Is There a Diversification Discount? A Re-examination*

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November 2018

ABSTRACT

The standard approach in the research of the diversification discount is to examine the excess value estimated from a valuation multiple. The excess value metric has two distinct properties: (1) a segment-size effect due to the link of the multiple to segment size; and (2) an imputed-value uncertainty effect due to the concavity of the excess value function. We first analyze fake conglomerates that are formed from randomly drawn pure-play firms to verify these two effects. Whereas involving no business diversification, these two effects are unusually strong. We then reexamine the diversification discount using real firm data. In a standard empirical framework, we show that the diversification discount disappears after controlling for segment size and imputed value uncertainty.

JEL classification: G34, L22, L25
Keywords: Conglomerate Valuation, Imputed Value, Diversification Discount

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The seminal works of Lang and Stulz (1994) and Berger and Ofek (1995) document that the value of a diversified conglomerate of multiple business segments is less than the value of a portfolio of the industry-matched pure-play firms. This finding is referred to as the diversification discount. Various issues regarding this finding have since been raised and debated in the finance literature. Early studies in the literature focus on the economic mechanisms and interpret this finding as evidence of the dark side of internal capital markets (e.g., Rajan, Servaes, and Zingales (2000)) and (Scharfstein and Stein (2000)).[1] More recent studies examine potential methodological problems behind this observation.[2] For instance, Campa and Kedia (2002) argue that a firm's decision to diversify is endogenously determined and the failure to control for firm characteristics and performance in the test is likely to cause a spurious diversification discount. Hund, Monk, and Tice (2016) demonstrate that failing to match for size and age between diversified and focused firms can cause a mechanical discount effect. Villalonga (2004a) questions the COMPUSTAT business segment data's suitability in identifying business segments. By using a new census database on business units, she finds a diversification premium from her sample. Despite such potential problems, however, the diversification discount phenomenon seems to remain robust based on the standard empirical methodologies and with more general samples (see, e.g., Rudolph and Schwetzler (2013) and Reed, Saffi, and

[1] Theory predicts both a bright side and a dark side of internal capital markets. On the bright side, internal capital markets allow the firm to achieve efficient allocation of funds within the organization and avoid using costly external capital that is subject to volatile market conditions and is likely to suffer from an adverse-selection problem (Myers and Majluf (1984) and Stein (1997)). On the dark side, internal fund allocations can be inefficient due to internal power struggle (Rajan, Servaes, and Zingales (2000)) and division managers' rent-seeking behaviour (Scharfstein and Stein (2000)).

[2] Rational explanations of diversification discount mechanisms are also proposed. Mansi and Reeb (2002) argue that there is a risk-reducing effect of corporate diversification. They show that the diversification discount becomes insignificant after this effect on the value of corporate bonds is taken into account. Reed, Saffi, and Wesep (2016) argue that conglomerates are subject to less divergence in investor opinions on their values than on the values of their individual divisions, which, in the presence of short sales constraints, means a conglomerate discount.

Wesep (2016)).

In this study, we re-examine the diversification discount by identifying the mechanical effects that are built in with the standard excess-value methodology. As a relative valuation metric, the excess value gauges a firm's value against its imputed value estimated from its segments' industry peers' price multiples. By comparing the excess value between focused firms and diversified conglomerates, previous studies rely on a key assumption: The excess value metric is unbiased toward pure-play firms so that any difference in the excess value between diversified and focused firms presents the effect of business diversification. We challenge this assumption by showing that, in the *absolute absence* of business diversification, a firm's excess value changes with its characteristics and can show a seeming discount or premium. We obtain this observation from a novel research strategy: We first construct simulation samples by forming fake conglomerates from randomly drawn pure-play firms and then apply the excess value approach to the simulation samples. Because such constructed conglomerates are artificial combinations of random, irrelevant pure-play firms, they involve no business diversification and have no association with any uncontrolled firm characteristics.

Our simulation results show surprisingly similar patterns of the effects on the excess value of typical firm characteristic variables. Most important, the simulations reveal a strong impact of two unaddressed factors on the excess value. As we explain below, these two factors, although purely mechanical, help remove any diversification discount in a standard, commonly used empirical framework. The first factor we identify is segment size. The common practice in existing studies is to control for firm size instead of segment size. When multi-segment conglomerates are concerned, the distinction between the two becomes not only necessary but also important, noting that a conglomerate firm's size is naturally decomposed into two components: the average segment size and the number of segments, and that the two components involve very different mechanisms. Regarding the first component, whereas there is no clear reason justifying a direct relationship between firm size and the excess value, there is an apparent link from a segment's size to its excess value. Consider the excess-value approach proposed by Berger and Ofek (1995), which is commonly used in the literature and which is also our focus.[3] In this approach, a segment's imputed value is typically estimated from its sales and its industry peers' median or mean value-to-sales multiples. Given the strong positive relationship between firm size and the multiple within an industry, larger segments' imputed values are estimated by relatively smaller multiples, consequently causing a mechanical positive relationship between segment size and the excess value. Regarding the second component, there is a close association between a conglomerate's number of segments and its degree of diversification, other things being equal. Hence, it is methodologically problematic to tie this component together with segment size, as is the case when a single control of firm size is used. Consistent with this analysis, our results show that these two components have contrasting impacts on the excess value and the second component is highly correlated with the key proxy variable for diversification. As a result, controlling for segment size separately reduces the observed diversification discount dramatically.

The second factor we identify is the uncertainty in the imputed value estimation. The excess value in its logarithmic function follows a well-shaped normal distribution, satisfying the data distribution requirement for the ordinary least square estimator. However, given the concavity of the excess value function, the inherent uncertainty in the imputed

[3] There are two classic versions of the excess value metric, one based on firms' q values, proposed by Lang and Stulz (1994), and the other based on firms' market values, proposed by Berger and Ofek (1995). Whereas both are commonly used in the literature, the latter has become predominating in recent studies (see, e.g., Hoechle et al. (2012), Rudolph and Schwetzler (2013), Kuppuswamy and Villalonga (2016), Hund, Monk, and Tice (2016), Reed, Saffi, and Wesep (2016), and Andres, Feunte, and Velasco (2017)). We also focus on the excess value metric of Berger and Ofek (1995).

value estimation determines that the average excess value estimate be lower than the true value (that could be obtained in the absence of uncertainty). This mathematical property applies to pure-play firms and multi-segment conglomerates as well. Since this effect depends on the distribution of data and valuation uncertainty, it can be asymmetric between pure-play firms and conglomerates. In other words, this mathematical property of the excess value function per see can result in a seeming discount or premium.

