Bankruptcy, Value Puzzles and the Survivorship Bias

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Abstract

This paper argues that a survivorship bias is able to distort upwards the measurement of the average ex-post firm value, because bankruptcy cancels firms with low realized cash flows from databases. This bias increases in bankruptcy probability, giving rise to known pricing puzzles across types of firms. For instance, it generates an ex-post discount on conglomerates when diversification helps survival. Similarly, it makes a parent company appear to trade at a discount relative to its standalone counterpart because the parent survives to recessions more often than the standalone firm. When bankruptcy costs are positive, the bias distorts inference on relative firm efficiency, turning a *true ex-ante* diversification premium, due to lower expected bankruptcy costs, into an *apparent ex-post* diversification discount. Our empirical analysis shows that the US conglomerate discount does not statistically differ from zero for firms that are closest to distress, increasing to 15.8% when firms belong to the top quartile of survival probability.

JEL Classification: G32, D23, K19.

Keywords: diversification discount, survivorship bias, parent company discount, bankruptcy, coinsurance, contagion.

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1 Introduction

Despite the real-world relevance of diversified firms, the link between their economic role and their value remains an open question. Some argue that diversification reduces firm efficiency, thereby lowering the value of diversified firms below that of specialized, standalone ones. Others question the causal link between the observed diversification discount and inefficiency, showing that it disappears once self-selection and accounting definitions enter the analysis. In a similar vein, other scholars show that the discount may simply reflect the efficient acquisition of lower value firms by conglomerates.[1]

The model in this paper sheds new light on value paradoxes, including the diversification discount, by focusing on bankruptcy. First, we show that a survivorship bias distorts upwards the measurement of the average ex-post firm value, because bankruptcy cancels low value firms from databases. This bias increases in bankruptcy probability. An implication is that it distorts the comparison of the average ex-post value of diversified and focused firms. If the former survive more often in adverse states of the world than the latter, then their average ex-post value will appear to be lower. Thus, bankruptcy and the survivorship bias contribute to explain the diversification discount.

Our model also allows for bankruptcy costs, in order to price a well known function of diversification - that of reducing bankruptcy costs through coinsurance (as in Banal, Ottaviani and Winton (2013), Boot and Schmeits (2000), Leland (2007), Lewellen (1971)). Our model will predict a true ex-ante premium for firms that save more bankruptcy costs, indicating this reason for the real-world relevance of diversified organizations. Interestingly, it will also predict the highest apparent average ex-post discount for these firms due to the survivorship bias. Our second contribution is to bring to the foreground this paradox and the wrong inference on relative firm efficiency it implies, when bankruptcy costs are positive.

Our third contribution is to highlight other pricing puzzles, across types of diversified organizations, due to the survivorship bias. Following Leland (2004) and Nicodano and Regis (2018), we juxtapose diversified business groups, where parent and subsidiary firms have separate legal liability, to diversified conglomerate mergers, where units are jointly liable for their debt obli-

[1] A summary of the early, but ongoing, debate on the conglomerate discount appears in Maksimovic and Phillips (2007).

gations. In a conglomerate, an unprofitable unit may drag the profitable units into bankruptcy. As a consequence, the true value of groups exceeds that of conglomerates. The reason is that groups avoid contagion thanks to separate incorporation, but allow a group affiliate to support other affiliates thus providing the same coinsurance benefits of the conglomerate. Since groups are able to survive more often, their apparent value will be lower.[2]

The survivorship bias may contribute to explain another pricing puzzle, namely the parent company discount relative to its standalone valuation.[3] According to our model, this discount originates from the parent surviving more often thanks to the dividend receipts from its subsidiaries. Since a listed subsidiary provides a smaller dividend to its parent company than a private one, taking the firm public reduces the parent company survival in industry downturns. The pricing implication of this reasoning is that the discount of the parent company, induced by the survivorship bias, is lower in pyramidal groups than in private groups, and disappears when subsidiaries are spun-off. Let us stress that, throughout the paper, the market prices firms correctly and there are no limits to arbitrage. What generates the difference between ex-ante true and ex-post apparent value is the exit of bankrupt firms from databases along with the inability of analysts to take this exit into account.

We use default probabilities of US firms in order to establish whether multi-segment firms have better survival skills than their single-segment components. This appears to be the case, both in univariate and multivariate experiments.[4] Moreover, we investigate the relationship between the survivorship bias and the conglomerate discount in a quantile regression of firm discount, when the sample is cut according to 25%, 50%, 75% percentiles of firm survival probability. It shows that the point estimate of the diversification discount is equal to 4.8%, but does not statistically differ from zero, for quartile firms that are closest to distress. When firms belong to the top quartile of survival probability, the conglomerate discount increases to 15.8%. The discount associated with the median survival probability is equal to 10.3%.[5]

Our analysis implies that the diversification discount originates from a survivorship bias,

[2]See Almeida, Park, Subrahmanhyam and Wolfenzon (2011) and references in Khanna and Yafeh (2007) for empirical evidence on relative value and profitability of group affiliates.

[3]See Cornell and Liu (2001) on the parent company discount.

[4]This result is consistent with evidence in Borghesi, Houston and Naranjo (2007), and Santioni, Schiantarelli and Strahan (2017). Moreover, firm age correlates with higher discounts (see Borghesi et al. (2007), and Hund, Monk and Tice (2010)) and only surviving firms grow older.

[5]By comparison, Berger and Ofek (1995) report an average conglomerate discount of 13%.

which is positively related to bankruptcy probability and inversely to economic efficiency if bankruptcy costs are positive. In our setting, the amount of debt is exogenous - as if firms were subject to credit rationing - so as to allow for straightforward value comparisons. The implications carry over to models that allow for an endogenous choice of debt (as in Leland (2007), Luciano and Nicodano (2014)) and ownership (Nicodano and Regis (2018)), conditional on the level of debt. Our model overlooks agency costs that have been the focus of much previous literature on the diversification puzzle. However, in a robustness section, we also investigate a setting with unobserved effort provision where coinsurance distorts effort incentives of conglomerate managers (as in Boot and Schmeits (2000)).

The rest of the paper proceeds as follow. Section 1.1 discusses closely related literature. Section 2 presents our simple model with bankruptcy costs. Section 3 derives true and apparent firm values and the relationship between the diversification discount and the survival skills of conglomerates and groups. Section 4 presents an empirical analysis of the relation between value and default probability. In Section 5 we discuss the robustness of our results. Conclusions follow. All proofs are in Appendix A.1, while Appendix A.2 provides a general version of the model. Appendices A.3 and A.4 provide further information on the variables included in the empirical analysis.

1.1 Related Literature

This paper provides new insight into the diversification-value controversy, bringing into this arena the known problem of survivorship bias in empirical finance. We know that databases either exclude companies that filed for bankruptcy or have otherwise ceased to exist, or report of their past existence but are obviously unable to report their post-bankruptcy prices and balance sheet data. Banz and Breen (1986) observe that this induces an ex-post-selection bias that disturbs the comparison of returns between different types of firms, such as firms with low and high price/earnings. Kothari, Shanken and Sloan (1995) show that ex-post selection overstates the excess return on high book-to-market portfolios. Brown, Goetzmann and Ross (1995) highlight how survival distorts return predictability and the equity premium. We show that it biases upwards the average ex-post value of firms. Moreover, the bias may distort our inference about the relative efficiency of diversified and focused organizations, because it is inversely related to economic efficiency when there are no market imperfections beside bankruptcy costs. We thus suggest a plausible explanation for the most puzzling aspect of the controversy, namely the existence of a large discount for diversified firms in the raw data together with the difficulty in associating it to a blatant inefficiency.

Gomes and Livdan (2004) argue that the conglomerate discount reflects the endogenous, efficient selection of less productive firms into diversified conglomerates. In a somewhat similar vein, our model suggests that the efficiency of firms with the largest average, ex-post discounts is actually the highest. The difference is that, in our setting, the discount is a pure artifact of the data. However, our argument concerning the survivorship bias holds in case there is a true, ex-ante discount (or premium) for conglomerates. This may stem from the functioning of the internal capital market (Almeida et al. (2011), Rajan, Servaes and Zingales (2000), Stein (2002)), from employee incentives (Cestone and Fumagalli (2005), Fulghieri and Sevilir (2011)), as well as production decisions (Alonso, Dessein and Matouschek (2015)). Our general point is that any true discount (or premium) due to such motives is upward (downward) biased by enhanced survival.

Other papers highlight the role of bankruptcy in explaining the diversification discount. Mansi and Reeb (2002) argue that diversification brings about a wealth transfer for bondholders at the expense of stockholders by reducing default risk. The excess value measure in the discount literature captures wealth transfer from stockholders but not the wealth transfer to bondholders, relying on the market value of equity but on the book value of debt. This produces an apparent diversification discount. Our insight indicates the presence of an additional distortion induced by the data, when the analyst does not account for the differential mortality of firms. Hund, Monk and Tice (2010) build on the idea that diversified firms have less uncertainty about future mean profitability. They show that diversified firms will trade at a discount relative to single segment firms due to convexity of the discounting function. In our model, diversified firms are less risky but the diversification discount is an artifact of the data.

2 The Model

This section sets up the essential elements of the model and derives the true cost of debt and the true value of different organizations.

2.1 Organizational Structures and Cash Flows

We define below three organizational types for two production units, that produce equal cash flows irrespective of the organization they belong to. Each production unit funds its investment through a fixed amount of debt. Organizations differ in the extent of support that each unit can provide to the other one, as well as in the extent of liability for the other unit debt. This affects both credit conditions and profits, net of funding costs, to each organization.

Each unit, indexed by $i = (A, B)$, raises an amount of debt D_i to invest in a project at the initial time ($t = 0$). The operating profit of each unit is realized in $t = 1$. It will be High $\{H\}$, and equal to $X_i > 0$, with probability $p_i \in (0, 1)$, and it will be Low $\{L\}$, and equal to zero, with probability $(1 - p_i)$. We define four states of the world, $\{HH, LL, HL, LH\}$, where the first (second) letter in each pair refers to the profit of unit A (B).

Our choice of values implies that each unit has insufficient operating profits in state L to honor its own debt obligations. Without support, it defaults, and the future profit of unit i, $K_i > 0$, is lost.[6] Our key assumption is that the profit of unit A, in state $\{HL\}$, exceeds combined debt repayment of the two units, whereas the profit of unit B is lower than the combined service of debt. We will later assess that payoffs satisfy these restrictions.

The entrepreneur chooses among three organizations: standalone firms, business groups and conglomerates. Standalone firms operate separately. Each is independently liable to competitive lenders, who require a interest factor R_i. Given the assumptions concerning cash flows, firm A defaults in states $\{LH\}$ and $\{LL\}$ while firm B defaults in $\{HL\}$ and $\{LL\}$. Thus, the survival probability of standalone A and B are $p_A^{Sur} = p_A$ and $p_B^{Sur} = p_B$, respectively.

In a conglomerate, segments A and B belong to the same firm. They are therefore jointly liable *vis-à-vis* lenders. The conglomerate defaults in state $\{LL\}$, when both units either have zero profits, and in state $\{LH\}$, when segment A drags the profitable segment B into bankruptcy. However, there are coinsurance benefits in state $\{HL\}$, because profits from segment A save B from insolvency.[7] Thus, the conglomerate organization allows for coinsurance, while standalone companies do not, but it suffers from contagion. We define the survival probability of conglomerates as $p_C^{Sur} = p_A$. So far, we are following the setup of Boot and Schmeits (2000) without

[6] Hennessy and Whited (2007) estimate bankruptcy costs in the range of 8%-15% of capital for US Compustat firms, while Leland (2007) calibrates them to 23% for BBB-rated firms.

[7] This is the situation when Indian groups fail to provide support to ailing subsidiaries (Gopalan, Nanda and Seru (2007)).

incentive problems, adding instead the assumption of asymmetric profits. This assumption makes contagion possible, a feature that is prominent in other analyses of conglomerate mergers such as Banal, Ottaviani and Winton (2013) and Leland (2007).

We now extend the analysis to groups. In a group, the incorporation of companies is separate and lenders fund them individually. The parent company B owns its subsidiary A and receives dividends that allow the parent to meet its debt obligations when the former is profitable and the latter is not, in state $\{HL\}$. Despite this ownership link, the parent company B enjoys corporate limited liability *vis-à-vis* the debt obligations of unit A. This limit on liability implies that unit A selectively defaults in state $\{LH\}$. Thus, the group organization allows for diversification, as in conglomerates, without incurring into contagion. Therefore, the subsidiary A and the parent company B survive with probability $p_{A \in G}^{Sur} = p_A$ and $p_{B \in G}^{Sur} = p_B + p_A(1 - p_B)$, respectively. In the first part of our analysis, we assume that the parent company B owns 100% of the shares of its subsidiary A.

It is worthwhile discussing a few features of our model concerning diversified organizations. First, corporate limited liability is central to the argument that groups save on bankruptcy costs with respect to conglomerates. Courts may occasionally repeal corporate limited liability asking the parent company to meet its subsidiary debt obligations. Appendix A.3, available upon request, reports on court practice in several jurisdictions, that usually 'pierce the corporate veil' in case of fraud, only. Second, the model is simple so as to allow for value comparisons. On the one hand, the amount of debt is exogenous, as in the case of credit rationing. In general, optimal debt responds to both coinsurance and contagion (Leland (2007), Nicodano and Regis (2018)). Insights on relative survival rates, relative efficiency and relative apparent values carry over to these more complex settings conditional on debt levels. On the other hand, our one-shot model rules out mergers and divestment, that have been the focus of prior research (Fluck and Lynch (1999), Gomes and Livdan (2004)). Another simplifying assumption is that coinsurance takes the form of a transfer from A to B, only, both in conglomerates and in groups. We could enlarge this minimalist state space to define an additional state in which B rescues A from bankruptcy and more generally to eliminate asymmetries in profits (as in Boot et al. (1993), and Luciano and Nicodano (2014)). In appendix A.2 we develop a more general version of the model that allows each unit to save the other from insolvency. These algebraic complications do not affect the key insight concerning true and apparent value of each organization, to which we turn in the next sections.

