782	3077.97	9699.29	269.85	801.56	2126.37
BL	5209	0.52	0.24	0.35	0.52	0.65
ML	4782	0.35	0.23	0.16	0.33	0.52
MB	4782	4.08	5.67	1.42	2.31	4.05
Q	4782	2.18	1.73	1.17	1.58	2.42
RKV	4955	0.52	0.45	0.31	0.53	0.79
CAPEX	5138	0.08	0.07	0.03	0.06	0.10
RND	2929	0.14	0.46	0.01	0.04	0.12
ROA	4870	0.06	0.11	0.04	0.08	0.11
NPM	5149	-0.01	0.41	0.03	0.06	0.11
BC	4972	0.64	0.21	0.51	0.59	0.76
TAN	4309	0.89	0.16	0.85	0.97	1.00
SVOL	5304	479.26	1068.88	55.49	146.72	402.32

Panel B: Target (before merger)

Variables	N	Mean	SD	1. Quartile	Median	3. Quartile
TA	3682	549.23	1046.02	73.48	183.88	508.92
TL	3672	336.29	695.63	24.56	80.15	278.25
SALES	3676	582.35	1186.48	65.82	182.43	534.87
BVE	3678	219.24	672.93	34.69	82.78	190.25
MVE	3360	558.71	1416.89	86.17	189.67	493.98
BL	3672	0.51	0.29	0.31	0.50	0.66
ML	3351	0.36	0.25	0.15	0.34	0.55
MB	3352	3.68	5.66	1.27	2.01	3.38
Q	3351	1.96	1.48	1.11	1.45	2.20
RKV	3451	0.46	0.48	0.22	0.47	0.74
CAPEX	3617	0.08	0.07	0.03	0.05	0.09
RND	2038	0.32	1.79	0.01	0.05	0.15
ROA	3383	0.04	0.15	0.02	0.07	0.10
NPM	3610	-0.09	0.70	0.02	0.05	0.09
BC	3561	0.67	0.21	0.54	0.62	0.84
TAN	2142	0.82	0.28	0.75	0.97	1.00
SVOL	3887	131.06	398.53	17.05	41.51	111.84

(*continued*)

Table IX – *(continued)*

Panel C: Merged firm (after merger)

Variables	N	Mean	SD	1. Quartile	Median	3. Quartile
TA	5719	4582.63	7453.09	730.71	1836.81	4646.25
TL	5708	2758.48	4574.54	353.91	1009.39	2815.64
SALES	5712	4167.13	7596.58	524.11	1518.85	3913.19
BVE	5705	1889.43	4675.14	249.66	698.11	1701.48
MVE	5629	5623.62	18595.37	498.03	1454.88	3884.50
BL	5708	0.60	0.61	0.43	0.58	0.71
ML	5627	0.43	0.25	0.23	0.42	0.61
MB	5627	3.95	6.30	1.26	2.01	3.43
Q	5627	1.77	1.24	1.09	1.38	1.94
RKV	5423	0.39	0.53	0.11	0.44	0.71
CAPEX	5619	0.06	0.05	0.02	0.04	0.07
RND	3308	0.13	0.63	0.01	0.04	0.13
ROA	5672	0.05	0.10	0.03	0.06	0.09
NPM	5671	0.01	0.34	0.03	0.06	0.11
BC	5421	0.54	0.20	0.41	0.52	0.64
TAN	5071	0.79	0.20	0.67	0.85	0.96
SVOL	5683	1057.29	3167.71	123.06	321.62	818.16

Table X
Acquirer, target and merged firm differences

The table presents mean values and test statistics of differences in means between the groups for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2009 drawn from Thomson Financial SDC Mergers and Acquisitions Database. The left-hand columns provide means and t-statistics for acquirer and target firms before the merger. The right-hand columns provide means for the merged (i.e., surviving) entity post merger and respective pro-forma (weighted average) pre merger values for the acquirer and target combined. The t-statistics are provided in the right-hand columns in italics based on two-sided t-tests of means. The symbols ***, **, * denote statistical significance at p<0.01, p<0.05, p<0.1 levels, respectively.