In the second part of this study, we re-examine the real firm data using a standard econometric model. Consistent with various previous studies, we observe a strong and robust diversification discount when conventional control variables are used in the model. We then revise the model following the insights from our simulations. After controlling for average segment size and a proxy for imputed value uncertainty, the diversification discount essentially disappears but frequently turns a premium. This finding is robust and obtained from a standard large sample and based on a standard econometric framework consistent with previous studies.

Our finding casts serious doubt on the long-debated diversification discount phenomenon. Several previous studies have examined other methodological problems that contribute to the diversification discount, such as selection bias (e.g., Campa and Kedia (2002)), segment data classification (Villalonga (2004a)), and unmatched firm characteristics (Hund, Monk, and Tice (2016)). Our study provides evidence showing that the mechanical effects of segment size and imputed value uncertainty are sufficient to account for the usually observed diversification discount. Our finding is compelling in two unique aspects. In one, we identify the mechanical factors from the simulations that are not subject to any effects of diversification or uncontrolled firm characteristics. In the other, our results are obtained from the data and empirical strategy that are highly consistent with previous studies, thus free of any compounding effects of data or technical complexity.

However, we are cautious not to draw a conclusion on the diversification discount. To the extent that the excess value approach we examine is not biased in valuation against pure-play firms, our finding suggests a necessary condition: For a study to show the diversification discount, it needs to survive the control of such mechanical factors.

Our regression results from the simulation sample and the real firm sample show remarkably similar and strong effects on the excess value of several important variables, such as capital expenditure, return on assets, liquidity, and market return volatility. In other words, the excess value can change notably with these variables in the absence of business diversification. Given this observation, it becomes more complicated or even difficult to interpret the usually observed effects of such variables: Do they capture a diversification effect, or how much do they reflect a diversification effect? Despite the importance of such questions, there seems no easy approach to obtaining a clear answer.

The rest of this paper is organized as follows. In Section I, we discuss the excess value approach, focusing on the mechanical effects of segment size and imputed value uncertainty, and outline our research strategy. Before discussing the simulation sample, in Section II we describe the real firm sample we use in this study. In Section III, we construct a simulation sample of fake conglomerates by using single-segment firms and then apply the excess value approach to the simulation sample. Section IV provides new evidence on the diversification discount by analyzing the real firm sample, where the results are compared between the conventional model and our revised model by controlling for segment size and imputed value uncertainty. The final section concludes.

I. The Excess Value Approach

A. The Excess Value

In the research of the diversification discount, an excess-value measure is commonly defined to compare the observed market value of a conglomerate with its unobserved imputed value estimated from its segment businesses. The rationale behind this relative valuation approach is that in the absence of organizational and capital market frictions, the value of a conglomerate should be the same as the sum of its segments' values as if they operated as standalone businesses. Therefore, any difference in the excess value should reflect economic mechanisms associated with business diversification that causes either a premium or a discount to the conglomerate's value. Depending on how a conglomerate's imputed value is estimated and compared with its market value, there are two commonly used versions of the excess value metric. Lang and Stulz (1994) propose the Tobin's q-based relative valuation approach, in which a conglomerate's q is compared with its imputed q. Whited (2001) points out a measurement error problem of q and questions the findings from the q-based excess value measures. In a more recent study, Custodio (2014) examines the accounting method caused problem of q-based measures, showing that they are biased upward by mergers and acquisitions and thus contribute to the observed discount on conglomerates because they are more acquisitive.

The other version is pioneered by Berge and Ofek (1995), in which a conglomerate's market value is compared with its imputed value that is estimated from the segments' industry peers' market values. This approach is used in most recent studies (See, e.g., Hoechle et al. (2012), Rudolph and Schwetzler (2013), Kuppuswamy and Villalonga (2016), Hund, Monk, and Tice (2016), Reed, Saffi, and Wesep (2016), and Andres, Feunte, and Velasco (2017)). Following these studies, we focus on this approach. The sales multiple-based excess value (EV) from this approach takes the following functional form:

$$EV = log \frac{MV}{\sum_n SALES_n \times IND_n(MV/SALES)} \tag{1}$$

where subscript n=1,2, ... , N denotes firms' segments, MV is the firm's market value (which is computed as the market value of equity plus the book value of debt), $SALES_n$ is the sales of segment *n*, and $IND_n(MV/SALES)$ is the median sales multiple, *MV/Sales* , of the segment's corresponding industry's peers. The excess value measure is applied to both standalone firms (where N=1) and diversified conglomerates (where N>1).

In the absence of a discount or premium on the conglomerate value and when the imputed value estimation is sufficiently accurate, the value to imputed value ratio should be close to one and thus $EV = 0$. To identify the diversification discount, the standard approach is to run the regression of the excess value on a diversification proxy (which we discuss below), controlling for relevant firm and capital market variables.

B. Mechanical Factors in the Excess Value

We now discuss two mechanical factors that affect the excess value through the computation method. Their effects are mechanical because they are from the excess value function but irrelevant to business diversification. The first mechanical factor is segment size.[4] In empirical corporate finance studies, firm size is often used as a major control variable even without a clearly justified economic mechanism. This also seems to be the case in the research of the diversification discount. However, when conglomerate firms are the concern, the distinction between firm size and segment size becomes an important issue. A conglomerate is larger either because it has more segments or because it has larger segments. With firm size being driven by these two distinct components, the conventional practice of controlling for firm size is valid only if the two components are associated with similar mechanisms and impact the excess value at similar magnitudes. Both economic intuition and real world observations suggests that this is not the case. For segment size,

[4] We consider segment size as a mechanical factor in the sense that it can affect the excess value through a mechanical channel. However, this by no means rules out the possibility that segment size also can affect the value of a conglomerate through non-mechanical channels such as agency costs and internal capital market efficiency.

because of a generally positive relationship between segment size and the sales multiple, the commonly used imputed value method, by design, introduces a positive relationship between segment size and the excess value. Figure 1 demonstrates this mechanical link with standalone firms, where Panel A shows the average within-industry relationships between the sales multiple and firm size and Panel B shows that between the excess value and firm size. The strong implication from this observation is that unless the valuation multiplier has no association with firm size (which is usually not the case), it is necessary to control for segment size to mitigate this mechanical effect.