2.2 Coinsurance, Contagion, and the Cost of Debt

We now determine the interest factors charged by the lenders, assuming risk-neutrality and a zero risk-free rate. Lenders of independent firms, $i = A, B$, receive the debt repayment in state $\{H\}$ and collect nothing in state $\{L\}$. It follows that the interest factor for unit i, R_i, satisfying the lenders' zero expected profit condition, $(1 - p_i) \times 0 + p_i R_i = D_i$, is equal to

$$R_i = D_i p_i^{-1} . \tag{1}$$

Conglomerate lenders receive the debt repayment in state $\{HH\}$ and $\{HL\}$. They also recover the cash flow X_B in state $\{LH\}$, when division A drags division B into bankruptcy, but B is profitable. Thus, the interest factor for the conglomerate is equal to

$$R_C = [D_A + D_B - p_B(1 - p_A)X_B)]p_A^{-1} . \tag{2}$$

This factor solves the zero profit condition, which requires lenders' expected repayments to equal the loan provided at t=0, i.e. $[p_A p_B + p_A(1-p_B)]R_C + p_B(1-p_A)X_B = D_A + D_B$. Lenders collect the interest payment when either both divisions are successful, an event that has probability $p_A p_B$, or division A is profitable but B is not, with probability $p_A(1 - p_B)$. Moreover, they recover profit, X_B, upon the conglomerate default when there is contagion, with probability $p_B(1 - p_A)$.

Turning to the group, lenders charge to the subsidiary A the same interest rate of the corresponding standalone firm defined by Equation (1), such that $R_{A \in G} = R_A$. This result holds because the subsidiary defaults in the same states of the world as the standalone firm. The cost of borrowing for the parent B is, instead, lower than the corresponding cost of unit B when it operates as a standalone, thanks to the possibility of support in state $\{HL\}$:

$$R_{B \in G} = D_B[p_B + p_A(1 - p_B)]^{-1} . \tag{3}$$

Indeed the parent, B, defaults in state $\{LL\}$ only. The dividend it receives from its subsidiary, A, in state $\{HL\}$ is sufficient to avoid its own insolvency. It avoids contagion from its subsidiary in state $\{LH\}$ thanks to its corporate limited liability. Therefore, lenders' zero expected profit condition, relative to the parent B, is $[p_B + p_A(1 - p_B)]R_{B\in G} = D_B$.

We can now rank the borrowing costs across the different organizational structures. Groups pay a lower interest factor on debt with respect to standalone firms, because the interest factor of the parent firm ($R_{B\in G}$) is lower than the interest factor when B is an independent unit (R_B). Such overall improvement in credit conditions is due to the positive probability of the coinsurance state $\{HL\}$ when subsidiary dividend allows the parent to survive. In turn, conglomerates pay a lower interest factor with respect to groups, because lenders anticipate recovering positive cash flow (X_B) when the profitable segment B defaults due to contagion. In other words, reduction in the interest factor stems from either lower bankruptcy costs, thanks to coinsurance, or higher recovery upon default due to contagion. Both conglomerates and groups have lower borrowing costs with respect to standalone firms, thanks to coinsurance. However, groups have a higher cost of debt than conglomerates because unit A lenders have no claim to unit B profits. Therefore, the borrowing costs can be ranked as follows:

$$R_C < R_G < R_A + R_B \,, \tag{4}$$

where $R_G = R_{A\in G} + R_{B\in G}$ is the overall cost of debt for a group.

We can now make explicit the restrictions on asymmetric cash flows, underlying the derivations of the previous equations. The assumption that profits in state $\{H\}$ allow to service debt implies that the cash flow in state H, X_i, exceeds the total debt repayment for each unit. For unit B, this implies that $X_B \geq max(R_B, R_{B\in G})$. Since the borrowing cost of a standalone exceeds that of the parent company, it is necessary that

$$X_B \geq D_B p_B^{-1} \,. \tag{5}$$

Recall now that the subsidiary, A, selectively defaults in state $\{LH\}$ while the parent company, B, receives support by A in state $\{HL\}$. This holds if the profit of unit A, X_A, exceeds the combined debt of the two units, i.e. $X_A \geq max(R_C, R_A + R_{B\in G})$, which requires that

$$X_A \geq D_A p_A^{-1} + D_B[p_B + p_A(1 - p_B)]^{-1}\,, \tag{6}$$

since group overall cost of debt is higher than that of conglomerates. The profit of unit B, X_B, must, in turn, fall short the combined interest factor, $X_B < min(R_C, R_A + R_{B\in G})$, which implies that unit B is never able to rescue unit A, i.e.

$$X_B < (D_A + D_B)[p_A + p_B(1 - p_A)]^{-1}\,. \tag{7}$$

The next subsection computes the value of each organization. We will show that a lower cost of debt in conglomerates does not imply that they have the highest value, completing the reasoning in Hann et al. (2013).

2.3 The Value of Diversification

The value of each organization coincides with profit, thanks to the zero risk-free rate assumption. It is straightforward to show that firm true value, TV, is respectively equal to:

$$TV_S = \pi_A + \pi_B + p_A^{Sur} K_A + p_B^{Sur} K_B \tag{8}$$

for two standalone firms;

$$TV_C = \pi_A + \pi_B + p_C^{Sur}(K_A + K_B) \tag{9}$$

for a conglomerate; and

$$TV_G = \pi_A + \pi_B + p_{A\in G}^{Sur} K_A + p_{B\in G}^{Sur} K_B \tag{10}$$

for a group, where $\pi_A = p_A X_A - D_A$, and $\pi_B = p_B X_B - D_B$ equal the expected current profits after the service of debt for unit A and B, respectively. Thus, the true value of each organization is increasing in its survival probability, as future profits depend on the ability of the firm to keep operating.

We now compare true values across firm organizations, also highlighting the effects of coinsurance, contagion and limited liability.

Proposition 1: *Assume costly bankruptcy. Then:*

a. Groups have the highest true value, due to their higher survival probability.

b. The group premium relative to conglomerates , i.e.

$$TV_G - TV_C = (p^{Sur}_{A\in G} - p^{Sur}_{C})K_A + (p^{Sur}_{B\in G} - p^{Sur}_{C})K_B\,, \tag{11}$$

represents the value of corporate limited liability, that is, saved contagion costs. The one relative to two standalone firms, i.e.

$$TV_G - TV_S = (p^{Sur}_{A\in G} - p^{Sur}_{A})K_A + (p^{Sur}_{B\in G} - p^{Sur}_{B})K_B\,, \tag{12}$$

represents the value of coinsurance.

c. Conglomerate true excess value relative to standalone firms, i.e.

$$TV_C - TV_S = (p^{Sur}_{C} - p^{Sur}_{A})K_A + (p^{Sur}_{C} - p^{Sur}_{B})K_B\,, \tag{13}$$

is positive if, and only if, coinsurance exceeds contagion probability.

In our simple setting, unit B is not able to rescue unit A and, consequently, p^{Sur}_A, p^{Sur}_C and $p^{Sur}_{A\in G}$ all equal p_A since A solely depends on its own ability to generate a profit in state $\{H\}$ and survive. Therefore, the group premium relative to a conglomerate equal $p_B(1-p_A)K_B$, while the group premium relative to two standalones is equal to $p_A(1-p_B)K_B$. In turn, the conglomerate excess value relative to standalone firms equals $[p_A(1-p_B) - p_B(1-p_A)]K_B$ and is positive if, and only if, $p_A < p_B$.

Proposition 1 highlights the economic role of diversified firms, namely enhanced survival, that increases firm value when bankruptcy costs are positive. The ability to save on bankruptcy costs may explain the reason why diversified business groups and conglomerates are common corporate organizations, generating a total value added of 28 US trillion dollars in over 200 countries (Altomonte and Rungi (2013), Herring and Carmassi (2009)). Part (b) highlights that corporate limited liability saves future profits (K_B) from being lost in the bankruptcy procedure due to contagion. This happens with probability $p_B(1-p_A)$, which is the probability that unit B, while solvent by itself, is unable to provide support to the insolvent one. Coinsurance allows saving unit B from insolvency. This occurs with probability $p_A(1-p_B)$, which is the probability that B is insolvent but unit A generates enough profits to support it. Part (c) indicates that the excess value of conglomerates is positive only if contagion problems are limited. It is not a new result, reminding of previous insight due to Banal et al. (2013) without tax distortions and Leland (2007) with tax distortions.

Even if conglomerates enjoy a lower interest rate, they do not have the highest value when compared to groups and standalone firms. This implies that conglomerates may have a low borrowing cost even when they destroy value with respect to (focused) standalone firms. The reason is that lenders anticipate a larger recovery-upon-default due to the contagion of healthy segments. We thus highlight that conglomerate diversification may counter-intuitively reduce both the interest rate and conglomerate value below the ones of focused firms in the presence of contagion costs. Groups have the highest expected value relative to both conglomerates and focused firms, because they best protect firm activity from bankruptcy.

Given the previous results, in the following section we explain how surviving firms, however organized, appear to trade at higher prices with respect to their true value. And we show that the firm type enjoying the highest true value thanks to diversification becomes the firm type with the highest apparent diversification discount.

3 The Diversification Discount and Other Puzzles

This section will argue that the survivorship bias contributes to the explanation of pricing puzzles. The best known is the diversification discount, that is the observation that the average ex-post value of diversified firms is lower than the average ex-post value of matched focused firms. The second one is the parent company discount, where a parent company displays lower value than an equivalent portfolio of standalone firms. We will first develop the theoretical predictions and then discuss some stylized facts about these pricing puzzles. Complete proofs are in Appendix A.1.

3.1 Survivorship Bias

The survivorship bias originates from two facts. First, datasets cannot contain balance sheet information on bankrupt firms. Second, the econometrician does not control for the survival ability of firms.

In order to be able to infer the *apparent* value, AV, of each organization, we must ask whether the state is high or low when the econometrician finds firms in her dataset. This will determine the chances of observing a high or a low cash flow. Let us, therefore, start with standalone units. The probability of state $\{H\}$, when the econometrician notes that a standalone firm is present in her dataset, is 1. Indeed, a standalone unit goes bankrupt and exits from the database in state $\{L\}$. It follows that the apparent value of a standalone is equal to the high cash flow realizations net of the debt repayment, that is:

$$AV_i = X_i + K_i - R_i = \pi_i (p_i^{Sur})^{-1} + K_i \, . \tag{14}$$

Therefore, the observed combined value of two independent firms is equal to

$$AV_S = \pi_A (p_A^{Sur})^{-1} + K_A + \pi_B (p_B^{Sur})^{-1} + K_B \, . \tag{15}$$

Let us now determine the probability of being in a good or bad state when the econometrician observes a conglomerate in the dataset. The probability of state $\{HH\}$, conditional on observing both standalone companies alive, is one. On the contrary, the probability of state $\{HH\}$ conditional on observing a conglomerate is lower, because of the conglomerate ability to survive when A rescues B. Such probability is $Pr[HH/(HH + HL)] = p_A p_B [p_A p_B + (1 - p_B) p_A]^{-1}$, which simplifies to p_B. The probability of state $\{HL\}$ conditional on observing a conglomerate, i.e. $Pr[HL/(HH + HL)]$, is equal to $(1 - p_B)$. Thus, the estimated value of the conglomerate equals

$$\begin{aligned} AV_C &= p_B (X_A + K_A + X_B + K_B - R_C) + (1 - p_B)(X_A + K_A + K_B - R_C) = \\ &= (\pi_A + \pi_B)(p_C^{Sur})^{-1} + K_A + K_B \, . \end{aligned} \tag{16}$$

Let us conclude with the group organization. The probability of state $\{H\}$, when the subsidiary A is alive, equals one because affiliation does not influence the default of the subsidiary. Hence, the apparent value of the subsidiary is equivalent to that of the corresponding standalone firm ($AV_{A\in G} = AV_A$). On the contrary, the state is $\{H\}$ with probability equal to $p_B[p_B + p_A(1-p_B)]^{-1}$, and $\{L\}$ with probability equal to $p_A(1-p_B)[p_B + p_A(1-p_B)]^{-1}$ when the parent company, B, appears in the dataset. This occurs because B survives in low states, when it generates zero cash flows, thanks to the subsidiary support. The econometrician, therefore, estimates the value of the parent company B as being equal to

$$\begin{aligned} AV_{B\in G} &= [p_B(X_B + K_B - R_{B\in G}) + p_A(1-p_B)(K_B - R_{B\in G})][p_B + p_A(1-p_B)]^{-1} = \\ &= \pi_B (p^{Sur}_{B\in G})^{-1} + K_B \,. \end{aligned} \tag{17}$$

Overall, the value of a group, conditional on survival, is

$$AV_G = \pi_A (p^{Sur}_{A\in G})^{-1} + K_A + \pi_B (p^{Sur}_{B\in G})^{-1} + K_B \,. \tag{18}$$

Clearly, Equations (15), (16) and (18) show that higher levels of survival probability result in lower firm values observed in the data. We summarize our results as follows:

Proposition 2:

a. The apparent value of a firm, AV, exceeds its true value, TV, due to a survivorship bias.

b. The true value of a firm equals the apparent value of its components multiplied by their survival probability, as follows:

$$TV_S = AV_A \times p^{Sur}_A + AV_B \times p^{Sur}_B \,, \tag{19}$$

$$TV_C = AV_C \times p^{Sur}_C \,, \tag{20}$$

$$TV_G = AV_{A\in G} \times p^{Sur}_{A\in G} + AV_{B\in G} \times p^{Sur}_{B\in G} \,. \tag{21}$$

This proposition highlights that sample firms survived in databases due to their higher realized profitability. Thus their average ex-post value exceeds their ex-ante true value with the bias being an increasing function of the organization probability of default. To infer the true value we must therefore multiply the biased average values by the survival probability.