	Individual firms			Merged firm		
	Acquirer	Target	*t-stat diff*	Post-merger	Pre-merger pro-forma	*t-stat diff*
SALES	2665.62	653.54	*18.80****	4167.13	2892.40	*9.11****
MVE	3867.88	598.74	*11.13****	5552.14	3034.59	*8.35****
BL	0.52	0.52	*0.8*	0.60	0.52	*9.53****
ML	0.36	0.37	*-2.59****	0.43	0.37	*12.42****
MB	4.05	3.65	*3.13****	3.94	3.78	*1.37**
Q	2.13	1.93	*6.97****	1.77	2.02	*-8.21****
RKV	0.52	0.46	*5.71****	0.35	0.46	*-4.98****
CAPEX	0.07	0.07	*-0.82*	0.06	0.07	*-13.48****
RND	0.15	0.34	*-4.71****	0.09	0.05	*2.64****
ROA	0.06	0.04	*10.40****	0.05	0.06	*-6.21****
NPM	0.01	-0.08	*7.58****	0.01	-0.01	*2.20***
BC	0.64	0.66	*-7.42****	0.54	0.64	*-23.03****
TAN	0.87	0.80	*11.50****	0.79	0.89	*-24.56****
SVOL	0.48	0.47	*0.89*	0.35	0.41	*-5.12****

Table XI
Cross-sectional leverage differences

The table presents cross-sectional differences in leverage and changes in leverage for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2010 drawn from Thomson Financial SDC Mergers and Acquisitions Database. Panel A presents means and t-statistics for differences of means for the weighted average pro-forma values of the combined acquirer and target before the merger. The sample is conditioned on growth opportunities (columns) based whether the *RKV* variable is higher or lower than the time-varying sample median and sorted into merger characteristics (rows) based on the two lowest (low) and the two highest (high) quintile portfolios of the respective variables. Panel B presents means and t-statistics for differences of means for values of the merged firm after the merger. The sample is conditioned on an increase in growth opportunities (columns) based whether the *RKV* variable is higher post merger compared to before. The t-statistics are based on two-sided t-tests with unequal variances. The symbols ***, **, * denote statistical significance at p<0.01, p<0.05, p<0.1 levels, respectively.

Panel A: Growth options before the merger

		Low			High			*t-stat (diff)*		
		ML	BL	Change ML(-1,+3)	ML	BL	Change ML(-1,+3)	*ML*	*BL*	*Change ML(-1,+3)*
Correlation	low	0.435	0.505	0.048	0.370	0.566	0.029	*5.35****	*-5.05****	*1.82***
	high	0.380	0.493	0.099	0.302	0.522	0.180	*6.42****	*-1.91***	*-1.59**
	t-stat (diff)	*4.44****	*1.19*	*-1.58**	*5.80****	*3.66****	*-4.08****			
Volatility	low	0.477	0.541	0.064	0.392	0.599	0.081	*7.86****	*-5.25****	*0.296*
	high	0.321	0.447	0.109	0.266	0.493	0.095	*4.52****	*-3.24****	*-0.99*
	t-stat (diff)	*13.50****	*9.86****	*-1.46*	*10.98****	*8.94****	*-0.36*			
Bankruptcy cost	low	0.474	0.570	0.080	0.422	0.636	0.154	*4.96****	*-6.87****	*1.07*
	high	0.311	0.415	0.084	0.242	0.450	0.018	*5.94****	*-2.39****	*-0.78*
	t-stat (diff)	*14.10****	*16.66****	*-0.15*	*16.72****	*16.58****	*3.54****			
ROA	low	0.438	0.500	0.166	0.393	0.563	0.285	*3.27****	*-4.48****	*0.13*
	high	0.321	0.479	-0.053	0.268	0.502	-0.081	*4.92****	*-1.86***	*-2.06***
	t-stat (diff)	*8.71****	*1.81**	*6.67****	*10.6****	*5.20****	*9.72****			
Profit Margin	low	0.418	0.514	0.107	0.335	0.545	0.127	*9.56****	*-3.17****	*0.04*
	high	0.393	0.472	0.023	0.303	0.506	0.011	*5.82****	*-1.72***	*0.73*
	t-stat (diff)	*2.13***	*4.44****	*2.93****	*2.60****	*3.13****	*3.40****			

(continued)