For the other component, the number of segments, the mechanism is totally different. As an intuitive dimension of conglomerate structure that reflects the degree of diversification, the number of segments is expected to be associated with the diversification proxy variables. This means that it should be negatively associated with the excess value measure should there be a diversification discount. Moreover, since the number of segments affects the distribution of the segment imputed values, there is also an imputed value uncertainty effect. This is the second mechanical effect we discuss, which, as we show below, also causes a negative segment number effect on the excess value.

Without separating the effects of segment size and segment number, an empirical model with the single control of firm size is equivalent to imposing an equal-effect constraint on the two components. Consequently, on the one hand, the segment size effect is strong and dominating, which forces the segment number component to be positively linked with the excess value; on the other hand, when the true segment number effect is different (e.g., as being negative or insignificant), there must be a negative compensating effect that is bound to show up through the correlated diversification proxy variable. Consistent with this prediction, our empirical results will show that separately controlling for segment size considerably reduces the observed diversification discount.

The second mechanical factor is imputed value uncertainty. Figure 2 shows the distributions of the market value-to-imputed value (Value/IV) ratio and the logarithm value of this ratio (i.e., the excess value) for conglomerates. Because the distribution of this ratio is highly skewed, it is transformed to a well-shaped normal distribution by taking logarithms to meet the data distribution requirement for the OLS estimator. However, this data transformation process also introduces an imputed value error effect because of the concavity of the excess value function. Table I and Figure 3 together illustrate this effect. In Table I, the Value/IV ratio for pure-play firms from industry median multiples show a significant average premium (about 17%). This premium disappears after the data is transformed into the excess value (where the average excess value becomes slightly negative). This seemingly puzzling observation is illustrated in Figure 3, where the mean values of the Value/IV ratio and the excess value are consistent with point D instead of A. The reduction in the average excess value can be explained by the effect of imputed value uncertainty in the same logic as the effect of an investor's income uncertainty on his expected utility: As a segment's imputed value varies with both its sales and its industry peers' multiples, the Value/IV ratio is subject to considerable uncertainty. And when this ratio changes from year to year around its average, the average excess value becomes lower than its true level (at around point A) that could be observed without uncertainty.

Apparently, the effect arising from the transformation of the Value/IV ratio to the excess value depends on both the uncertainty and the distribution of this ratio. The numbers from the industry mean multipliers in Table I show a significant discount on the value for both diversified and focused firms. Hence, when this effect is asymmetric between the two groups, it can cause an observed diversification discount.

In addition to inherent business risk and stock market uncertainty, a conglomerate's number of segments also affects the imputed value uncertainty. In other words, as mentioned above, the number of segments can also have a negative impact on the excess value through this mechanical mechanism.

C. Empirical Model

The econometric model consistent with Berger and Ofek (1995) and others can be described as follows:

$$EV = \beta_0 + \beta_1\ Diversification + \beta_2\ log(Firm\ Size) + Other\ Controls \qquad (2)$$

where *Diversification* is a proxy for business diversification (denoted as *DIV*). The coefficient β_1 determines the value effect of diversification.

When the two components of firm size – segment size and segment number – are associated with different underlying mechanisms, the specification needs to be revised as the following:

$$EV = \beta_0 + \beta_1\ DIV + \beta_2\ log(SSIZE) + \beta_3\ log(NOS) + Other\ Controls \qquad (3)$$

where $Firm\ Size = Average\ Segment\ Size\ (SSIZE) \times Number\ of\ Segments\ (NOS)$. Therefore, estimating the conventional model, (2), is equivalent to estimate the revised model, (3), with the constraint $\beta_2 = \beta_3$. After further including the control for imputed value uncertainty, *IVU*, our revised model becomes:

$$EV = \beta_0 + \beta_1\ DIV + \beta_2\ log(SSIZE) + \beta_3\ log(NOS) + \beta_4\ IVU + Other\ Controls \qquad (4)$$

By estimating both the conventional model (2) and the revised model (4), we can highlight the roles of the mechanical factors through the change in the key coefficient β_1. More importantly, in a novel strategy, we first apply this approach to a simulation sample and then to the real firm sample. For the simulation analysis, we construct a sample of fake conglomerates by randomly drawing standalone firms and apply the excess value approach to the simulation sample. Because the fake conglomerates are mechanical combinations of randomly drawn standalone firms, they are completely irrelevant to business diversification or any specific firm characteristics. Therefore, any effects identified from the simulation are purely mechanical.

One commonly used proxy for diversification, *DIV*, is the dummy variable for diversified firms. Diversified firms are defined as conglomerates that report segments in two or more industries based on the 4-digit SIC codes. An alternative proxy for diversification is the degree of diversity proposed by Rajan et al. (2000). As in Eq. (5), the diversity measure is defined as the standard deviation of the segment asset-weighted q's divided by the equally weighted average q of all segments in the firm, where the segment q's are their corresponding industry median Tobin's q's.

$$Diversity = \frac{\sqrt{\frac{1}{N-1}\sum_n (w_n q_n - \overline{wq})^2}}{\frac{1}{N}\sum_n q_n} \tag{5}$$

where w_n is segment *n*'s assets divided by the firm's total assets. We use both the dummy variable for diversified firms and the diversity measure as alternative proxies for the effect of diversification.

One challenge to the estimation of the revised model is how to measure imputed value uncertainty, *IVU*, which is unobservable. We use two alternative proxy variables. The first proxy variable is the standard deviation of segments' imputed values in a year within a conglomerate, scaled by their imputed value mean. Given a conglomerate firm's segment structure, we expect this proxy to reflect the variation in the imputed value estimation. The second proxy for *IVU* is the standard deviation of a conglomerate's lagged imputed values over the previous five years, divided by the five years' mean.

We include in the model the following usual control variables: Profit margin computed as earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales, leverage as long-term liability divided by total assets, capex as capital expenditure divided by sales, return on assets (ROA) as net income divided by total assets, and liquidity as cash and its equivalent divided by total assets. In addition, two variables for capital market conditions are also included, which are market return as the annual return of the S&P 500 index compounded from monthly returns and market return volatility as the standard deviation of the S&P 500 index daily returns. Firm fixed effects are also included in the test when the real firm sample is used.