We are now ready to address pricing puzzles arising from the comparison of the apparent values of firms. Both group affiliates and conglomerates exploit diversification in order to survive during industry downturns. We now show that both appear to trade at a discount relative to standalone companies when the econometrician does not account for the fact that sample firms are the ones that survived. We thus address the methodology of several papers investigating the excess value of multi-unit firms. These papers typically match single-unit to multi-unit firms, when all of them are alive, and therefore appear in the database.

Let us start from the conglomerate discount, comparing Equations (15) and (16). The conglomerate appears to have a lower market value with respect to standalone firms if

$$(\pi_A + \pi_B)(p_C^{Sur})^{-1} < \pi_A(p_A^{Sur})^{-1} + \pi_B(p_B^{Sur})^{-1}\,, \tag{22}$$

that is, if $p_B^{Sur} < p_C^{Sur}$ or, equivalently, $p_A > p_B$. Thus, conglomerates trade at an apparent discount relative to standalone firms when the probability of coinsurance exceeds the probability of contagion, or, equivalently, the survival probability of conglomerates is higher than that of comparable standalones. If bankruptcy costs are positive, the above result leads to the wrong inference concerning relative firm efficiency. A conglomerate discount (premium) will characterize conglomerates that save (contribute to higher) bankruptcy costs.

To isolate the business group discount, we carry out a similar comparison between the apparent values of a group and that of comparable standalone units, that is when an econometrician observes all units in operations. The group value in (18) is lower than the apparent value of two comparable independent units in (15), if

$$\pi_A(p_{A\in G}^{Sur})^{-1} + \pi_B(p_{B\in G}^{Sur})^{-1} < \pi_A(p_A^{Sur})^{-1} + \pi_B(p_B^{Sur})^{-1}\,, \tag{23}$$

or $p_B^{Sur} < p_{B\in G}^{Sur}$. This inequality simplifies to $p_B < 1$, which holds by assumption. It follows that surviving parent companies appear to trade at a discount, while in reality, they are saving on dissipative bankruptcy.

In summary, the survivorship bias affects both conglomerates and business groups. However, the diversification discount for business groups is more severe because the group survives more often when profitability is low, which implies that the apparent value of groups is always lower than the apparent value of conglomerates, as follows:

$$\pi_A(p_{A\in G}^{Sur})^{-1} + \pi_B(p_{B\in G}^{Sur})^{-1} < (\pi_A + \pi_B)(p_C^{Sur})^{-1}\,, \tag{24}$$

that is, if $p_C^{Sur} < p_{B\in G}^{Sur}$, or $p_A < 1$. This inequality, again, holds by assumption.

We summarize our results as follows:

Proposition 3: *Assume an analyst matches groups and conglomerates to comparable standalone firms, conditional on available data, without accounting for different mortality. Then:*

a. The value of conglomerates appears lower than the value of standalone firms if contagion probability is lower than coinsurance probability, with the difference being equal to

$$AV_S - AV_C = \pi_A[(p_A^{Sur})^{-1} - (p_C^{Sur})^{-1}] + \pi_B[(p_B^{Sur})^{-1} - (p_C^{Sur})^{-1}]\,. \tag{25}$$

b. The value of groups appears lower than the value of standalone firms, the difference being equal to

$$AV_S - AV_G = \pi_A[(p_A^{Sur})^{-1} - (p_{A\in G}^{Sur})^{-1}] + \pi_B[(p_B^{Sur})^{-1} - (p_{B\in G}^{Sur})^{-1}]\,. \tag{26}$$

c. The value of groups appears lower than the value of conglomerates, the difference being equal to

$$AV_C - AV_G = \pi_A[(p_C^{Sur})^{-1} - (p_{A\in G}^{Sur})^{-1}] + \pi_B[(p_C^{Sur})^{-1} - (p_{B\in G}^{Sur})^{-1}]\,. \tag{27}$$

d. When bankruptcy costs are positive, the larger is the true diversification premium the larger is the apparent diversification discount.

Proposition 3.a, 3.b and 3.c imply that the discount is larger the better the relative survival ability of a firm. Furthermore, Proposition 3.d implies that comparing average market values of different organizations conditional on survival leads to the wrong inference concerning their relative efficiency, when there are positive bankruptcy costs. This is not due to distortions in market prices: prices are rational, and there are no limits to arbitrage. The wrong inference derives from the different survival ability of organizations, which investors and analysts alike often fail to consider because of data limitations.

3.2 Explaining Observed Pricing Puzzles

This section collects some stylized facts that our model may help explain. It begins with the evidence of a positive value of diversification in experiments that are free from the survivorship bias. It proceeds to discuss the observed relationship between the conglomerate discount, firm age and segment relatedness, connecting it to the survivorship bias.[8] It then reads through the lenses of our model both the parent company discount and the so called boring company puzzle. Our model posits that diversification creates value, as in Proposition 1, and this should be evident when no survivorship bias disturbs the inference. Indeed, diversification has positive value when the analyst uses survey data to estimate ex-ante returns (see Hann, Ogneva and Ozbas (2013)). Survey data should not be subject to selection bias, to the extent that surveyed people remember the occurrence of defaults. Similarly, a regression analysis that accounts for defaulted units - thus getting rid of the survivorship bias - should reveal that diversified firms outperform during industry distress. Gopalan and Xie (2011) measure the average discount on multi-units firms just before and during unexpected industry distress, taking into account the disappearance (through delisting, i.e. bankruptcies, mergers, etc.) of weak standalone firms. They find that the average conglomerate discount reduces from 20% the year before industry distress to 6.9% in the three years after industry distress.

We now turn to the diversification discount. While most studies do not control for differential bankruptcy of conglomerates and portfolios of focused firms, the relationship between firm age and the diversification discount is well known. Borghesi, Houston, and Naranjo (2007) show that part of the discount arises from differences between mature diversified firms and young focused firms. After controlling for firm age, the diversification discount falls by 15% to 30%. They also find that conglomerates are less likely to declare bankruptcy than their focused counterparts and that this is not the result of diversified firms refocusing before going bankrupt. They interpret their findings in the light of models suggesting a life-cycle for firm growth opportunities (Matsusaka (2001), Bernardo and Chowdhry (2002)). Our model (Proposition 3) suggests instead that controlling for age reduces the survivorship bias. The positive association of the conglomerate discount with firm age also appears in Hund, Monk, and Tice (2014). They argue

[8] In the diversification discount literature there is hardly any distinction between conglomerates and groups. This is because databases, such as Compustat, usually refer to conglomerates also when subsidiaries issue debt in their own name - and are, therefore, groups according to our model.

that, as firm ages, asset multiples decrease more quickly for focused firms because uncertainty about their true value resolves more quickly. In the light of our model, mature diversified firms survive to adverse contingencies thanks to cross-subsidization. Without controlling for age, their ex-post average profits and average value appear lower due to the survivorship bias. Once the analyst controls for age, the survivorship bias fades away.

Our model assumes unrelated diversification, in that cash flows are independently distributed. The survivorship bias would diminish in case of more synchronous bankruptcies in conglomerates units, due to higher cash flow correlation. This implication aligns with the observation that firms engaging in unrelated diversification are subject to significantly higher discount compared to conglomerate operating in related business (Berger and Ofek (1995)). This finding holds when using BITS instead of Compustat data (Villalonga (2004a)), as well.

In Proposition 3, groups and their parent companies have lower apparent values than their standalone counterparts, because they survive more often to industry downturns. Several works document the lower valuation of groups with respect to non-group affiliates, attributing it to tunneling and expropriation of resources by controlling shareholders (Joh (2003), Bae, Kang and Kim (2002), Johnson, Boone, Breach and Friedman (2000)). However, Masulis, Pham and Zein (2008) find that Tobin's Q is higher in subsidiaries of pyramidal groups, where the separation of ownership from control is high, than in firms at the top, after controlling for endogeneity of group membership. Proposition 3 may account for both stylized facts. Similarly, Mitchell, Pulvino and Stafford (2002), and Cornell and Liu (2001), find several cases in which the value of the parent company is lower than the value of its subsidiary.[9] In our setting, the healthier is the subsidiary, the lower is the apparent value of the parent because of its higher likelihood of survival thanks to the dividends of the subsidiary.

Last but not least, Proposition 3 relates the survivorship bias to the probability of default, that is arguably higher for firms operating in industries with higher profit dispersion. The bias may, therefore, contribute to explain why companies in such industries display higher value than firms in "boring" industries. Chen, Hou and Stulz (2015) cannot find a rational explanation to this seeming mispricing and resort to a behavioral one. They also show that firms in less boring industries have lower realized returns. This evidence appears consistent with both a mispricing

[9] Schill and Zhou (2001), and Lamont and Thaler (2000) find that subsidiaries have higher value than their parent firms in carve outs operations.

conjecture and our survivorship bias explanation.

In summary, our model may provide a unifying rationale for puzzling patterns uncovered by different strands of empirical work.

4 Empirical Analysis

In this section, we use default probabilities of US firms in order to establish whether multi-segment firms have better survival skills than single-segment firms. Moreover, we will investigate the relationship between the survivorship bias and both the ex-post value and the conglomerate discount. We will juxtapose all types of multi-segment to single-segment firms, as our data sources do not distinguish between groups and conglomerates. Consistent with previous papers addressing the diversification discount, we call all multi-segment firms "conglomerates".

A necessary condition for conglomerates to trade at a discount due to the survivorship bias is that their survival probability exceeds the one of standalone firms. We therefore begin with a test of this hypothesis in the raw data. We then measure the apparent conglomerate discount in the raw data. Including in the sample defaulted firms in order to correct for the survivorship bias is not possible, as we cannot observe both the value and balance sheet items of defaulted firms. We thus run the opposite experiment of trying to aggravate the survivorship bias, by eliminating from the beginning of the sample all the companies that defaulted during the sample period. If our conjecture is correct, we should observe an increase in the conglomerate discount in the raw data after eliminating defaulted companies. We also calculate the true value of standalone firms as the product of their apparent value times their survival probability. When we exclude defaulted firms from the beginning of the sample, there are two effects. On the one hand, the average profitability of remaining companies is likely to be higher, lifting both apparent and true values. On the other hand, the survival probability of remaining standalones increases, thereby increasing true values.

Of course, differential survival may derive from differential firm characteristics other than diversification. This is the reason why we proceed to a multivariate analysis of the diversification discount, following Villalonga (2004b), using the regression model:

$$y_{i,t} = \alpha + \beta Conglomerate_{it} + \Gamma X_{i,t-1} + \varepsilon_t \, , \tag{28}$$

where the dependent variable is firm excess value as in Berger and Ofek (1995), and $X_{i,t-1}$ a vector of controls including firm characteristics and year fixed effects. The variable 'Conglomerate' is an indicator variable that is equal to one if the firm is engaged in industry diversification. Its coefficient measures the benchmark discount of conglomerate firms. Again, we expect the apparent component of such benchmark discount to increase once we aggravate the survivorship bias by eliminating from the beginning of the sample all defaulted firms.

Our model determines value and discounts as a function of exogenous PDs. Thus, it is tempting to include the PD as an explanatory variable in a conglomerate discount regression. This procedure would not however deliver unbiased estimates, as more general models show that they are jointly determined (Leland (2007), among others). We thus investigate whether both the apparent conglomerate discount and the excess default probability of conglomerates have similar explanatory variables in a multivariate regression. We then run a quantile regression relating the excess value of conglomerates, within each survival probability quartile, to a conglomerate dummy along with other controls. We expect the apparent component of the conglomerate discount to be negligible or low for firms close to defaults, and larger discounts for firms with higher probability of survival.

Throughout our analysis, we use one-year ahead historical default probabilities that follow the methodology in Duan, Sun, and Wang (2012).[10] Since we are not using risk-adjusted probabilities, our analysis provides a lower bound to the impact of the survivorship bias on firm value and the conglomerate discount. See Almeida and Philippon (2007) for a risk-adjusted estimate.

4.1 Data and Sample

Our sample combines several data sources over the years 1990-2014. Firstly, we retrieve information on multi-segment firms from COMPUSTAT-Historical Segments. As customary in this literature, we exclude financial and utility firms (see Berger and Ofek (1995), Villalonga (2004b), Villalonga and Amit (2006)). Previous studies associate each segment with a similar independent firm in the same industry (Lamont and Polk (2001), Villalonga (2004b), Kolasinski (2009))

[10]For robustness, we also estimate the hazard rate model

$$P_{t-1}(Y_{i,t}=1) = [1 + exp(-a - bx_{i,t-1})]^{-1} \tag{29}$$

where Yit is an indicator variable equal to 1 when the firm goes bankrupt at time t. The vector x alternatively includes the predictive variables in Campbell et al. (2008), or (Shumway (2001), or Chava and Jarrow (2004)).

to compute the discount of conglomerate firms with respect to the standalone ones. We follow a similar approach, applying the sample selection as in Lamont and Polk (2001) and Berger and Ofek (1995). We discard all segments that do not have at least five similar single-units firms in the same industry (4, 3, and 2-digits SIC), and negligible segments with total firm sales lower than $20 million. We then require that, for each segment in a conglomerate, we can match with at least five single-segment firms in the industry.[11]

Information on firm bankruptcy comes from three sources. The first is the COMPUSTAT-NA database, which provides the indication of deletion of a company, as well as the motivation of deletion. We keep only the deletions for bankruptcy filings. The second source is CRSP, which also gives information about all public firms delisted for a bankruptcy filing. The third source is the UCLA- LoPucki Bankruptcy Research Database (BRD). It reports the bankruptcy filings in the United States Bankruptcy Courts, since October 1st, 1979, of the major public companies.[12] Coverage includes cases filed under both Chapter 7 and Chapter 11. We also retrieve the one-year ahead probability of default by the Credit Research Initiative (CRI) from the National University of Singapore.[13] This dataset provides the individual firms probability of default (PD from now on) for a cross country sample of 107,490 companies.