Table XI – *continued*

Panel B: Change in growth options after merger

		Increase			Decrease			*t-stat (diff)*		
		ML	BL	Change ML(-1,+3)	ML	BL	Change ML(-1,+3)	*ML*	*BL*	*Change ML(-1,+3)*
Correlation	low	0.439	0.579	0.013	0.471	0.574	0.075	*-3.33****	*0.63*	*-1.69**
	high	0.438	0.591	0.058	0.387	0.520	0.199	*4.13****	*7.17****	*-4.16****
	t-stat (diff)	*0.13*	*-1.30*	*-1.06*	*7.67****	*6.11****	*-4.10****			
Volatility	low	0.453	0.595	0.039	0.439	0.562	0.106	*1.39*	*4.34****	*-2.69****
	high	0.430	0.574	0.019	0.404	0.529	0.181	*2.33****	*5.11****	*-3.64****
	t-stat (diff)	*2.41***	*2.64****	*0.49*	*3.21****	*3.77****	*-2.43***			
Bankruptcy cost	low	0.489	0.633	0.109	0.489	0.583	0.132	*1.81**	*4.14****	*-0.81*
	high	0.383	0.528	-0.053	0.334	0.478	0.135	*4.76****	*3.80****	*-3.98****
	t-stat (diff)	*11.07****	*13.39****	*-3.98****	*12.60****	*11.93****	*0.08*			
ROA	low	0.507	0.598	0.200	0.459	0.539	0.242	*4.39****	*4.38****	*-1.33*
	high	0.360	0.565	-0.116	0.332	0.521	-0.017	*3.04****	*6.27****	*-2.51****
	t-stat (diff)	*15.42****	*4.03****	*7.52****	*11.50****	*1.98***	*8.42****			
Profit Margin	low	0.490	0.634	0.078	0.436	0.554	0.140	*5.84****	*11.08****	*-2.82****
	high	0.416	0.557	-0.012	0.355	0.500	0.082	*4.99****	*2.71****	*-1.75**
	t-stat (diff)	*8.14****	*10.55****	*2.56****	*6.54****	*5.48****	*1.71**			

Table XII
Market leverage level regressions

The table presents results of pooled cross-sectional regressions on the dependent variable market leverage (*ML*) for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2010. The regressions are pooled over event time from 5 years before the merger completion to 5 years after. Except for *CORR* and *RDD* all variables are calculated as the weighted average values of acquirer and target pre merger and the values of the merged entity post merger, winsorized at the 1%-level and used with a one-year lag. All variables are defined in Appendix A. Each of the column pairs presents results of pooled OLS regressions controlling for industry fixed effects (left-hand side) and random effects panel regressions (right-hand side) for different proxies used for *GROWTH*. All *GROWTH* and *GROWTH2* variables are demeaned. Heteroskedasticity robust t-statistics are reported in parentheses. The symbols ***, **, * denote statistical significance at p<0.01, p<0.05, p<0.1 levels, respectively.

	GROWTH = Q		*GROWTH = RKV*		*GROWTH = CAPEX*		*GROWTH = RND*	
	Industry fixed effects	Panel GLS	Industry fixed effects	Panel GLS	Industry fixed effects	Panel GLS	Industry fixed effects	Panel GLS
CORR	-0.024	-0.039	-0.024	-0.035	-0.022	-0.036	-0.024	-0.035
	(-4.93)***	(-3.78)***	(-4.95)***	(-3.78)***	(-4.50)***	(-3.55)***	(-4.91)***	(-3.46)***
GROWTH	0.005	-0.017	-0.061	-0.030	-0.449	-0.099	-0.176	-0.112
	(0.89)	(-4.84)***	(-5.99)***	(-4.37)***	(-5.29)***	(-1.12)	(-7.41)***	(-6.11)***
GROWTH2	-0.004	0.001	0.003	0.002	2.069	0.758	0.009	0.006
	(-4.12)***	(1.27)	(4.61)***	(4.84)***	(4.35)***	(1.46)	(6.96)***	(5.67)***
MISVAL	-0.052	-0.016	-0.116	-0.059	-0.053	-0.021	-0.052	-0.021
	(-3.34)***	(-2.71)***	(-20.25)***	(-11.81)***	(-3.53)***	(-3.08)***	(-3.57)***	(-3.15)***
SALES	0.016	0.033	0.014	0.030	0.017	0.035	0.015	0.032
	(7.15)***	(8.83)***	(6.67)***	(8.60)***	(7.32)***	(9.08)***	(6.92)***	(8.50)***
ROA	-0.564	-0.372	-0.444	-0.372	-0.546	-0.428	-0.640	-0.475
	(-13.87)***	(-9.97)***	(-10.94)***	(-9.58)***	(-12.82)***	(-11.82)***	(-14.20)***	(-12.63)***
SVOL	-0.018	-0.012	-0.008	-0.014	-0.023	-0.017	-0.019	-0.017
	(-3.08)***	(-2.07)**	(-1.44)	(-2.32)**	(-3.69)***	(-2.80)***	(-3.04)***	(-2.88)***
BC	-0.413	-0.275	-0.364	-0.286	-0.434	-0.280	-0.393	-0.275
	(-17.25)***	(-10.98)***	(-16.97)***	(-11.73)***	(-16.74)***	(-10.87)***	(-16.44)***	(-10.97)***