II. Sample and Data

Before discussing our simulation analysis, we need to describe the real firm sample used in this study, which provides the basis for our simulation sample construction. We retrieve our sample from the Compustat Industrial Annual files for the period from 1998 to 2016. As Hund, Monk, and Tice (2010) point out, the new reporting rule SFAS 131 went into effect in 1998, which differs materially from the previous accounting standard, SFAS 14, with regard to segment reporting (Berge and Hann, 2003). For this reason, we focus on the period starting from 1998. The Compustat Segment database reports four types of segment classification: business segment, operation segment, geographic segment, and state segment. As in previous studies, we identify segments based on the business segment classification. For firms that only report geographic or state segments, we treat them as single-segment firms. Following Hoechle et al. (2012), we consider any segment with missing SIC codes as a "missing segment". Such a segment's sales and assets are re-allocated to the conglomerate's other segments proportionally. We drop firms whose segment sales and assets are both missing or whose segments are all labeled as missing.

Segments with negative sales or assets are also considered as missing.

We merge the segment data with the firm-level data from the Compustat Fundamentals Annual database by the *gvkey* code provided by Compustat. As usual, we deal with several segment specific data problems as follows. We exclude from the sample financial firms, conglomerates with one or more segments in the financial industry (SIC code from 6000 to 6999), and firms of sales below $20 million. To minimize inconsistency between firm-level and segment-level data, for each conglomerate, we require the sum of its segments' sales to be within the 5% range of the firm's total sales and the sum of its segments' assets to be within the 25% range of the firm’s total assets (see, e.g., Hund et al. (2010) and Hoechle et al.(2012)). For conglomerates with sales or assets differentials between firm levels and segment totals, we follow Berger and Ofek (1995) to gross up or down the segment sales or assets by the percentage difference. We exclude extreme excess values that are above log(4) or below log(1/4) from the analysis. To allow more effective control of firm fixed effects, we further require each firm in the final sample used in the regression analysis to have observations of three or more years.

The final sample has 7,158 firms and 62,263 firm-year observations. Consistent with Berger and Ofek (1995) and Hund et al. (2010), about one third of our observations are from diversified conglomerates. Table II presents the summary statistics for selected variables. Conglomerate firms on average has 2.6 segments and the average diversity is 0.35. Compared with focused firms, diversified conglomerates are about three times larger, suggesting that the average size of segments is largely comparable to that of focused firms. The statistics show notable differences in several important firm characteristics. For instance, conglomerates have higher leverage, lower liquidity, and higher profit margin. This observation is consistent with the notion that diversified firms are different and firms choose to diversify for a reason (Campa and Kedia (2002), and Villalonga (2004b)).

III. Simulation Analysis

A. Simulation Sample

To construct the simulation sample, we first determine the pool of more than 5,500 single segment firms, including those with sales below $20 million for the convenience of the simulation sample to match the real firm sample in segment size distribution. We then draw randomly from the pool of single segment firms and mechanically combined them to form fake conglomerates. To mimic the real sample distribution in segment structure and segment size, we construct 2,800 firms by randomly drawing, without replacement, from the pool, which consists of 1,000 single-segment firms, 400 two-segment firms, 200 three-segment firms, and 100 four-segment firms. Noting that fewer than 3 percent of all real conglomerate firms have five or more segments, we do not construct fake conglomerates of five or more segments. The composition of the four segment number groups is reasonably comparable with that of the real firms. And for each segment number group, we require the average segment size to match the distribution of the real firms. We further require each firm to have observations of three or more years.

We repeat the sample construction process 1,000 times, of which each produces a simulation sample for regression analysis. Table III reports the average statistics (over 1,000 simulation samples) for the key variables in comparison with those of the real firm sample. A fake conglomerate firm's assets, sales, and market value are the corresponding sums of its fake segment assets, sales, and market value, respectively. Imputed value and excess value are computed for fake conglomerates in the same method as for real conglomerates: A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' median value-to-sales multiple. The firm's excess value is the logarithm of the value-to-imputed value ratio.

The table shows close similarities in firm size and valuation for single-segment firms between the simulated sample and the real firm sample. This is expected given the simulation sample construction design. For multi-segment firms, however, there is a notable difference between the two samples. The standard deviations indicate smaller variations of all variables for the simulation sample, suggesting that the variables are less dispersed with the simulation sample than with the real firm data. This difference is visibly increasing in the number of segments. This difference can be explained by the simulation sample construction process in which we mimic the size distribution of the real data by requiring, within each segment number group, randomly constructed firms to satisfy the given size ranges. This process tends to exclude from the simulation sample not only extreme size firms but also firms with more volatile variables.

Although this difference should not affect our simulation analysis qualitatively, it suggests potentially weaker effects for the results from the simulation sample. This is expected because less skewed value distribution and possibly less imputed value uncertainty make the mechanical effects less serious.

B. Simulation Regression Analysis

We perform regressions analysis for each of the 1,000 simulation samples. Table IV presents the results of our simulation regression analysis, where we report the average coefficients from the 1,000 simulations. The reported simulated *p*-value is defined as the minimum of the fractions of the 1,000 coefficient estimates that are larger or less than zeros multiplied by 2.[5] The excess value is computed using either industry median multiples (columns 1-6) or industry mean multiples (columns 7-12). The regressions in columns 1

[5] For example, if the percentage is less than 1%, we indicate the corresponding statistical significance level by three asterisks, ***. See Efron (1979) for the bootstrap methodology.

and 7 are from the conventional model, Eq. (2), which are consistent with previous studies. All other regressions are from the revised mode, Eq. (4), for alternative specifications regarding segment size, segment number, and imputed value uncertainty.

Our main observations from Table 5 can be summarized as follows. First, the firm size effect estimated from the conventional model is driven by segment size. As expected, the excess value is positively associated with average segment size in the revised model regressions. The segment size effect is statistically highly significant and economically strong in all regressions. On the other hand, the effect of segment number on the excess value is insignificant in all regressions. This finding supports the argument that the two components of firm size are associated with different mechanisms and the mechanical effect of segment size needs to be separately controlled.

Second, consistent with the predicted effect of imputed value uncertainty, the coefficients on the two uncertainty proxy variables are all negative and mostly significant. Two of the coefficients on the proxy variable based on lagged imputed values are insignificant, possibly due to the relatively small size of the simulation sample and the requirement for lagged imputed values. As shown in the next section, these coefficients in the corresponding real data regressions become significantly negative.