After merging all these datasets, we remain with 32,258 firm-year observations, of which 11,271 are multi-segment firms (conglomerates) - see Table 1, columns 1 and 2. Thus conglomerates represent 34.5% of active US firms in our (unrestricted) sample. Table 1 also reports the number of defaults and failures per year in our sample. As in Campbell et al. (2008), a default event is a bankruptcy filing under either Chapter 7 or Chapter 11 of the bankruptcy code. Failures are defined more broadly to include bankruptcies, financially driven delistings (reported in CRSP), or D (default) ratings issued by a leading credit rating agency. The total number of failures (275 and 703 in the restricted and unrestricted sample, respectively) therefore exceeds the total number of defaults (261 and 664, respectively).

The variation in the number of firms stems from three sources, namely the entry of new

[11] We follow this procedure to obtain comparable results with prior ones. Such filtering does however impact the survivorship bias, as we are conditioning the measurement of the discount on surviving stand alone firms.

[12] A company is public according to this source if it filed an Annual Report (Form 10-K or Form 10) with the Securities and Exchange Commission in a year ending not less than three years before the filing of the bankruptcy case. A company is major if assets are worth $100 million or more, measured in 1980 dollars (about $280 million in current dollars).

[13] Data are available at www.rmicri.org.

companies, the exit of bankrupt firms and mergers. This is the reason why the last column of Table 1 reports the number of merger events. The acquisition of a distressed company may indeed contribute to both reduce the value of conglomerates (as in Gomes and Livdan (2004)) and to increase the survivorship bias, since low-valuation single-segment firms disappear from databases.

4.2 Univariate Analysis

Following past works (Berger and Ofek (1995), Villalonga (2004b), Villalonga and Amit (2006), Kuppuswamy and Villalonga (2015)), we define the excess value as the natural logarithm of the ratio between firm market value and its imputed value at the end of the year, computed as the sum of its segments' imputed values. The imputed value obtains by multiplying each segment most recent asset (sales) value by the median market-to-assets multiplier of single-segment firms in the same industry. We implement the industry matching using the narrower SIC including at least five single-segment firms. The procedure to measure the excess PD is similar. It is set as the natural logarithm of the ratio between a firm's PD and its imputed PD at the end of the year. The imputed value is the sum of its segments' imputed values, as above.

Figure 1 portrays the excess PD for different interval of the excess value of conglomerates and standalone firms. It shows that excess conglomerate values are negative - and large in absolute values - along with excess default probabilities. The relationship is, however, non-monotone. Figure 2 reports excess values and excess PDs according to the industry SIC1 classification. These figures show that the excess value of conglomerates is negative but in Retail Trade, which happens to be an industry where the excess conglomerate PD is also positive. Conglomerates represent 40% of manufacturing, a typically mature industry, while in services (Hi-tech, etc.) their share falls to 30%.

Table 2 reports the summary statistics of the main variables used in our empirical analysis. Panel A refers to conglomerates, Panel B to standalones and Panel C to control variables. Both Panel A and Panel B report excess-value and excess PD, and the number of events of default, failure and mergers. According to our model, conglomerates that add to the true value of their segments have lower PD, because coinsurance exceeds contagion. Consistent with this view, conglomerates' mean and median PDs are 18-19% lower than their segments'. Interestingly, there are cases where contagion exceeds coinsurance, as revealed by the maximum value (4,68) of the excess PD distribution. Clearly, our survivorship bias theory does not apply to these cases.

The bankruptcy rate of US segments from 1990 to 2014 is around 0.3% on average (see column (2), corresponding to the Segment Industry Distress line). The conglomerate default rate is, on average, lower, whether measured by the PD from the CRI database, the default or failure rates in the LoPucki database (0.07%). In fact, the average default rate of conglomerates (0.7%) is 20% lower than the default rate of standalones (0.9%), as apparent from a comparison of columns (2). This evidence suggests that conglomerates are able to move resources across their segments in order to offset industry-specific shocks.

We add mergers deals from Thompson Reuters. Conglomerates are likelier to be bidders than targets, and they are likelier than standalone firms to be bidders (see Panel B). Since exits from the sample due to defaults and mergers are more frequent for standalone firms, and we expect entry of standalone firms not to exceed the entry of conglomerates, it is not surprising both their mean and median age are lower.

As for control variables, we measure profitability with net income to total assets ratio (NITA), and we compute the volatility of stock returns (SIGMA). We also employ several financial indicators, including leverage and market-to-book value (MB), along with US macroeconomic data (from the NBER website) such as GDP growth and interest rates. The details of variable construction are in the Appendix A.2. We just stress that, following Campbell et al. (2008), and Cohen, Polk, and Vuolteenaho (2003), we adjust total assets by adding to the book value of total assets 10% of the difference between market and book equity, to deal with outliers that may otherwise bias our financial ratios.

We are ready to turn to our experiment of exacerbating the survivorship bias, expecting an increase in the diversification discount. Table 3 reports tests of the differences in excess value between conglomerates and standalone firms. Panel A uses the full sample, including firms that enter or exit the database after the beginning of the sample. In Panel B, the sample contains only firms surviving until 2014, thereby excluding the defaulted ones. Table 3 also reports the variation in mean excess PDs across firm types. We see that conglomerates (stand alone firms) have a default probability that is 21.2% (6.3%) lower than their imputed segments. In Panel

B, the excess survival probability of conglomerates grows to 37.2% (and the difference in the excess PD of stand alone firms and conglomerate increases from 15% in Panel A to 18.2% in Panel B). In Panel C, the sample also excludes firms entering the sample after the initial date. The mean conglomerate discount reaches 17.2% and the conglomerate excess survival relative to its segments 51.3%. Consistent with the insight of the model, the better is the relative survival ability of conglomerate firms, the more severe the survivorship bias, the larger the conglomerate discount.

In Table 4, we provide an estimate of the true values of both standalone and conglomerate firms, by multiplying the Market-to-book ratio by the survival probability. The difference between the average apparent and true values is positive and statistically different from zero for both standalone firms (0.016) and conglomerates (0.012). Of course, there is considerable variation, ranging from zero to 3.86 for standalone firms and to 3.45 for conglomerates.

4.3 Multivariate Analysis

We now turn to the estimation of the benchmark diversification discount, as in Equation (28), without considering past works correcting for self-selection different from the survivorship bias or for accounting distortions.

Table 5 reports the results when the dependent variable is the excess value and the vector of firm characteristics includes industry (3-digits SIC code) and year fixed effects. Columns (1),(4), and (5) exclude firm age from the set of explanatory variables, while the subsequent ones include it. Column (3) reports the estimation on the complete sample with firm fixed effects. Table 5 shows that the diversification discount persists after controlling for firm and industry characteristics: the diversification discount is equal to 13% and 11% in columns 1 and 2, respectively, confirming the traditional findings on the diversification discount. Firm age increases with survival skills. It is therefore not surprising, given our insight, that the diversification discount falls when we control for age. Restricting the sample to surviving firms and to firms present in all years increases the benchmark conglomerate discount to 14.9% and 14.1% respectively. When we add controls for firm fixed effects (column (3)), the conglomerate discount drops to 3.9%, increasing to 6.5% when we exacerbate the survivorship bias in unreported estimates.

Table 6 shows that the similar controls explain a considerable share of the variation of the excess PDs (with the same sign). This is consistent with the implications of structural models of credit risk, that jointly determine value and default. Estimates show that there is a negative benchmark excess default probability (the coefficient of the conglomerate dummy), indicating that conglomerate PD is on average 10% lower than for standalone firms. Moreover, it increases to 14.7% and to 18.8% when we progressively restrict the sample.

Table 7 reports results of a quantile regression of the firm discount, when the dependent variable is the excess value and samples are divided according to 25%, 50%, 75% percentiles of firms survival probability. Firms in the lowest percentile are the ones with the highest default probability. Table 7 shows that the diversification discount disappears when firms are very close to distress (column (1)), and increases with survival skills. When firms have very high survival probability (column (4)), the conglomerate discount increases to 16%.

This evidence establishes that conglomerates with better survival skills than their component segments suffer the highest value discount. As shown in Tables 3 and Table 6, such excess survival ability also exceeds the one of standalone firms. The excess survival probability moves together the conglomerate discount, as suggested by our model.

5 Robustness

This section qualifies previous results. It suggests that the apparent discount is larger when unit B is able to support unit A (Section 1). It then suggests other modifications to relative pricing that derive from partial ownership of the subsidiary (Section 2) and non-contractible managerial effort (Section 3).

5.1 A Larger Apparent Discount

Our model set-up allows only unit B to support unit A, for simplicity. However, this simplifying assumption compresses the apparent diversification discount. In fact, unit B does not suffer from the survivorship bias. It is, however, easy to add a state of nature with A profits in excess of the debt obligations for both units, as in Leland (2007) and Nicodano and Regis (2018). In that state, unit A would be able to support unit B. This addition is also realistic. For instance, parent companies often support their subsidiaries, without being subject to contractual guarantees. For example, they write “comfort letters” assuring subsidiary lenders that they would assist them in distress. These letters do not undermine their limited liability, because they are legally unenforceable, but allow the parent company to choose whether to honor them ex-post (Boot et al. (1993)).

Appendix A.2 provides such generalization showing that Proposition 2 and Proposition 3 go through with the necessary variation in the definition of the survival probabilities. Moreover, it shows that the survivorship bias in both groups and conglomerates might become even more severe relative to standalone firms.

5.2 Diversification Benefits in Pyramidal Groups

Previous sections deal with groups with fully owned subsidiaries, which are common in several jurisdictions. However, pyramidal groups with listed subsidiaries are also common (see La Porta et al. (1999)). This section investigates the consequences of partial subsidiary ownership for the diversification role of groups and their pricing, continuing to sidestep the expropriation of minority shareholders taking place with separation of ownership from control. A simple argument implies that the listing of affiliates does not, in general, improve, and may worsen, group survival thereby reducing both the true premium and the apparent discount.

Let the parent firm own a percentage, γ, of subsidiary equity. Then the dividends it receives from the subsidiary reduce to γX_A. Lower dividends increase the costs of parent debt, as lenders anticipate a higher default probability. Let variable λ account for the bailout probability, we assume that it might assume two values, conditional to the realization of cash flow of units A and B:

$$\begin{aligned} \lambda = 1 \qquad & if \qquad \gamma X_A \geq (R_A + R_{B\in G}) \,, \\ \lambda = 0 \qquad & if \qquad \gamma X_A < (R_A + R_{B\in G}) \,. \end{aligned} \tag{30}$$

We can determine the threshold value of γ, which we indicate with γ^*, such that $\lambda = 1$:

$$\gamma > \gamma^* = (R_A + R_{B\in G}) X_A^{-1} = \{D_A p_A^{-1} + D_B [p_B + p_A(1 - p_B)]^{-1}\} X_A^{-1} \,. \tag{31}$$

Since X_A is greater than $(R_A + R_{B\in G})$ by assumption, the RHS of this equation is always lower than one. This result indicates that coinsurance is no longer possible, in a pyramidal group, if the parent ownership share falls short of γ^*. In such a case, both the cost of debt and the value are equal across group affiliates and standalone firms. Consequently, the group will not suffer from the survivorship bias.

5.3 Effort Provision, Contagion, and Outside Funding

The previous sections show that diversified firms suffer from an apparent discount when they reduce bankruptcy costs with respect to standalone firms. It also establishes that the discount is larger on groups than on conglomerates, provided coinsurance and contagion do not distort managerial incentives.

This section discusses the robustness of this result once the probability of success for unit A becomes endogenous and non-contractible, expanding on the analysis of Boot and Schmeits (2000). They assume that managerial effort increases the success probability of unit A, but imposes on it a monitoring cost. Lenders will exert "market discipline", trying to detect the true probability of success of the unit. Boot and Schmeits (2000) point out that there are negative incentive effects in conglomerates, due to coinsurance. Effort provision in conglomerates is lower than in standalone firms for all levels of market discipline because Manager A does not fully internalize the positive consequences of his effort provision on unit B.

Our model reinforces their insight, because unit A may also contaminate unit B with manager A enjoying a lower funding cost rather than incurring a penalty. Such contagion is not present in a group thanks to the limited liability of each unit. These agency costs tend to diminish the survival skills of diversified firms, especially in conglomerates, thereby reducing the true diversification premium. Thus, the apparent diversification discount will fall as the relevance of managerial moral hazard grows.[14]

6 Conclusion

There is conflicting evidence on the performance of diversified organizations. While owners choose diversified organizations for their firms, several works find that corporate diversification reduces firm value. This paper proposes a resolution of this conflict going back to an old economic rationale for diversification, which is enhanced firm survival. We point out that the

[14]Details of the derivation are available upon request.

diversification discount may artificially arise in empirical analysis because of the better survival skills of diversified organizations. This pricing paradox is due to a known problem of existing databases, namely the ex-post selection bias. Databases do not contain price information on standalone firms that disappeared in a downturn due to defaults, while they do include the diversified affiliates that survived. Thus, ex-post relative average price does not reflect relative firm value because such measurement does not control for this selection bias.

Our pricing model shows that the implied apparent diversification discount, conditional on databases that cancel bankrupt firms, is even larger for groups than for conglomerates, because of their better survival skills. An extensive literature considers such discount as true, relating it to the possibility of using minority shareholders' resources to the benefit of the controlling party. Our paper points out an alternative reason for group discounts, which rests in its ability to avoid contagion thanks to their corporate limited liability. Corporate limited liability is a persistent legal provision of groups across several jurisdictions, which policy-makers consider a benefit of the group organization.

This reasoning leads to conclude that the economic function of diversification, consisting in limiting dissipative bankruptcy costs, is hard to detect in the data. Our empirical analysis shows that diversified companies display higher average survival probability than their focused components. Their excess survival probability correlates with their measured observed discount. Moreover, both increase when we exacerbate the survivorship bias.

We leave it to future work to estimate bankruptcy costs saved through diversification, thereby explaining owners' preferences for diversification. Our analysis has implications over and beyond diversification. It shows that the measure of firm value that we normally use is distorted upwards the more, the larger is the incidence of defaults. This insight should lead to a reconsideration of cross-sectional values, as well as of stock indexes.