(continued)

Table XII – *continued*

TAN	0.234	0.152	0.213	0.164	0.275	0.128	0.232	0.134
	(9.47)***	(5.13)***	(9.51)***	(5.71)***	(10.29)***	(4.14)***	(9.78)***	(4.55)***
RND	-0.038	-0.018	-0.035	-0.019	-0.041	-0.017		
	(-1.70)*	(-1.89)*	(-1.97)**	(-1.96)**	(-1.68)*	(-1.93)*		
RDD	-0.059	-0.051	-0.049	-0.055	-0.061	-0.052	-0.049	-0.047
	(-7.69)***	(-6.20)***	(-7.05)***	(-6.93)***	(-7.91)***	(-6.22)***	(-6.70)***	(-5.69)***
BEFORE1	-0.066	-0.063	-0.062	-0.066	-0.070	-0.066	-0.061	-0.063
	(-8.40)***	(-11.28)***	(-8.39)***	(-11.70)***	(-8.70)***	(-11.52)***	(-7.76)***	(-11.07)***
BEFORE2	-0.058	-0.053	-0.057	-0.056	-0.062	-0.056	-0.052	-0.051
	(-6.88)***	(-8.51)***	(-7.10)***	(-9.03)***	(-7.34)***	(-8.74)***	(-6.22)***	(-8.09)***
BEFORE3	-0.038	-0.035	-0.042	-0.038	-0.042	-0.036	-0.028	-0.029
	(-4.29)***	(-4.95)***	(-4.94)***	(-5.49)***	(-4.70)***	(-5.00)***	(-3.19)***	(-4.14)***
BEFORE4	-0.040	-0.034	-0.049	-0.039	-0.043	-0.033	-0.031	-0.027
	(-4.09)***	(-4.30)***	(-5.34)***	(-4.93)***	(-4.44)***	(-4.09)***	(-3.14)***	(-3.37)***
Constant	0.451	0.296	0.452	0.329	0.412	0.313	0.435	0.320
	(18.33)***	(8.24)***	(19.16)***	(9.70)***	(15.91)***	(8.55)***	(17.94)***	(9.06)***
Observations	4412	4412	4412	4412	4344	4344	4412	4412
Adj. R-squared	0.434	0.394	0.488	0.495	0.435	0.402	0.439	0.419

Table XIII
Market leverage changes regressions

The table presents results of pooled cross-sectional regressions on changes in market leverage (*DML*) after mergers for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2010. Changes in the variables are calculated as the differences between post and pre merger values over four year lags and pooled over three rolling windows (-3,+1), (-2, +2) and (-1,+3) where 0 is the year of merger completion. Except for *CORR* and *RDD* all variables are calculated as the weighted average values of acquirer and target pre merger and the values of the merged entity post merger and winsorized at the 1%-level. Other control variables include *SVOL*, *SALES*, *RND*. All variables are defined in Appendix A. Each of the column pairs presents results of pooled OLS regressions controlling for industry fixed effects (left-hand columns) and Prais-Winston FGLS regressions (right-hand columns) controlling for industry fixed effects and serial correlation in the residuals using different proxies for *GROWTH*. Standard errors are clustered by mergers and robust t-statistics are reported in parentheses. The symbols ***, **, * denote statistical significance at p<0.01, p<0.05, p<0.1 levels, respectively.