Third and importantly, including the controls for segment size and imputed value uncertainty notably elevates the coefficient on the diversification dummy. The coefficient is negative, although insignificant, in the conventional model regressions (columns 1 and 7) but turns positive in most of the revised model regressions. The insignificant coefficient on the diversification dummy in the conventional model regressions is not necessary surprising. Because the simulation sample has no systematic difference in firm characteristics between single-segment firms and fake conglomerates, any selection-bias caused diversification effect does not occur with the simulation sample. Moreover, as fake conglomerates exhibit less data variations, the mechanical effects of segment size and imputed value uncertainty may become less serious.

Finally, the excess value is significantly associated with many of the important control variables such as capital expenditure, return on assets, liquidity, and market return volatility. As will be seen in the next section, these associations are surprisingly similar to those from the real firm sample. This observation seems puzzling because all effects from the simulation regressions are supposed to be mechanical. However, to the extent that those variables are related to firm sales and value (and thus the imputed value) or to valuation uncertainty, directly or indirectly, they can capture or reflect some of the mechanical effects of segment size and imputed value uncertainty.

IV. New Evidence on the Diversification Discount

The key message from the above simulation analysis is that segment size, imputed value uncertainty, and many conventional control variables are important factors that affect the excess value in the absence of business diversification. These effects are mechanical and need to be controlled in the test for the diversification discount. We now apply the same test strategy to our real firm sample.

Tables V to VIII present the real sample results of our regression analyses for the excess value. The regressions are run for two alternative diversification proxies (the diversification dummy and diversity) and two alternative imputed value estimation methods (industry median multiples and industry mean multiples). The four tables report the regressions for the four alternative scenarios, respectively.

In Table V, the first two columns present the regressions from a standard model consistent with previous studies, with and without firm fixed effects respectively. The other columns present our revised model regressions, where average segment size, number of segments, and a proxy for imputed value uncertainty are controlled, in alternative specifications.

The two conventional model regressions confirm the diversification discount phenomenon documented by many previous studies: the coefficient on the diversification dummy is negative and statistically highly significant. Including firm fixed effects halves the coefficient, suggesting that a significant part of the diversification discount is from uncontrolled time-invariant firm characteristics. Given this important observation, we include firm fixed effects in all revised model regressions. We hence directly compare the revised model regressions (columns 3-7) with the conventional model with firm fixed effects (column 2).

As expected and consistent with the simulation results discussed above, the real firm data also reveal a positive effect of average segment size and a negative effect of imputed value uncertainty on the excess value. Both effects are statistically highly significant and economically strong. On the other hand, the effect of the number of segment is insignificant in all relevant regressions. The most dramatic result is that the coefficient on the diversification dummy essentially disappears in all five revised model regressions. To understand this result better, it is useful to highlight the major differences between the conventional model and each of the revised models. The only difference between regressions (2) and (3) is the implicit constraint $\beta_2 = \beta_3$ on the conventional model. Relaxing this constraint in regression (3) removes the diversification discount, leaving all other parameter estimates largely unchanged. We view this finding as evidence of a spurious compensating effect of the number of segment, in regression (2), through the diversification dummy.

In regressions (4) and (6), we simultaneously control for average segment size and imputed value uncertainty, but without controlling for segment number. One advantage of these two models is that the parameter estimates are free of any potential compounding effect due to multicollinearity between segment number and the diversification dummy. Including these two mechanical factors either removes the diversification discount or makes it turn into a diversification premium.

In regressions (5) and (7), all control variables are included and the coefficients are highly consistent with the other three revised model regressions, showing a strong positive effect of segment size, a strong negative effect of imputed value uncertainty, and the absence of the diversification discount.

We then replace the diversification dummy with the diversity measure and re-run all the regressions. The results are reported in Table VI, which are qualitatively the same as those in Table V except that the diversification discount is weaker based on the diversity measure. Consequently, the coefficient on diversity becomes significantly positive in all revised model regressions, suggesting a diversification premium.

We now turn to the excess value estimation by suing industry mean multiples. Because the mean multiples tend to overstate imputed values due to the right-skewed distribution of the sales multiple, the mean multiple based approach is bound to lead to a greater diversification discount (as illustrated by the statistics in Table I). This means that it is easier to show a diversification discount but more difficult to show its absence, using the industry mean multiple based excess values. However, if the conventional finding is indeed driven by the mechanical factors, our approach should also work with the excess value obtained from industry mean multiples.

We hence rerun the regressions in Table V and Table VI for the excess value based on industry mean multiples. We report the regressions on the diversification dummy in Table VII and the regressions on the diversity measure in Table VIII. As expected, the first two regressions in both tables show notably greater diversification discounts. However, after segment size and imputed value uncertainty are controlled, the discount disappears in most regressions in Table VII and becomes a diversification premium in all regressions in Table VIII.

It is worth noting the effect of the number of segments. Although this control does not change the overall picture of the absence of the diversification discount, its effect is negative in all six regressions. One potential concern is that because of its correlation with the diversification proxy, the number of segments may partially capture the diversification discount effect. Inconsistent with this possibility, a comparison of the coefficient on the diversification proxy between the different specifications shows that adding the control of segment number does not necessarily reduce the coefficient. In Table VIII, on the contrary, the coefficient increases in both magnitude and significance level from regression (4) to (5), and from regression (6) to (7). Alternatively, since the number of segments directly changes the imputed value variation, it may capture part of the imputed value uncertainty effect. This possibility is supported by a consistent offsetting effect between the two control variables.

V. Conclusion

By analyzing randomly formed fake conglomerates, we identify the mechanical yet important effects of segment size and imputed value uncertainty on the excess value. We then show that the widely observed diversification discount disappears after these two factors are controlled in a standard econometric model. Our findings raise serious questions about the nature of the diversification discount phenomenon. Is it due to the economic mechanisms of business diversification or some built-in effects through the excess-value function irrelevant to business diversification? The answer depends on the validity of the excess-value metric. As it is deemed suitable for valuation of conglomerate segments, our study presents strong evidence against the notion of diversification discount. On the other hand, since our examination focuses on the most commonly used excess-value approach, we cannot rule out the possibility that a diversification discount shows up when certain alternative valuation approach is used. Indeed, it is not the objective of this study to draw a conclusion on the diversification discount, which requires a comprehensive examination and comparison of various relative-valuation measures. To the extent that our approach is not biased in valuation against pure-play firms relative to conglomerate segment businesses, our findings highlight the great importance of controlling for the mechanical factors in the research of the diversification effects.