A Appendices

A.1 Proofs

In this section, we provide the proofs of equations and propositions.

Equation (4): Borrowing costs across organizations

First, we need to prove that $R_C < R_A + R_B$, that is:

$$[D_A + D_B - p_B(1-p_A)X_B]p_A^{-1} < D_A p_A^{-1} + D_B p_B^{-1}$$

$$[D_B - p_B(1-p_A)X_B]p_A^{-1} < D_B p_B^{-1}$$

$$[D_B - p_B(1-p_A)X_B]p_B < D_B p_A$$

$$p_B^2(1-p_A)X_B > D_B p_B - D_B p_A$$

$$X_B > D_B(p_B - p_A)[p_B^2(1-p_A)]^{-1} .$$

This inequality always holds because the threshold level of the cash flow, $X_B^* = D_B(p_B - p_A)[p_B^2(1-p_A)]^{-1}$, is lower than the minimum level required for unit B cash flow when successful (Equation (5)), that is

$$D_B(p_B - p_A)[p_B^2(1-p_A)]^{-1} < D_B p_B^{-1}$$

$$(p_B - p_A)[p_B(1-p_A)]^{-1} < 1$$

$$p_B - p_A < p_B(1-p_A)$$

$$p_A > p_A p_B ,$$

that is, $p_B < 1$, which holds by assumption. We now need to show that the combined cost of debt is lower for business groups, that is $R_G < R_A + R_B$. Since the interest factor in unit A is the same for both organizational forms, $R_{A\in G} = R_A$, the following must hold:

$$R_{B\in G} < R_B$$
$$D_B[p_B + p_A(1-p_B)]^{-1} < D_B p_B^{-1}$$
$$p_B + p_A(1-p_B) > p_B$$
$$p_A(1-p_B) > 0\,,$$

that is $p_B < 1$, which is always satisfied. Finally, we need to show that the cost of debt for conglomerates is lower than the business group case, that is $R_C < R_A + R_{B\in G}$. This inequality can be written as:

$$[D_A + D_B - p_B(1-p_A)X_B]p_A^{-1} < D_A p_A^{-1} + D_B[p_B + p_A(1-p_B)]^{-1}$$
$$[D_B - p_B(1-p_A)X_B]p_A^{-1} < D_B[p_B + p_A(1-p_B)]^{-1}$$
$$D_B - p_B(1-p_A)X_B < D_B p_A[p_B + p_A(1-p_B)]^{-1}$$
$$p_B(1-p_A)X_B > D_B\{1 - p_A[p_B + p_A(1-p_B)]^{-1}\}$$
$$p_B(1-p_A)X_B > D_B[p_B + p_A(1-p_B) - p_A][p_B + p_A(1-p_B)]^{-1}$$
$$p_B(1-p_A)X_B > D_B[p_B(1-p_A)][p_B + p_A(1-p_B)]^{-1}$$
$$X_B > D_B[p_B + p_A(1-p_B)]^{-1}$$

i.e. $X_B > R_{B\in G}$. This last inequality is always satisfied because profits for unit B, when successful, are sufficient to repay its own debt by assumption.

Equation (7): Maximum level allowed for unit B cash flow

By assumption, unit B cash flow must fall short the combined interest factor for conglomerates and groups. Since conglomerate lenders require a lower interest rate compared to group lenders,

X_B should be lower than R_C, that is:

$$X_B < [D_A + D_B - p_B(1 - p_A)X_B]p_A^{-1}$$

$$p_A X_B < D_A + D_B - p_B(1 - p_A)X_B$$

$$[p_A + p_B(1 - p_A)]X_B < D_A + D_B$$

$$X_B < (D_A + D_B)[p_A + p_B(1 - p_A)]^{-1}\,,$$

which proves the inequality in (7).

Equations (8)-(10): Firm true values

We define $\pi_A = p_A X_A - D_A$ and $\pi_B = p_B X_B - D_B$. Therefore, the combined profits of two independent units can be written as

$$\begin{aligned} TV_S &= p_A(X_A + K_A - R_A) + p_B(X_B + K_B - R_B) = \\ &= p_A X_A + p_A K_A - D_A + p_B X_B + p_B K_B - D_B = \\ &= \pi_A + \pi_B + p_A K_A + p_B K_B\,, \end{aligned} \tag{A.1}$$

which proves Equation (8) since $p_A^{Sur} = p_A$ and $p_B^{Sur} = p_B$. In turn, conglomerate profits are equal to

$$\begin{aligned} TV_C &= p_A p_B(X_A + K_A + X_B + K_B - R_C) + p_A(1 - p_B)(X_A + K_A + K_B - R_C) = \\ &= p_A(X_A + K_A + K_B - R_C) + p_A p_B X_B = \\ &= p_A X_A + p_A(K_A + K_B) + p_B X_B - D_A - D_B = \\ &= \pi_A + \pi_B + p_A(K_A + K_B)\,, \end{aligned} \tag{A.2}$$

proving Equation (9), as $p_C^{Sur} = p_A$. Moreover, group profits are equal to

$$\begin{aligned}
TV_G = & \ p_A p_B (X_A + K_A + X_B + K_B - R_A - R_{B\in G}) + \\
& + p_A(1-p_B)(X_A + K_A + K_B - R_A - R_{B\in G}) + \\
& + p_B(1-p_A)(X_B + K_B - R_{B\in G}) = \\
& = p_A(X_A + K_A - R_A) + p_B X_B + [p_B + p_A(1-p_B)](K_B - R_{B\in G}) = \\
& = p_A X_A + p_A K_A - D_A + p_B X_B + [p_B + p_A(1-p_B)]K_B - D_B = \\
& = \pi_A + \pi_B + p_A K_A + [p_B + p_A(1-p_B)]K_B \, ,
\end{aligned} \tag{A.3}$$

which is equivalent to Equation (10), given that $p_{A\in G}^{Sur} = p_A$ and $p_{B\in G}^{Sur} = p_B + p_A(1-p_B)$.

Proposition 1: Firm values across organizations

First, Equations (11)-(13) result directly from proper combinations of Equations (8)-(10). Moreover, we write Equation (A.3) using Equation (A.1) as:

$$TV_G = TV_S + p_A(1-p_B)K_B \, , \tag{A.4}$$

and, similarly, we write Equation (A.3) using Equation (A.2) as:

$$TV_G = TV_C + p_B(1-p_A)K_B \, . \tag{A.5}$$

This proves Part (a) of Proposition 1, since we assume positive bankruptcy costs. As for Part (b), the value increase relative to conglomerates (standalone companies) in (A.4) ((A.5)) determines the benefits of corporate limited liability (coinsurance). Finally, equating (A.4) and (A.5) and rearranging terms we find that conglomerate profits are higher than those of standalone firms if the diversification effect prevails on the contagion effect:

$$p_B K_B < p_A K_B \, , \tag{A.6}$$

or $p_A > p_B$, with the conglomerate true excess value relative to standalones equal to

$$TV_C - TV_S = p_A(1-p_B)K_B - p_B(1-p_A)K_B \, , \tag{A.7}$$

which proves Part (c).

Equations (14)-(18): Firm apparent values

Recall that we defined $\pi_i = p_i X_i - D_i$. Then, the value of a standalone observed in the dataset by the econometrician is equal to

$$AV_i = X_i + K_i - R_i = (p_i X_i - D_i)p_i^{-1} + K_i\,, \tag{A.8}$$

which immediately proves Equations (14) and (15) since the survival probability of an independent firm is $p_i^{Sur} = p_i$. Conglomerates estimated value, in turn, is equal to

$$\begin{aligned}
AV_C &= p_B(X_A + K_A + X_B + K_B - R_C) + (1 - p_B)(X_A + K_A + K_B - R_C) = \\
&= X_A + K_A + p_B X_B + K_B - [D_A + D_B - p_B(1 - p_A)X_B]p_A^{-1} = \\
&= X_A + K_A + p_B X_B[1 + (1 - p_A)p_A^{-1}] + K_B - (D_A + D_B)p_A^{-1} = \\
&= X_A + K_A + p_B p_A^{-1} X_B + K_B - (D_A + D_B)p_A^{-1} = \\
&= (p_A X_A + p_B X_B - D_A - D_B)p_A^{-1} + K_A + K_B\,,
\end{aligned} \tag{A.9}$$

which is equivalent to Equation (16), as $p_C^{Sur} = p_A$. Moreover, the apparent value of a parent company B equals

$$\begin{aligned}
AV_{B\in G} &= [p_B(X_B + K_B - R_{B\in G}) + p_A(1 - p_B)(K_B - R_{B\in G})][p_B + p_A(1 - p_B)]^{-1} = \\
&= \{p_B X_B + [p_B + p_A(1 - p_B)]K_B - D_B\}[p_B + p_A(1 - p_B)]^{-1} = \\
&= (p_B X_B - D_B)[p_B + p_A(1 - p_B)]^{-1} + K_B\,.
\end{aligned} \tag{A.10}$$

The last equality proves Equation(17) since the survival probability of the parent is equal to $p_B + p_A(1 - p_B)$. Therefore, proof of Equation (18) is straightforward since both the apparent value and the survival probability of the subsidiary equal those of the equivalent standalone, with $AV_{A\in G} = AV_A$ and $p_{A\in G}^{Sur} = p_A^{Sur} = p_A$.

Proposition 2: True and apparent value of firms

First of all, we conveniently rearrange Equations (A.1)-(A.3) as follows:

$$TV_S = (X_A + K_A - D_A p_A^{-1})p_A + (X_B + K_B - D_B p_B^{-1})p_B \,, \tag{A.11}$$

$$TV_C = (X_A + K_A + p_B p_A^{-1} X_B + K_B - D_A p_A^{-1} - D_B p_A^{-1})p_A \,, \tag{A.12}$$

$$\begin{aligned} TV_G = {} & (X_A + K_A - D_A p_A^{-1})p_A + \{K_B + (p_B X_B - D_B)[p_B + p_A(1-p_B)]^{-1}\}\times \\ & \times [p_B + p_A(1-p_B)] \,, \end{aligned} \tag{A.13}$$

and Equations (A.8)-(A.10) such that:

$$AV_S = X_A + K_A - D_A p_A^{-1} + X_B + K_B - D_B p_B^{-1} \,, \tag{A.14}$$

$$AV_C = X_A + K_A + p_B p_A^{-1} X_B + K_B - D_A p_A^{-1} - D_B p_A^{-1} \,, \tag{A.15}$$

$$AV_G = X_A + K_A - D_A p_A^{-1} + K_B + (X_B p_B - D_B)[p_B + p_A(1-p_B)]^{-1} \,. \tag{A.16}$$

Therefore, the apparent value of a standalone firm is higher than its true value if both $p_A < 1$ and $p_B < 1$, which is always verified. The bias increases in the standalone probabilities of default $(1 - p_A)$ and $(1 - p_B)$. In turn the apparent value of a conglomerate exceeds its true value if $p_A < 1$, which, again, is always satisfied. Similarly to the standalone case, the bias increases in the probability of default of conglomerates, $(1 - p_A)$. Finally, the apparent value of a group exceeds its true value if $p_A < 1$ and $p_B + p_A(1 - p_B) < 1$. The first inequality holds by assumption and the second is equivalent to $(1-p_A)(1-p_B) > 0$ which is always satisfied as well. The difference between the apparent and the true value of a group increases in the probability of default of both the subsidiary A, $(1-p_A)$, and the parent company B, $(1-p_A)(1-p_B)$. This proves Part (a) of Proposition 2.

Moreover, writing Equations (A.11), (A.12) and (A.13) using Equations (A.8), (A.9) and (A.10), we obtain:

$$TV_S = AV_A \times p_A + AV_B \times p_B = AV_A \times p_A^{Sur} + AV_B \times p_B^{Sur} \,, \tag{A.17}$$

$$TV_C = AV_C \times p_A = AV_C \times p_C^{Sur} \,, \tag{A.18}$$

$$TV_G = AV_{A\in G} \times p_A + AV_{B\in G} \times [p_B + p_A(1-p_B)] = AV_{A\in G} \times p_{A\in G}^{Sur} + AV_{B\in G} \times p_{B\in G}^{Sur} \,, \tag{A.19}$$

which proves Part (b) of Proposition 2.

Equations (22)-(24): Apparent values across organizations

We want to prove that, due to a survivorship bias, the estimated value of groups is lower than that of both comparable conglomerates and standalones. Moreover conglomerate appear to have a lower value with respect to their independent counterparts if contagion probability is lower than coinsurance probability. We first prove the inequality in Equation (22), implying that conglomerates trade at an apparent discount relative to standalone firms by comparing Equations (15) and (16):

$$
\begin{aligned}
(\pi_A + \pi_B)(p_C^{Sur})^{-1} + K_A + K_B < \pi_A(p_A^{Sur})^{-1} + K_A + \pi_B(p_B^{Sur})^{-1} + K_B \\
\pi_B(p_C^{Sur})^{-1} < \pi_B(p_B^{Sur})^{-1} \\
p_A^{-1} < p_B^{-1}
\end{aligned}
$$

which holds if $p_A > p_B$, since $p_C^{Sur} = p_A^{Sur}$. Thus, conglomerates trade at an apparent discount (premium) relative to standalone firms when the probability of coinsurance, $p_A(1-p_B)$, exceeds (falls below) the probability of contagion, $p_B(1-p_A)$.

We now need to prove the inequality in (23), implying that groups trade at an apparent discount vis-à-vis standalone firms by comparing Equations (15) and (18):

$$
\begin{aligned}
\pi_A(p_{A\in G}^{Sur})^{-1} + K_A + \pi_B(p_{B\in G}^{Sur})^{-1} + K_B < \pi_A(p_A^{Sur})^{-1} + K_A + \pi_B(p_B^{Sur})^{-1} + K_B \\
\pi_B(p_{B\in G}^{Sur})^{-1} < \pi_B(p_B^{Sur})^{-1} \\
[p_B + p_A(1-p_B)]^{-1} < p_B^{-1} \\
p_A(1-p_B) > 0\,,
\end{aligned}
$$

since $p_{A\in G}^{Sur} = p_A^{Sur}$. The last inequality simplifies to $p_B < 1$, which is always satisfied.