	GROWTH = Q		*GROWTH = RKV*		*GROWTH = CAPEX*		*GROWTH = RND*	
	Industry fixed effects	Prais-Winston FGLS	Industry fixed effects	Prais-Winston FGLS	Industry fixed effects	Prais-Winston FGLS	Industry fixed effects	Prais-Winston FGLS
CORR	-0.071	-0.062	-0.055	-0.040	-0.071	-0.058	-0.066	-0.050
	(-2.86)***	(-2.66)***	(-2.24)**	(-1.70)*	(-2.85)***	(-2.42)**	(-2.56)**	(-2.06)**
*BEFORE1*CORR*	0.097	0.120	0.075	0.094	0.092	0.130	0.093	0.126
	(2.51)**	(3.55)***	(1.76)*	(2.78)***	(2.35)**	(3.93)***	(2.40)**	(3.86)***
DGROWTH	-0.054	-0.056	0.007	0.006	-0.537	-0.373	-0.030	-0.007
	(-4.68)***	(-5.88)***	(2.02)**	(2.78)***	(-3.62)***	(-2.95)***	(-0.60)	(-0.14)
*BEFORE1*DGROWTH*	0.011	0.022	-0.040	-0.071	0.217	0.370	-0.068	0.245
	(0.69)	(1.60)	(-1.41)	(-3.32)***	(1.02)	(1.65)*	(-0.45)	(1.41)
DGROWTH2	-0.005	-0.005	0.000	0.000	2.078	1.382	-0.002	-0.010
	(-2.13)**	(-2.83)***	(2.15)**	(3.14)***	(2.73)***	(2.80)***	(-0.15)	(-0.45)
*BEFORE1*DGROWTH2*	0.005	0.004	0.016	0.046	0.284	-0.177	0.110	0.084
	(1.18)	(1.10)	(0.64)	(2.38)**	(0.18)	(-0.08)	(1.48)	(1.29)
DROA	-0.701	-0.653	-0.955	-0.801	-0.861	-0.800	-0.951	-0.828
	(-4.60)***	(-5.19)***	(-6.59)***	(-6.44)***	(-6.62)***	(-7.32)***	(-6.78)***	(-7.14)***
*BEFORE1*DROA*	-0.030	-0.271	0.281	0.305	0.013	-0.146	0.119	-0.121
	(-0.14)	(-1.02)	(0.90)	(1.41)	(0.05)	(-0.61)	(0.55)	(-0.47)

(continued)

Table XIII - *continued*

DBC	-0.052	-0.055	-0.051	-0.082	-0.121	-0.113	-0.092	-0.094
	(-0.90)	(-1.03)	(-0.84)	(-1.45)	(-1.93)*	(-1.96)*	(-1.46)	(-1.67)*
*BEFORE1*DBC*	-0.307	-0.146	-0.337	-0.108	-0.279	-0.143	-0.310	-0.127
	(-2.41)**	(-1.42)	(-2.27)**	(-1.04)	(-1.99)**	(-1.32)	(-2.20)**	(-1.23)
DTAN	-0.187	-0.162	-0.264	-0.211	-0.205	-0.169	-0.252	-0.203
	(-2.35)**	(-2.37)**	(-3.09)***	(-2.77)***	(-2.53)**	(-2.33)**	(-3.01)***	(-2.76)***
*BEFORE1*DTAN*	0.376	0.175	0.374	0.237	0.315	0.215	0.350	0.193
	(2.48)**	(1.24)	(2.02)**	(1.64)	(1.90)*	(1.40)	(2.11)**	(1.32)
SYN	0.067	0.065	0.106	0.088	0.076	0.087	0.094	0.093
	(1.49)	(1.85)*	(2.27)**	(2.78)***	(1.66)*	(2.98)***	(2.11)**	(3.16)***
*BEFORE1*SYN*	0.013	0.312	-0.137	0.056	-0.049	0.232	-0.105	0.222
	(0.09)	(1.68)*	(-0.76)	(0.35)	(-0.35)	(1.20)	(-0.67)	(1.26)
BEFORE1	-0.078	-0.079	-0.068	-0.076	-0.064	-0.070	-0.068	-0.076
	(-4.88)***	(-4.87)***	(-3.94)***	(-4.73)***	(-3.80)***	(-4.27)***	(-4.12)***	(-4.63)***
AFTER1	0.012	0.013	0.008	0.009	0.014	0.013	0.013	0.012
	(1.14)	(1.51)	(0.61)	(0.93)	(1.21)	(1.36)	(1.10)	(1.28)
AFTER2	0.026	0.022	0.026	0.019	0.035	0.031	0.032	0.029
	(2.05)**	(1.93)*	(1.93)*	(1.53)	(2.62)***	(2.52)**	(2.41)**	(2.32)**
AFTER3	0.047	0.048	0.057	0.056	0.063	0.062	0.062	0.062
	(3.47)***	(3.74)***	(3.91)***	(4.03)***	(4.63)***	(4.60)***	(4.36)***	(4.48)***
Constant	-0.003	-0.009	-0.016	-0.018	-0.027	-0.026	-0.018	-0.022
	(-0.08)	(-0.32)	(-0.45)	(-0.59)	(-0.76)	(-0.87)	(-0.53)	(-0.74)
Other controls	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1242	1242	1139	1139	1216	1216	1242	1242
Adj. R-squared	0.334	0.296	0.247	0.204	0.299	0.235	0.262	0.215