Our study shows the overall picture for all conglomerate firms. Yet it has little to say about differences in the diversification effects among firms of different characteristics. In the possible presence of both a bright side and a dark side of internal capital markets (Maksimovic and Phillips, 2013), one expects relevant firm and capital market variables to play a role in regard of mechanisms such as information asymmetry, cost of capital, and agency costs. However, our simulation results also show that in the absence of business diversification, mechanical effects can occur through the various firm characteristics and capital market variables. The implication here is that it is empirically challenging to disentangle the real diversification effects from those of mechanical factors.

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Table I
Excess Value: Diversified Firms vs. Focused Firms

Our sample covers the period from 1998 to 2016 (which is described in more detail in Table II). This table presents the sample mean and median for the market value to imputed value ratio (or the Value/IV ratio) and the excess value as a brief comparison between diversified firms and focused businesses. Diversified firms are defined as conglomerates that report segments in two or more different industries based on the 4-digit SIC codes. A firm's market value is the total market value of common equity and book value of debt. Its imputed value is the sum of its segments' imputed values, of which each is the segment's sales multiplied by its industry peers' median or mean value-to-sales multiple. The firm's excess value is the logarithm of the Value/IV ratio. We perform the Wilcoxon signed-rank test for the difference in the statistics between diversified and focused firms. *** denotes statistical significance at the 1% level.

	(Imputed Value from Industry Median Multiple)		(Imputed Value from Industry Mean Multiple)	
	Mean	Median	Mean	Median
Excess Value: log(Value/IV)				
Diversified	-0.080	-0.069	-0.273	-0.275
Focused	-0.012	0.000	-0.174	-0.179
Difference	-0.068***	-0.069***	-0.099***	-0.096***
Value/IV Ratio				
Diversified	1.071	0.933	0.863	0.755
Focused	1.165	1.000	0.947	0.821
Difference	-0.093***	-0.067***	-0.083***	-0.066***

Table II
Summary Statistics

This table presents summary statistics of selected variables for our sample, separately for diversified firms (Panel A) and stand-alone firms (Panel B). Diversified firms are defined as conglomerates that report segments in two or more different industries based on the 4-digit SIC codes. The sample covers the period from 1998 to 2016. Following previous studies, we exclude from the sample financial firms, conglomerates with financial segments, and firms of sales below $20 million. For each conglomerate, as usual, we require the sum of its segments' sales to be within the 1% range of the firm's total sales and the sum of its segments' assets to be within the 25% range of the firm's total assets. As Rajan et al. (2000), we compute the diversity measure as the standard deviation of the segment asset-weighted *q*'s divided by the equally weighted average *q* of all segments in the firm, where the segment *q*'s are their corresponding industry median Tobin's *q*'s. Market value is the total market value of common equity and book value of debt. Leverage is long-term liability divided by total assets. Liquidity is cash and its equivalent divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Number of segments is a conglomerate's number of segments that are in distinct industries.

	Mean	Median	Standard deviation	Min	Max	Obs.
A. Diversified Firms						
Market Value ($million)	13,366	1,741	39,141	5	711,308	21,649
Assets ($million)	8,840	1,193	26,583	1	411,275	21,649
Sales ($million)	6,784	1,097	22,805	20	483,521	21,649
Leverage	0.219	0.197	0.188	0.000	0.956	21,649
Liquidity	0.112	0.064	0.131	0.000	0.796	21,649
Capex	0.080	0.039	0.132	0.0	1.3	21,649
ROA	1.5%	3.7%	13.0%	-84.1%	29.7%	21,649
Profit Margin	14.0%	13.0%	15.3%	-108.4%	67.2%	21,649
Number of segments	2.61	2.00	0.94	2.00	10.00	21,649
Diversity	0.35	0.33	0.20	0.00	1.03	17,854
B. Focused Firms						
Market Value ($million)	4,477	578	17,338	2	796,691	40,614
Assets ($million)	2,546	336	9,562	1	321,686	40,614
Sales ($million)	1,921	291	6,582	20	233,715	40,614
Leverage	0.183	0.110	0.215	0.000	0.956	40,614
Liquidity	0.196	0.121	0.202	0.000	0.796	40,614
Capex	0.103	0.037	0.208	0.0	1.3	40,614
ROA	0.8%	3.2%	17.7%	-84.1%	29.7%	40,614
Profit Margin	11.1%	11.2%	23.9%	-108.4%	67.2%	40,614

Table III
Sample Comparison: Real Firms vs. Simulated Firms

This table provides information on firm size, value, and segment structure as a comparison between our real firm sample and the simulation sample. The simulation sample is composed of randomly drawn stand-alone and fake multi-segment firms. More specifically, to mimic the conglomerate composition regarding segment structure and firm size distribution of real firms, we construct 2,800 firms by randomly drawing, without replacement, from the pool of about 5,500 pure-play firms. The simulation sample consists of 1,000 standalone firms, 400 two-segment firms, 200 three-segment firms, and 100 four-segment firms. All the multi-segment firms are fake conglomerates that are mechanical combinations of randomly drawn stand-alone firms involving no business diversification. We require each firm to have observations of three or more years. We repeat the simulation process 1,000 times and report the average statistics across all simulations. A fake conglomerate firm's assets, sales, and market value are the corresponding sums of its fake segment assets, sales, and market value, respectively. Imputed value and excess value are computed similarly for real and randomly drawn firms: A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' median value-to-sales multiple. The firm's excess value is the logarithm of the ratio of the firm's market value over its imputed value.