Finally, we compare the price of a group to that of a conglomerate when both are alive to prove the inequality in (24). The value of the group in operation (Equation (18)) is lower than the value of the conglomerate in operation (Equation (16)) if:

$$\pi_A(p_{A\in G}^{Sur})^{-1} + K_A + \pi_B(p_{B\in G}^{Sur})^{-1} + K_B < (\pi_A + \pi_B)(p_C^{Sur})^{-1} + K_A + K_B$$
$$\pi_B(p_{B\in G}^{Sur})^{-1} < \pi_B(p_C^{Sur})^{-1}$$
$$[p_B + p_A(1-p_B)]^{-1} < p_A^{-1}$$
$$p_B(1-p_A) > 0\,,$$

since $p_{A\in G}^{Sur} = p_C^{Sur}$. The last inequality simplifies to $p_A < 1$, which holds by assumption.

Proposition 3: Survivorship bias and diversification discount

We need to prove that the survivorship bias generates a discount for groups and conglomerates. This entails showing that the value of a conglomerate, when alive, exceeds the value of two alive group affiliates. First, the conglomerate discount relative to comparable standalones is equal to

$$\begin{aligned} AV_S - AV_C &= \pi_A(p_A^{Sur})^{-1} + K_A + \pi_B(p_B^{Sur})^{-1} + K_B + \\ &- (\pi_A + \pi_B)(p_C^{Sur})^{-1} - K_A - K_B = \\ &= \pi_A[(p_A^{Sur})^{-1} - (p_C^{Sur})^{-1}] + \pi_B[(p_B^{Sur})^{-1} - (p_C^{Sur})^{-1}] = \\ &= (p_B X_B - D_B)[p_B^{-1} - p_A^{-1}]\,, \end{aligned} \tag{A.20}$$

since $p_A^{Sur} = p_C^{Sur}$, which proves Proposition 3.a. Moreover the group discount with respect to comparable independent firms equals

$$\begin{aligned} AV_S - AV_G &= \pi_A(p_A^{Sur})^{-1} + K_A + \pi_B(p_B^{Sur})^{-1} + K_B + \\ &- \pi_A(p_{A\in G}^{Sur})^{-1} - K_A - \pi_B(p_{B\in G}^{Sur})^{-1} - K_B = \\ &= \pi_A[(p_A^{Sur})^{-1} - (p_{A\in G}^{Sur})^{-1}] + \pi_B[(p_B^{Sur})^{-1} - (p_{B\in G}^{Sur})^{-1}] \\ &= (p_B X_B - D_B)\{p_B^{-1} - [p_B + p_A(1-p_B)]^{-1}\}\,, \end{aligned} \tag{A.21}$$

since $p_A^{Sur} = p_{A\in G}^{Sur}$, which proves Proposition 3.b. Finally, the group discount relative to a conglomerate equals

$$
\begin{aligned}
AV_C - AV_G &= (\pi_A + \pi_B)(p_C^{Sur})^{-1} + K_A + K_B + \\
&- \pi_A(p_{A\in G}^{Sur})^{-1} - K_A - \pi_B(p_{B\in G}^{Sur})^{-1} - K_B = \\
&= \pi_A[(p_C^{Sur})^{-1} - (p_{A\in G}^{Sur})^{-1}] + \pi_B[(p_C^{Sur})^{-1} - (p_{B\in G}^{Sur})^{-1}] \\
&= (p_B X_B - D_B)\{p_A^{-1} - [p_B + p_A(1-p_B)]^{-1}\}\,,
\end{aligned}
\tag{A.22}
$$

since $p_C^{Sur} = p_{A\in G}^{Sur}$, which proves Proposition 3.c.

Furthermore, we can define the differential true values across organizations, by appropriately combining Equations (8), (9), and (10), as follows:

$$TV_C - TV_S = (p_C^{Sur} - p_B^{Sur})K_B\,, \tag{A.23}$$

$$TV_G - TV_S = (p_{B\in G}^{Sur} - p_B^{Sur})K_B\,, \tag{A.24}$$

$$TV_G - TV_C = (p_{B\in G}^{Sur} - p_C^{Sur})K_B\,, \tag{A.25}$$

since $p_A^{Sur} = p_C^{Sur} = p_{A\in G}^{Sur}$. Therefore, the true diversification premium of an organization (Equations (A.23)-(A.25)) is a positive function of its relative survival ability, if bankruptcy costs, K_B, are positive. Likewise, the apparent diversification discount of an organization (Equations (A.20)-(A.22)) increases in its relative survival ability. Therefore, the larger the true diversification premium of a firm, the larger its apparent diversification discount, which proves Proposition 3.d.

Equation (31): Apparent discount with partial ownership

We now determine how the partial ownership affects the apparent value of the parent firm. For each level of the ownership γ, the probability of bailout λ is function of the cash flow of unit A, the probability of success of both units, and their amounts of debt, that is:

$$\lambda(X_A, p_A, p_B, D_A, D_B) = 1 \qquad \text{if} \qquad X_A \geq (R_A + R_{B\in G})/\gamma\,.$$

The apparent value of the parent firm, corrected by the probability of bailout of unit B equals

$$AV_{B\in G,\lambda} = [(X_B + K_B - R_{B\in G,\lambda})p_B + (K_B - R_{B\in G,\lambda})\lambda p_A(1-p_B)][p_B + \lambda p_A(1-p_B)]^{-1}\,, \tag{A.26}$$

where $R_{B \in G,\lambda} = D_B[p_B + \lambda p_A(1-p_B)]^{-1}$, which equals R_B if $\lambda = 0$ and $R_{B\in G}$ if $\lambda = 1$. Equation (A.26), then, reduces to AV_B if $\lambda = 0$, and to $AV_{B\in G}$ if $\lambda = 1$. Intuitively, if parent ownership share γ is lower than its threshold level, γ^*, the coinsurance between the parent and its subsidiary is not possible, and $\lambda = 0$. This also implies that the conditional probability of state $\{H\}$ when observing a parent in operation is the same as a standalone firm, equal to one, and the interest factors of parents and standalone firms align. It follows that the group will not suffer from the survivorship bias, and the apparent value of parent firms equal the apparent value of standalone firms, ceteris paribus.

A.2 General Model

This section provides a general version of the model defined in Section 2 with an additional state of the world. Within this setting, each unit operating profit in $t = 1$ can be medium, high or low. It will be medium $\{M\}$, and equal to $X_i^M > 0$, with probability $p_i^M \in (0,1)$, it will be high $\{H\}$, and equal to $X_i^H > X_i^M$, with probability $p_i^H \in (0,1)$, and it will be low and equal to zero with probability $p_i^L = (1 - p_i^M - p_i^H)$. Accordingly, we define nine states of the world, $\{LL, LM, ML, LH, HL, MM, MH, HM, HH\}$.

The key assumption of the general model is that the profit of each unit, in state $\{H\}$, exceeds the combined debt repayment of the two units, while, in state $\{M\}$, it is sufficient to honor its own debt obligations but not the combined service of debt. Consequently, not only unit A can rescue unit B in state $\{HL\}$ but also unit B can save unit A from bankruptcy in state $\{LH\}$, provided that they do not operate as independent entities. Setting $p_A^M = 0$, $p_A^H = p_A$, $p_B^M = p_B$, $p_B^H = 0$, $X_A^H = X_A$, $X_B^M = X_B$ leads to the original model where only unit A can rescue unit B in state $\{HL\}$.

Let us now consider, for each organization, its survival probability, cost of debt and cash Flow conditions within the general model. First, standalone firms survive in states $\{M\}$ and $\{H\}$ with probability $p_i^{Sur} = (p_i^M + p_i^H)$ and default in state $\{L\}$.

On the other hand, a conglomerate defaults in states $\{LL\}$, $\{LM\}$ and $\{ML\}$ when both units do not realize any profit, when unit A drags profitable unit B into bankruptcy and when unit B drags solvent unit A into bankruptcy, respectively. However, conglomerates survive when either their segments are both profitable, states $\{MM\}$, $\{MH\}$, $\{HM\}$ and $\{HH\}$, or one of their units can save the other from insolvency, states $\{LH\}$ and $\{HL\}$. Conglomerate survival probability is, therefore, equal to $p_C^{Sur} = (p_A^H + p_B^H - p_A^H p_B^H + p_A^M p_B^M)$.

Finally, group affiliates benefit from both limited liability and coinsurance gains. Thus, the subsidiary A selectively defaults in state $\{LM\}$ while it is rescued by the parent B in state $\{LH\}$, then surviving with probability $p_{A\in G}^{Sur} = (p_A^M + p_A^H + p_A^L p_B^H)$. The parent company, in turn, goes bankrupt in state $\{ML\}$ without affecting its subsidiary, and receives funds from it to meet its debt obligations in state $\{HL\}$, staying alive with probability $p_{B\in G}^{Sur} = (p_B^M + p_B^H + p_A^H p_B^L)$.

Within this framework, the interest factor charged by the lenders, satisfying their zero expected profit condition, is equal to

$$R_i = D_i(p_i^M + p_i^H)^{-1} = D_i(p_i^{Sur})^{-1} \tag{A.27}$$

for a standalone,

$$\begin{aligned} R_C &= (D_A + D_B - p_A^M p_B^L X_A^M - p_A^L p_B^M X_B^M)(p_A^H + p_B^H - p_A^H p_B^H + p_A^M p_B^M)^{-1} \\ &= (D_A + D_B - p_A^M p_B^L X_A^M - p_A^L p_B^M X_B^M)(p_C^{Sur})^{-1} \end{aligned} \tag{A.28}$$

for a conglomerate,

$$R_{A\in G} = D_A(p_A^M + p_A^H + p_A^L p_B^H)^{-1} = D_A(p_{A\in G}^{Sur})^{-1}\,, \tag{A.29}$$

$$R_{B\in G} = D_B(p_B^M + p_B^H + p_A^H p_B^L)^{-1} = D_B(p_{B\in G}^{Sur})^{-1} \tag{A.30}$$

for a subsidiary and a parent company of a group, respectively. As before, we can show that the following inequality holds:

$$R_C < R_{A\in G} + R_{B\in G} < R_A + R_B\,. \tag{A.31}$$

Therefore, the assumption that profit in state $\{M\}$ exceeds the individual debt repayment implies that $X_i^M \geq max(R_i, R_{i\in G})$. Since standalones have a higher cost of debt relative to groups, the following condition must hold:

$$X_i^M \geq D_i(p_i^M + p_i^H)^{-1}\,. \tag{A.32}$$

At the same time, cash flow in state {M} must fall short the combined interest factor, such that $X_i^M < min(R_C, R_{A\in G} + R_{B\in G})$, which requires

$$X_i^M < (D_i + D_j - p_i^L p_j^M X_j^M)(p_i^H + p_i^M + p_i^L p_j^H)^{-1} \tag{A.33}$$

since conglomerate interest factor is lower than that of groups. The additional assumption that each unit cash flow in state $\{H\}$ exceeds the cost of debt for the two units implies $X_i^H \geq max(R_C, R_{A\in G} + R_{B\in G})$ which requires, since R_C is lower than $R_{A\in G} + R_{B\in G}$, that

$$X_i^H \geq D_A(p_A^M + p_A^H + p_A^L p_B^H)^{-1} + D_B(p_B^M + p_B^H + p_A^H p_B^L)^{-1}\,. \tag{A.34}$$

Let us define $\pi_A = X_A^M p_A^M + X_A^H p_A^H - D_A$ and $\pi_B = X_B^M p_B^M + X_B^H p_B^H - D_B$ as the expected current profit after the service of debt for unit A and B, respectively. Therefore, it can be shown that the true value definitions (Equations (8)-(10)), apparent value definitions (Equations (14)-(18)), and Propositions 1, 2, and 3 hold for the general model as well, once the reader takes into account the new definitions of π_i and the survival probability of each organization.[15]

Indeed, the general model confirms the main results of the restricted model highlighting the role of the different survival skills of each organization in determining the conglomerate discount. Provided that contagion is less likely than coinsurance, the apparent value differential between standalones and conglomerates can be even larger, since within this setting each units have the ability to rescue the other from bankruptcy in certain states of the world. As the survival probability gap between independent and diversified firms increases, the conglomerate discount grows if expected current profits after the service of debt remain equal.

Likewise, the group apparent discount relative to comparable independent firms might be even more severe, since allowing the parent to rescue its subsidiary increases the survival probability of a group, which translates in a higher discount compared to standalone firms if, again, the expected net profits do not drop.

[15] Details and proofs of the derivation are available upon request.

A.3 Construction of Variables

A.3.1 Dependent Variables

EXCESS VALUE is computed as the natural logarithm of the ratio between a firm's market value and its imputed value.. The imputed value is computed as the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching is done by using the narrower SIC including at least five single-segment firms.

EXCESS DEFAULT PROBABILITY is computed as the natural logarithm of the ratio between a firm's probability of default (PD) and its imputed PD at the end of the year. The imputed value is the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. Default probabilities are retrieved from the Credit Research Initiative (CRI) of the University of Singapore (RMI-NUS). The estimation of CRI's probabilities is built on the forward intensity model developed by Duan et al. (2012, Journal of Econometrics).

MB (market-to-book) is the ratio between the market value of firm equity (computed by multiplying yearly closing price by the number of outstanding shares) and the book value of the equity (seq).

A.3.2 Independent Variables - Multivariate Regressions

CALC is the ratio of firm Current assets (ca) to firm Current liabilities (cl).

CAPEX is the ratio of firm Capital Expenditure to firm Total Assets.

DIVIDENDS is the ratio of Dividends to Total Assets.

EBITDA is the ratio of firm Earnings before Extraordinary Items to firm Total Assets.