Table XIV
Merger gains

The table presents the results of a univariate and multivariate analysis of acquirer, target and combined cumulative abnormal announcement returns for the three days around the acquisition announcement for a sample of completed U.S. acquisitions over the period of Jan 1, 1980 to December 31, 2010. Panel A shows cumulative abnormal returns (CARs) conditioned on various merger characteristics (rows) for acquirer, target and the combined firm based on the two lowest (low) and the two highest (high) quintile portfolios of the respective variables. Total merger gains are calculated as the market value weighted CARs of acquirer and target. All CARs are statistically significant at the 0.001 level. Panel B presents the results of cross-sectional OLS regressions of total merger CARs on merger characteristics. Coefficients on industry and year controls are suppressed. All variables are defined in Appendix A. Heteroskedasticity robust t-statistics are reported in parentheses. The symbols ***, **, * denote statistical significance at p<0.01, p<0.05, p<0.1 levels, respectively.

Panel A: Cumulative abnormal announcement returns CAR (-1,+1)

Merged firm characteristics		Acquirer	Target	Total merger gains
growth	high	-1.64%	19.83%	1.30%
	low	-2.36%	18.67%	0.52%
Correlation	high	-2.62%	18.39%	0.26%
	low	-1.47%	19.46%	1.40%
Volatility	high	-2.05%	17.89%	0.69%
	low	-1.62%	20.33%	1.39%
Bankruptcy cost	high	-3.00%	18.84%	-0.01%
	low	-1.09%	19.25%	1.70%
Profitability	high	-1.79%	21.03%	1.34%
	low	-2.72%	17.36%	0.04%
Synergies	high	-2.56%	18.61%	0.35%
	low	-1.85%	18.80%	0.98%
All		-2.00%	19.25%	0.91%

(continued)

Table XIV – *continued*

Panel B: Cross-Sectional regressions on merger CAR			
	(1)	(2)	(3)
CORR	-0.044	-0.041	-0.046
	(-2.70)***	(-2.39)**	(-2.68)***
ML	0.084	0.091	0.106
	(2.75)***	(2.91)***	(3.13)***
HIGHML	0.072	0.073	0.071
	(3.25)***	(3.26)***	(3.16)***
GROWTH	-0.008	-0.008	-0.012
	(-1.17)	(-1.10)	(-1.49)
MISVAL	-0.014	-0.013	-0.015
	(-2.08)**	(-1.92)*	(-2.00)**
SALES	-0.020	-0.021	-0.021
	(-6.52)***	(-6.59)***	(-6.37)***
ROA	0.090	0.081	0.123
	(2.06)**	(1.82)*	(2.35)**
SVOL	0.006	0.004	0.013
	(0.39)	(0.27)	(0.87)
BC	0.040	0.043	0.053
	(1.36)	(1.41)	(1.66)*
HIGHBC	-0.025	-0.024	-0.020
	(-2.48)**	(-2.40)**	(-1.88)*
RND	-0.018	-0.030	-0.027
	(-0.64)	(-0.88)	(-0.83)
FOCUS	0.023	0.024	0.020
	(2.70)***	(2.70)***	(2.34)**
Constant	0.178	0.182	0.130
	(5.25)***	(5.06)***	(3.14)***
Industry fixed effects	no	yes	yes
Year fixed effects	no	no	yes
Observations	544	544	544
Adj. R-squared	0.169	0.163	0.155