	Real Firm Sample					Simulation Sample				
	Mean	Median	Std Dev	No of Firms	Obs	Mean	Median	Std Dev	No of Firms	Obs
A. Sing-segment Firms										
Assets	2,546	336	9,562	5,534	40,614	2,132	368	6,342	876	6,794
Sales	1,921	291	6,582	5,534	40,614	1,381	287	3,264	876	6,794
Market Value	4,477	578	17,338	5,534	40,614	3,616	624	10,811	876	6,794
Imputed Value (IV)	3,911	555	14,720	5,534	40,614	3,362	608	11,022	876	6,794
Excess Value: ln(Value/IV)	0.01	0.00	0.58	5,534	40,614	-0.019	-0.004	0.560	876	6,794
B. 2-Segment Conglomerates										
Assets	5,720	753	19,847	2,748	13,134	3,348	736	8,038	395	1,567
Sales	4,568	688	19,274	2,748	13,134	1,920	520	3,647	395	1,567
Market Value	9,210	1,123	33,425	2,748	13,134	5,396	1,241	12,670	395	1,567
Imputed Value (IV)	8,964	1,161	33,815	2,748	13,134	4,866	1,162	11,564	395	1,567
Excess Value: ln(Value/IV)	0.08	-0.08	0.56	2,748	13,134	0.025	0.015	0.502	395	1,567
C. 3-Segment Conglomerates										
Assets	9,627	1,733	28,794	1,390	5,529	5,153	1,744	9,272	201	851
Sales	7,782	1,489	26,459	1,390	5,529	3,287	1,336	4,797	201	851
Market Value	14,613	2,438	41,396	1,390	5,529	8,556	2,923	15,436	201	851
Imputed Value (IV)	16,246	2,525	58,324	1,390	5,529	7,861	2,726	15,151	201	851
Excess Value: ln(Value/IV)	0.09	-0.06	0.53	1,390	5,529	0.056	0.045	0.435	201	851
D. 4-Segment Conglomerates										
Assets	15,959	3,984	33,884	562	1,878	6,641	2,899	9,853	100	415
Sales	11,102	3,084	21,735	562	1,878	4,505	2,312	5,483	100	415
Market Value	21,790	5,409	43,657	562	1,878	11,149	4,934	16,632	100	415
Imputed Value (IV)	25,831	5,576	61,101	562	1,878	10,397	4,537	17,051	100	415
Excess Value: ln(Value/IV)	0.07	-0.04	0.51	562	1,878	0.070	0.061	0.397	100	415

Table IV
Mechanical Effects on the Excess Value: Simulations from Fake Conglomerates

This table presents the results of our regression analysis for the excess value from the simulation sample. The simulation sample is composed of randomly drawn stand-alone and fake multi-segment firms. The sample has 1,000 standalone firms, 400 two-segment firms, 200 three-segment firms, and 100 four-segment firms. All the multi-segment firms are fake conglomerates that are mechanical combinations of randomly drawn stand-alone firms. A fake conglomerate firm's assets, sales, and market value are the corresponding sums of its fake segment assets, sales, and market value, respectively. A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' median or mean value-to-sales multiple. The excess value is the logarithm of the ratio of the firm's market value over its imputed value. As in previous studies, extreme excess values that are above log(4) or below log(1/4) are dropped. We run the regression of the excess value on the proxy variable for diversification, controlling for commonly used firm and stock market variables. We use the dummy variable for diversified firms as the proxy for diversification. Diversified firms are fake conglomerates that have two or more fake segments. The excess value in columns 1 to 6 is based on the imputed value estimated from industry median multiples and in columns 7 to 12 based on the imputed value estimated from industry mean multiples. We use two alternative proxy variables for imputed value uncertainty. The first proxy variable is the standard deviation of a firm's segments' imputed values in a year, scaled by the average segment imputed value. The second proxy variable is the standard deviation of a firm's lagged imputed values over past five years, scaled by the imputed value mean. Other control variables that are commonly used are as follows: Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Leverage is long-term liability divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Liquidity is cash and its equivalent divided by total assets. Market return is the annual return of the S&P 500 index, compounded from monthly returns. Market return volatility is the standard deviation of the S&P 500 index daily returns. We construct the simulation sample and run each regression 1,000 times and report the average coefficients from the 1,000 simulations. We define and report the simulated *p*-values (in square brackets) as the minimum of the fractions of the 1,000 coefficient estimates that are larger or less than zeros multiplied by 2. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively, based on the simulated *p*-values.

	(Imputed Value from Industry Median Multiple)						(Imputed Value from Industry Mean Multiple)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Diversified Dummy	-0.014	0.028	0.185***	0.117**	0.044*	-0.000	-0.030	0.020	0.159***	0.100*	0.028	-0.006
	(0.57)	(0.62)	(0.00)	(0.04)	(0.09)	(1.00)	(0.20)	(0.71)	(0.00)	(0.07)	(0.27)	(0.91)
log(Firm Assets)	0.077***						0.080***					
	(0.00)						(0.00)					
log(Average Segment Assets)		0.077***	0.080***	0.080***	0.081***	0.081***		0.081***	0.083***	0.083***	0.083***	0.083***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
log(Number of Segments)		0.031		0.093*		0.048		0.025		0.081		0.037
		(0.56)		(0.08)		(0.46)		(0.65)		(0.14)		(0.58)
Proxy 1 for IV Uncertainty			-0.121***	-0.138***					-0.110***	-0.124***		
			(0.00)	(0.00)					(0.00)	(0.00)		
Proxy 2 for IV Uncertainty					-0.023	-0.022					-0.092**	-0.091**
					(0.61)	(0.62)					(0.03)	(0.03)
Profit Margin	0.073***	0.072***	0.075***	0.075***	0.092**	0.092**	0.061**	0.061**	0.063**	0.063**	0.078**	0.078**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Capex	0.185***	0.185***	0.183***	0.184***	0.189***	0.190***	0.171***	0.171***	0.169***	0.170***	0.177***	0.177***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Leverage	0.065	0.065	0.065	0.065	0.049	0.05	0.079*	0.078*	0.078*	0.078*	0.057	0.058
	(0.12)	(0.13)	(0.13)	(0.13)	(0.32)	(0.32)	(0.06)	(0.06)	(0.07)	(0.07)	(0.23)	(0.23)
ROA	0.061**	0.061**	0.063**	0.062**	0.105***	0.104***	0.063***	0.064***	0.065***	0.065***	0.099***	0.099***
	(0.04)	(0.04)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Liquidity	0.699***	0.698***	0.695***	0.696***	0.650***	0.650***	0.616***	0.616***	0.613***	0.615***	0.588***	0.588***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Market Return	0.0290	0.0280	0.0260	0.0270	-0.076**	-0.076**	0.053**	0.052**	0.050*	0.051*	-0.044	-0.043
	(0.30)	(0.31)	(0.35)	(0.33)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.06)	(0.21)	(0.21)
Market Return Volatility	4.831***	4.845***	4.865***	4.858***	2.844**	2.834**	5.180***	5.197***	5.216***	5.210***	3.227***	3.219***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Constant	-0.718***	-0.722***	-0.738***	-0.738***	-0.730***	-0.729***	-0.897***	-0.902***	-0.917***	-0.917***	-0.884***	-0.883***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Average Observations	9,626	9,626	9,626	9,626	6,603	6,603	9,486	9,486	9,486	9,486	6,500	6,500
Adjusted R2	0.122	0.122	0.125	0.126	0.130	0.130	0.119	0.120	0.122	0.123	0.129	0.129