LEVERAGE is the ratio betweeb total debt (dltt+dlc) and firm total assets.

NITA is the ratio between firm Net Income and firm Total Assets.

SALES GROWTH is the yearly growth of the ratio of Sales and firm Total Assets.

SIZE is the natural logarithm of firm total assets.

A.3.3 Independent Variables - Survival Analysis

ADJSIZE is the logarithm of the total firm assets adjusted by 10% of the difference between the market equity and the book equity of the firm $[TA + 0.1(ME - BE)]$.

EBTA is the ratio between firm Market Equity and the firm Total Liabilities.

EXRET is the difference between the log gross firm return in CRSP (ret), and the log gross return on the S& P Index.

MELT is the ratio between the Market Equity of the firm and firm Total Liabilities.

REAT is the ratio between firm retained earnings and the total assets.

SIGMA is volatility of a firm stock returns, computed as the annualized standard deviation of daily stock returns, averaged over 3 months:

$$SIGMA_{i,t-1,t-3} = \left(\frac{252 \times \sum\limits_{t-1,t-2,t-3} r^2}{n-1} \right).$$

NIMTA is the ratio between firm Net Income (ni in compustat) and the sum of firm Market Equity to Total Liabilities (net income/ME+assets).

TLMTA is the ratio of Total Liabilities, and the sum of firm Market Equity to Total Liabilities.

TLTA is the ratio between firm Total Liabilities and firm Total Assets(adjusted).

RSIZE is the logarithm of the ratio of firm Market Equity to the S& P500 Market Value.

WC is the firm Working Capital over total assets.

Appendix A.3. Pairwise Correlations

This table reports the pairwise correlation coefficients for the variables included in the regression analysis.

	EVsale	PDsale	PD (1y)	Default	Failure	Merger	Ind. Distr.	Leverage	EBITDA	Cap. Ex.	Sales gr.	Divid.	Age
Ex. Value	1.0000												
Ex. PD	-0.0990*	1.0000											
PD (1y)	-0.0510*	0.3822*	1.0000										
Default	-0.0422*	0.0977*	0.2336*	1.0000									
Failure	-0.0440*	0.1025*	0.2331*	0.9740*	1.0000								
Merger	0.0710*	-0.0713*	-0.0544*	0.0290*	0.0259*	1.0000							
Ind. Distr.	0.0039	0.0024	0.0166*	0.0173*	0.0223*	-0.0068	1.0000						
Leverage	0.1116*	0.2298*	0.1423*	0.0456*	0.0431*	-0.0340*	0.0172*	1.0000					
EBITDA	-0.0285*	-0.3076*	-0.1449*	-0.0728*	-0.0745*	0.0849*	0.0048	-0.0350*	1.0000				
Cap. Ex.	0.0542*	0.0068	-0.0087	-0.0225*	-0.0208*	-0.0201*	0.0263*	0.0843*	0.2153*	1.0000			
Sales Gr.	0.0582*	0.0236*	0.0051	-0.0222*	-0.0233*	0.0855*	0.0092	-0.0182*	0.1448*	0.2857*	1.0000		
Divid.	-0.0404*	-0.2094*	-0.0618*	-0.0224*	-0.0201*	-0.0059	0.0073	-0.0267*	0.2410*	-0.0059	-0.0635*	1.0000	
Age	-0.0858*	-0.1297*	-0.0544*	-0.0107	-0.0078	-0.0340*	0.0158*	0.0434*	0.0558*	-0.1831*	-0.2665*	0.0920*	1.0000

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Table 1: **Number of bankruptcy and merger events per year**
This table lists the total number of active firms, the number of conglomerates (including groups), of defaults and failures for every year. The sample consists of the intersection of the COMPUSTAT, CRSP, CRI and the UCLA- LoPucki Bankruptcy Research Database (BRD), over the period January 1990 - December 2014.

Year	**Active firms**	**Conglomerates**	**Default**	**Failures**	**Mergers**
1990	839	258	0	0	122
1991	911	271	2	2	104
1992	994	295	1	1	144
1993	1.092	300	2	2	187
1994	1.251	307	1	1	207
1995	1.390	337	7	7	255
1996	1.543	340	3	3	307
1997	1.628	306	13	13	338
1998	1.481	476	13	13	328
1999	1.421	571	26	29	313
2000	1.348	538	25	25	269
2001	1.342	517	29	29	228
2002	1.394	533	12	13	262
2003	1.335	507	14	15	237
2004	1.372	546	15	16	272
2005	1.332	533	15	16	264
2006	1.366	556	11	12	285
2007	1.397	556	11	12	298
2008	1.374	532	10	11	230
2009	1.335	510	12	13	182
2010	1.273	508	11	12	236
2011	1.214	495	6	7	245
2012	1.198	485	5	6	311
2013	1.216	504	7	7	305
2014	1.212	490	10	10	354
Total	32.258	11.271	261	275	6.283

Table 2: **Summary statistics**
The table reports the summary statistics for all the variables used in the analysis. The sample consists of the intersection of the COMPUSTAT, CRSP, CRI and the bankruptcy datasets over the period January 1990 - December 2014. For each variable, column (1) reports the number of observations, columns (2)-(3) the mean and standard deviation, columns (4)-(6) the percentile distribution. Panel A refers to conglomerates, Panel B to standalones, Panel C to the control variables for the entire sample.

Panel A: Conglomerates	Obs. (1)	Mean (2)	Std. Dev. (3)	Min (4)	Median (5)	Max (6)
Excess Value (sales mult.)	11.271	-0,156	0,596	-4,888	-0,128	3,590
Excess PD (sales mult.)	11.271	-0,212	1,056	-5,867	-0,191	4,686
PD (one year)	11.271	0,007	0,032	0,000	0,001	0,877
Default (Y/N)	11.271	0,007	0,083	0,000	0,000	1,000
Failure (Y/N)	11.271	0,007	0,085	0,000	0,000	1,000
Mergers (Y/N - as bidders)	11.271	0,216	0,412	0,000	0,000	1,000
Mergers (Y/N - as targets)	11.271	0,007	0,083	0,000	0,000	1,000
Industry Distress	11.271	0,016	0,125	0,000	0,000	1,000
Segment Industry Distress	11.271	0,033	0,180	0,000	0,000	1,000
Numb. Segments	11.271	2,899	1,143	2,000	3,000	21,000
Age (years)	11.271	17	9	0	16	44
Panel B: Standalones						
Excess Value (sales mult.)	20.987	-0,066	0,605	-3,839	-0,014	4,204
Excess PD (sales mult.)	20.987	-0,063	0,855	-5,963	0,000	4,568
PD (one year)	20.987	0,009	0,037	0,000	0,001	0,981
Default (Y/N)	20.987	0,009	0,093	0,000	0,000	1,000
Failure (Y/N)	20.987	0,009	0,095	0,000	0,000	1,000
Mergers (Y/N - as bidders)	20.987	0,183	0,387	0,000	0,000	1,000
Mergers (Y/N - as targets)	20.987	0,011	0,103	0,000	0,000	1,000
Industry Distress	20.987	0,011	0,105	0,000	0,000	1,000
Age (years)	20.987	11	8	0	10	46
Panel C: Control Variables	Obs. (1)	Mean (2)	Std. Dev. (3)	Min (4)	Median (5)	Max (6)
Size	32.258	5,777	1,798	2,377	5,560	12,507
EBITDA	32.258	0,119	0,112	-0,576	0,125	0,471
CAPEX	32.258	0,075	0,088	0,000	0,047	0,687
Sales growth (SG)	32.258	0,149	0,307	-0,626	0,091	2,844
Dividends (Y/N)	32.258	0,011	0,024	0,000	0,000	0,293
LTAT	32.258	0,479	0,210	0,065	0,486	0,981
CACL	32.258	2,538	1,913	0,000	2,004	12,442
Leverage	32.258	0,211	0,185	0,000	0,188	0,813
NITA	32.258	0,017	0,124	-1,711	0,040	0,306
TLTA	32.258	0,453	0,211	0,040	0,454	0,972
EXRET	31.697	-0,003	0,121	-0,584	0,000	0,602
NIMTA	32.258	0,003	0,106	-1,586	0,028	0,278
TLMTA	32.258	0,358	0,229	0,007	0,323	0,986
EXRETAVG	30.651	-0,013	0,069	-0,484	-0,007	0,264
SIGMA	31.590	0,048	0,057	0,001	0,028	0,409
CASHMTA	32.258	0,089	0,114	0,000	0,048	0,924
MB	32.258	2,401	1,743	0,461	1,828	6,834
PRICE	32.258	0,804	1,870	-12,562	0,663	17,462

Table 3: **Univariates**
The table reports statistics for firm value and default across firm type, and tests for univariate differences in value between conglomerates and standalone firms. The sample consists of the intersection of the COMPUSTAT, CRSP, and the bankruptcy datasets over the period January 1990 - December 2014. Panel A reports statistics for all firms in the sample. Panel B reports statistics for firms that do not disappear from the sample until 2014, while Panel C reports the statistics for firms that remain in the panel for all the sample period (we exclude firms that disappear or enter in the sample before 2015). Column (4) reports the univariate test difference between conglomerates and standalone firms. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Panel A: All firms	Observations	Conglomerates Mean	Standalones Mean	Difference
	(1)	(2)	(3)	(4)
Excess value (sales multipliers)	32,258	-0.156	-0.066	-0.090***
Excess PD (sales multipliers)	32,258	-0.212	-0.063	-0.150***
Default (Y/N)	32,258	0.007	0.009	-0.002
Failure (Y/N)	32,258	0.007	0.009	-0.002
Mergers (Y/N - as bidder)	32,258	0.216	0.183	0.033***
Mergers (Y/N - as targets)	32,258	0.007	0.011	-0.004**
Panel B: Surviving firms	**Observations**	**Conglomerates Mean**	**Standalones Mean**	**Difference**
	(1)	(2)	(3)	(4)
Excess value (sales multipliers)	13,561	-0.181	-0.083	-0.098***
Excess PD (sales multipliers)	13,561	-0.372	-0.189	-0.182***
Mergers (Y/N - as bidder)	13,561	0.244	0.188	0.056***
Mergers (Y/N - as targets)	13,561	0.004	0.007	-0.003*
Panel C: All years in the sample	**Observations**	**Conglomerates Mean**	**Standalones Mean**	**Difference**
	(1)	(2)	(3)	(4)
Excess value (sales multipliers)	5,455	-0.197	-0.091	-0.107***
Excess PD (sales multipliers)	5,455	-0.513	-0.351	-0.162***
Mergers (Y/N)	5,455	0.250	0.162	0.088***

Table 4: **Univariates: True and apparent values**
The table reports the summary statistics for apparent and true values of firms according to the equations in proposition 2.b. True values are the product of apparent values times the CRI survival probability, which is equal to $(1 - PD)$. Firm apparent value is set equal to the Market to Book Ratio. Panels A-C (D-F) refers to standalone firms (conglomerates). Panels A and D report statistics referring to the whole sample emerging from the intersection of the COMPUSTAT, CRSP, and the bankruptcy datasets over the period January 1990 - December 2014. Panels B and E report statistics of firm value for firms that do not disappear during the sample period (surviving firms), while Panels C and F also exclude the firms entering in the sample after 1990. In each panel, for each variable, columns (2)-(3) report the mean and standard deviation, columns (4)-(6) the percentile distribution. The last row computes the t-test for the coefficient of the difference between apparent value and true value, while parentheses report the t-stat. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

Panel A: True and Apparent values *(standalones)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	20,959	2.555	1.843	0.461	1.963	6.834
True Value	20,959	2.538	1.838	0.019	1.949	6.834
Diff (Apparent-True value)	20,959	0.016	0.083	0.000	0.002	3.858
T-test		0.014***				
		(34.000)				

Panel B: Surviving Firms *(standalones)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	8,359	2.655	1.864	0.461	2.062	6.834
True Value	8,359	2.645	1.864	0.019	2.055	6.834
Diff (Apparent-True value)	8,359	0.010	0.059	0.000	0.001	2.388
T-test		0.008***				
		(19.000)				

Panel C: All years in the sample *(standalones)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	2,859	2.396	1.677	0.461	1.879	6.834
True Value	2,859	2.392	1.678	0.398	1.872	6.834
Diff (Apparent-True value)	2,859	0.005	0.024	0.000	0.001	0.830
T-test		0.004***				
		(13.000)				

Table 4: **Univariates: True and apparent values** - continued (conglomerates)

Panel D: True and Apparent values *(conglomerates)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	11,271	2.114	1.496	0.461	1.653	6.834
True Value	11,271	2.102	1.490	0.057	1.642	6.834
Diff (Apparent-True value)	11,271	0.012	0.065	0.000	0.001	3.445
T-test		0.014***				
		(34.000)				
Panel E: Surviving Firms *(conglomerates)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	5,202	2.147	1.452	0.461	1.690	6.834
True Value	5,202	2.141	1.449	0.227	1.685	6.834
Diff (Apparent-True value)	5,202	0.007	0.032	0.000	0.001	0.785
T-test		0.008***				
		(19.000)				
Panel F: All years in the sample *(conglomerates)*	Obs. (1)	Mean (2)	St. Error (3)	Min (4)	p(50) (5)	Max (6)
Apparent value (MB)	2,596	2.063	1.362	0.461	1.635	6.834
True Value	2,596	2.058	1.362	0.227	1.632	6.834
Diff (Apparent-True value)	2,596	0.004	0.023	0.000	0.000	0.782
T-test		0.004***				
		(13.620)				

Table 5: **Excess value**
The table reports the estimation of the following equation:

$$y_{i,t} = \alpha + \beta\, Conglomerate + \Gamma X_{i,t-1} + \varepsilon_t\,,$$

where the dependent variable is the excess value over the period January 1990 - December 2014, computed as the natural logarithm of the ratio between a firm's market value and its imputed value at the end of the year. The imputed value is the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. The variable "conglomerate" is an indicator variable equal to one if the firm is a multi-segments firm. The model controls for a vector of firm characteristics (listed in the table), including year and industry fixed effects. In all specifications, the standard errors are clustered at firm level. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

	Dep. var. = Excess value						
	All sample			Surviving firms		All years in the sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Conglomerate	-0.130***	-0.110***	-0.039**	-0.149***	-0.131***	-0.141***	-0.135***
	(-7.810)	(-6.771)	(-2.233)	(-5.342)	(-4.830)	(-3.250)	(-3.191)
Age		-0.076***	-0.110***		-0.070***		-0.108
		(-6.442)	(-5.378)		(-3.612)		(-1.386)
Assets	0.083***	0.088***	0.165***	0.083***	0.087***	0.081***	0.083***
	(-15.11)	(-15.65)	(-14.18)	(-8.74)	(-8.92)	(-4.84)	(-4.79)
EBITDA	-0.433***	-0.386***	-0.006	-0.639***	-0.583***	-0.261	-0.267
	(-5.968)	(-5.318)	(-0.101)	(-4.772)	(-4.308)	(-1.234)	(-1.268)
Capital Exp.	0.557***	0.485***	0.284***	0.522***	0.444***	0.645**	0.625**
	(-6.60)	(-5.76)	(-5.27)	(-3.23)	(-2.84)	(-2.02)	(-2.02)
Sales growth	0.094***	0.059***	-0.069***	0.103***	0.070**	-0.034	-0.045
	(-5.57)	(-3.39)	(-5.476)	(-3.49)	(-2.28)	(-0.490)	(-0.632)
Dividend ratio	-0.737***	-0.743***	-0.261	-0.382	-0.425	-0.218	-0.110
	(-2.822)	(-2.844)	(-1.090)	(-1.052)	(-1.189)	(-0.420)	(-0.208)
Firm FE	No	No	Yes	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	*0.109*	*0.115*	*0.681*	*0.183*	*0.183*	*0.267*	*0.269*
N	*32,258*	*32,258*	*32,221*	*13,561*	*13,561*	*5,455*	*5,455*

Table 6: **Excess default probability**
The table reports of the following equation:

$$y_{i,t} = \alpha + \beta\, Conglomerate + \Gamma X_{i,t-1} + \varepsilon_t\,,$$

where the dependent variable is the excess default probability over the period January 1990 - December 2014, computed as the natural logarithm of the ratio between a firm's PD and its imputed PD at the end of the year. The imputed value is the sum of its segments' imputed value, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. The variable "conglomerate" is an indicator variable equal to one if the firm is a multi-segments firm. The model controls for a vector of firm characteristics (listed in the table), including year and industry fixed effects. In all specifications, the standard errors are clustered at firm level. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

	Dep. var. = Excess PD						
	All sample			Surviving firms		All years in the sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Conglomerate	-0.098***	-0.074***	-0.099*	-0.147***	-0.131***	-0.188***	-0.188***
	(-4.870)	(-3.698)	(-1.899)	(-4.358)	(-4.023)	(-3.350)	(-3.359)
Age		-0.097***	-0.043		-0.093***		0.006
		(-7.978)	(-1.307)		(-5.117)		(-0.06)
Size	-0.140***	-0.134***	-0.089***	-0.140***	-0.143***	-0.143***	-0.143***
	(-22.144)	(-20.996)	(-3.727)	(-13.347)	(-14.140)	(-7.508)	(-7.458)
Capital Exp.	0.049	-0.042	0.522***	0.130	0.225*	-0.278	-0.277
	(-0.56)	(-0.483)	(-3.78)	(-0.99)	(-1.73)	(-0.993)	(-0.994)
Sales growth	0.192***	0.147***	0.051*	0.148***	0.115***	0.153**	0.154**
	(-11.17)	(-8.53)	(-1.78)	(-4.65)	(-3.62)	(-2.32)	(-2.31)
Dividend ratio	-4.710***	-4.708***	-1.719***	-4.978***	-5.017***	-7.609***	-7.615***
	(-12.739)	(-13.007)	(-3.496)	(-9.549)	(-9.924)	(-6.986)	(-7.033)
Leverage	1.405***	1.398***	1.019***	1.374***	0.363***	1.197***	1.197***
	(-27.88)	(-27.95)	(-9.99)	(-16.15)	(-3.03)	(-7.74)	(-7.74)
Nita	-1.404***	-1.351***	-0.753***	-1.672***	-1.442***	-2.295***	-2.295***
	(-25.442)	(-24.625)	(-7.652)	(-14.510)	(-12.547)	(-9.011)	(-9.026)
Cacl	-0.085***	-0.088***	-0.059***	-0.091***	-0.042***	-0.100***	-0.100***
	(-16.634)	(-17.199)	(-5.891)	(-10.775)	(-4.468)	(-5.837)	(-5.816)
Firm FE	No	No	Yes	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	*0.266*	*0.270*	*0.481*	*0.277*	*0.296*	*0.326*	*0.326*
N	*32,221*	*32,221*	*13,561*	*13,561*	*13,561*	*5,455*	*5,455*

Table 7: **Quantile regression**
The table reports of the following equation:

$$\textit{by percentile (Survival probability): } y_{i,t} = \alpha + \beta\, Conglomerate + \Gamma X_{i,t-1} + \varepsilon_t \,,$$

where the dependent variables is the excess value over the period January 1990 - December 2014, computed as the natural logarithm of the ratio between a firm's market value and its imputed value at the end of the year. The imputed value is the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. The variable "conglomerate" is an indicator variable equal to one if the firm is a multi-segments firm. The model is performed on four subsamples split according to the 25th, 50th, and 75th percentiles of the firms survival probability (defined as one-year default probability). The model controls for a vector of firm characteristics (listed in the table), including year and industry fixed effects. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

	Dep. var. = Excess Value Survival probability			
	p(25)	p(50)	p(75)	p(100)
	(1)	(2)	(3)	(4)
Conglomerate	-0.048	-0.103***	-0.091***	-0.158***
	(-1.643)	(-4.206)	(-4.315)	(-6.892)
Age	-0.061***	-0.085***	-0.076***	-0.058***
	(-3.068)	(-5.250)	(-5.023)	(-3.277)
Size	0.132***	0.101***	0.057***	0.039***
	(-14.03)	(-12.63)	(-7.93)	(-5.57)
EBITDA	-0.027	-0.755***	-0.832***	-1.297***
	(-0.264)	(-6.632)	(-6.880)	(-9.414)
Capex	0.719***	0.702***	0.360***	-0.176
	(-5.76)	(-5.61)	(-2.91)	(-1.028)
Sales growth	0.051*	0.044	0.053*	0.046
	(-1.66)	(-1.59)	(-1.82)	(-1.41)
Dividend ratio	0.546	-0.493	-1.306***	-1.087***
	(-0.99)75	(-1.084)	(-2.617)	(-3.351)
Firm FE	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	*0.167*	*0.147*	*0.141*	*0.242*
N	*8,046*	*8,059*	*8,036*	*8,080*

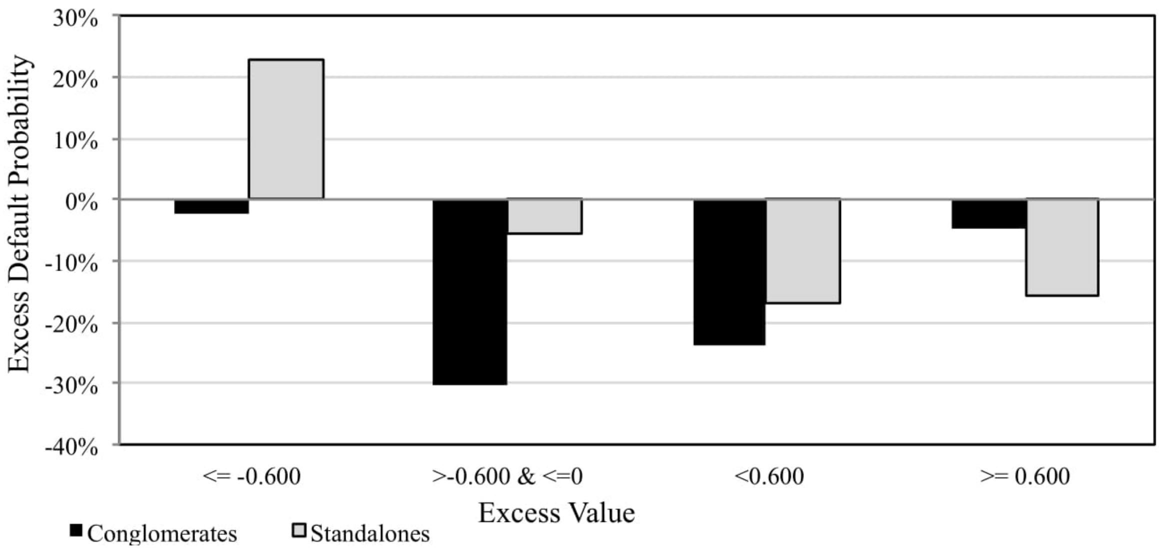

Figure 1: **Excess default probability by excess values categories**
This figure reports the value of the excess probability of default for different intervals of the excess value for conglomerates and standalone firms. The excess value is the natural logarithm of the ratio between a firm's market value and its imputed value at the end of the year. The imputed value is the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. For each interval of the computed excess value, we report the value of the excess probability of default, computed as the natural logarithm of the ratio between a firm PD and its imputed PD at the end of the year. The imputed value is the sum of its segments' imputed values, obtained by multiplying the segment's most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry.

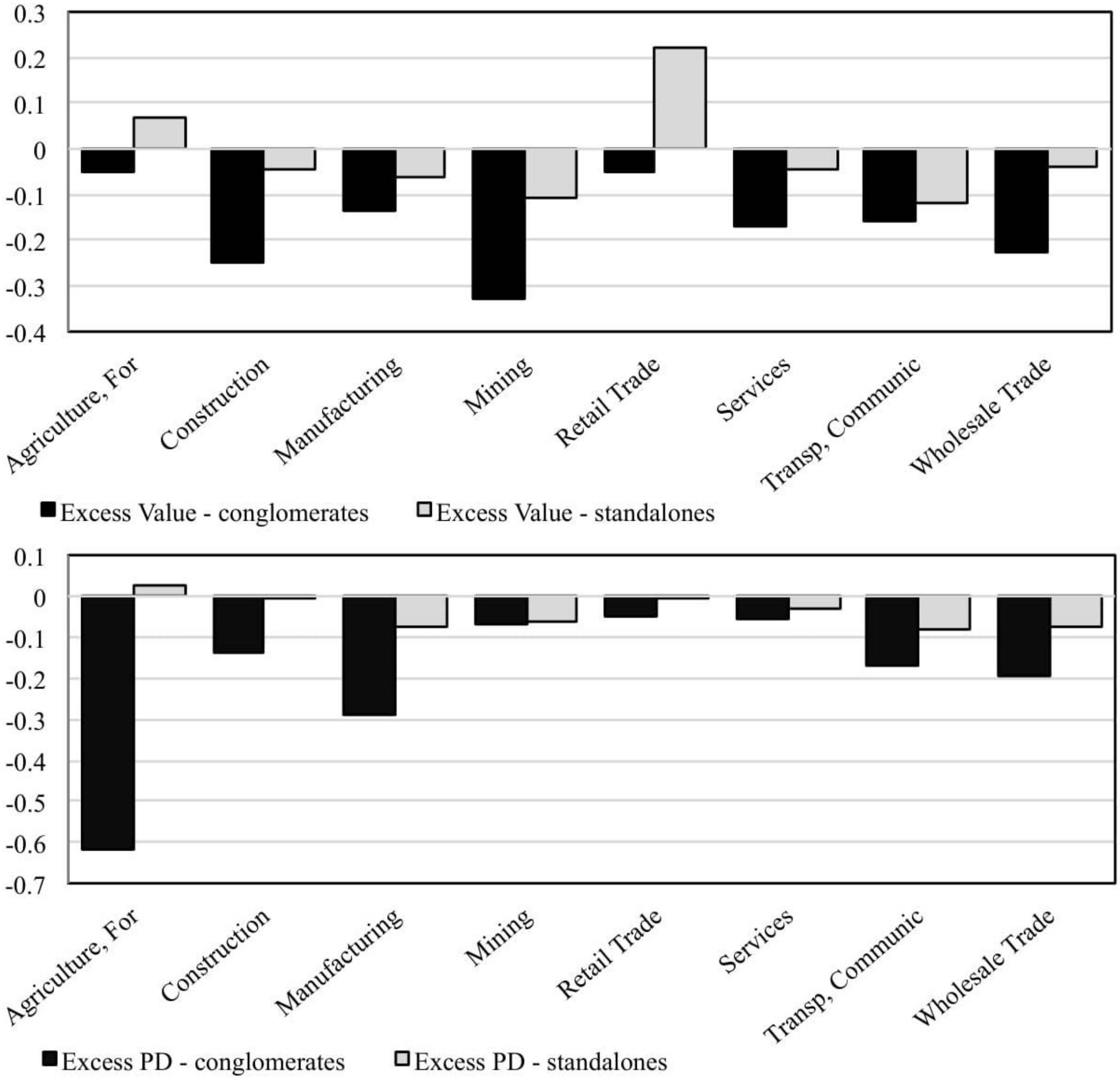

Figure 2: **Excess value and excess default probabilities by industries**
This figure reports the value of the excess probability of default for different interval of the excess value for conglomerates (Panel A) and standalone firms (Panel B) across industries. The excess value is the natural logarithm of the ratio between a firms market value and its imputed value at the end of the year. The imputed value is the sum of its segments imputed values, obtained by multiplying the segments most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry. The industry matching uses the narrower SIC including at least five single-segment firms. For each interval of the computed excess value, we report the value of the excess probability of default, computed as the natural logarithm of the ratio between a firm PD and its imputed PD at the end of the year. The imputed value is the sum of its segments imputed values, obtained by multiplying the segments most recent annual assets (sales) by the median market-to-assets multiplier of single-segment firms in the same industry.