Table V
Regression Analysis 1: Excess Value from Industry Median Multiple on Diversification Dummy

This table presents the results of our regression analysis for the excess value from the real firm sample. Our sample covers the period from 1998 to 2016. Following previous studies, we exclude from the sample financial firms, conglomerates with financial segments, and firms of sales below $20 million. We use the dummy variable for diversified firms as the proxy for diversification. Diversified firms are defined as conglomerates that report segments in two or more different industries based on the 4-digit SIC codes. A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' median value-to-sales multiple. The excess value is the logarithm of the ratio of the firm's market value over its imputed value. The first two columns present the regressions from a standard model consistent with previous studies, with and without firm fixed effects respectively. The other columns present our revised model regressions, where average segment size, segment number, and a proxy for imputed value uncertainty are controlled, in alternative specifications. We use two alternative proxy variables for imputed value uncertainty. The first proxy variable is the standard deviation of a firm's segments' imputed values in a year, scaled by the average segment imputed value. The second proxy variable is the standard deviation of a firm's lagged imputed values over past five years, scaled by the imputed value mean. Other control variables that are commonly used are as follows: Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Leverage is long-term liability divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Liquidity is cash and its equivalent divided by total assets. Market return is the annual return of the S&P 500 index, compounded from monthly returns. Market return volatility is the standard deviation of the S&P 500 index daily returns. Heteroskedasticity robust *t*-statistics are shown in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(Conventional Model)		(Revised Model)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Diversification Dummy	-0.0799***	-0.0418***	-0.0225	0.0231*	0.0120	-0.0059	-0.0054
	(-17.27)	(-6.56)	(-1.61)	(1.88)	(0.76)	(-0.59)	(-0.33)
log(Firm Assets)	0.0688***	0.0256***					
	(56.78)	(8.83)					
log(Average Segment Assets)			0.0271***	0.0263***	0.0267***	0.0515***	0.0515***
			(7.60)	(7.48)	(7.51)	(12.40)	(12.19)
log(Number of Segments)			0.0018		0.0167		-0.0006
			(0.12)		(1.08)		(-0.03)
Proxy 1 for Imputed Value Uncertainty				-0.0458***	-0.0478***		
				(-4.54)	(-4.63)		
Proxy 2 for Imputed Value Uncertainty						-0.0831***	-0.0830***
						(-6.44)	(-6.43)
Profit Margin	0.0611***	-0.018	-0.0186	-0.018	-0.0181	0.0296	0.0296
	(4.00)	(-1.34)	(-1.05)	(-1.02)	(-1.03)	(1.38)	(1.38)
Capex	0.3759***	0.6002***	0.5996***	0.6000***	0.5999***	0.5364***	0.5364***
	(33.74)	(38.67)	(34.15)	(34.17)	(34.16)	(25.41)	(25.41)
Leverage Ratio	0.2046***	0.0883***	0.0879***	0.0878***	0.0874***	0.0649***	0.0649***
	(17.83)	(6.59)	(5.92)	(5.90)	(5.88)	(3.99)	(3.99)
ROA	0.3395***	0.3235***	0.3230***	0.3240***	0.3240***	0.2904***	0.2904***
	(18.27)	(22.58)	(17.66)	(17.72)	(17.72)	(14.25)	(14.25)
Liquidity	0.8644***	0.7343***	0.7347***	0.7357***	0.7363***	0.7297***	0.7297***
	(64.68)	(42.66)	(34.51)	(34.58)	(34.59)	(30.06)	(30.04)
Market Return	0.0084	0.0276**	0.0279**	0.0270**	0.0270**	-0.0762***	-0.0762***
	(0.55)	(2.56)	(2.57)	(2.49)	(2.49)	(-6.32)	(-6.32)
Market Return Volatility	5.4719***	6.1394***	6.1649***	6.1464***	6.1495***	3.9935***	3.9935***
	(9.86)	(15.19)	(15.66)	(15.62)	(15.63)	(9.58)	(9.58)
Constant	-0.7379***	-0.4512***	-0.4594***	-0.4556***	-0.4592***	-0.5713***	-0.5711***
	(-66.76)	(-22.48)	(-19.14)	(-19.32)	(-19.14)	(-20.42)	(-20.00)
Firm Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62,263	62,098	62,098	62,098	62,098	48,399	48,399
Adjusted R2	0.146	0.076	0.076	0.077	0.077	0.075	0.075

Table VI
Regression Analysis 2: Excess Value from Industry Median Multiple on Diversity

This table presents the results of our regression analysis for the excess value from the real firm sample. Our sample covers the period from 1998 to 2016. Following previous studies, we exclude from the sample financial firms, conglomerates with financial segments, and firms of sales below $20 million. We use the diversity measure proposed by Rajan et al. (2000) as the proxy for diversification. A firm's business diversity is computed as the standard deviation of the segment asset-weighted q's divided by the equally weighted average q of all segments in the firm, where the segment q's are their corresponding industry median Tobin's q's. A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' median value-to-sales multiple. The excess value is the logarithm of the ratio of the firm's market value over its imputed value. The first two columns present the regressions from a standard model consistent with previous studies, with and without firm fixed effects respectively. The other columns present our revised model regressions, where average segment size, segment number, and a proxy for imputed value uncertainty are controlled, in alternative specifications. We use two alternative proxy variables for imputed value uncertainty. The first proxy variable is the standard deviation of a firm's segments' imputed values in a year, scaled by the average segment imputed value. The second proxy variable is the standard deviation of a firm's lagged imputed values over past five years, scaled by the imputed value mean. Other control variables that are commonly used are as follows: Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Leverage is long-term liability divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Liquidity is cash and its equivalent divided by total assets. Market return is the annual return of the S&P 500 index, compounded from monthly returns. Market return volatility is the standard deviation of the S&P 500 index daily returns. Heteroskedasticity robust *t*-statistics are shown in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(Conventional Model)		(Revised Model)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Diversity	-0.1321***	-0.0169	0.0317*	0.1419***	0.1412***	0.0410**	0.0561***
	(-11.49)	(-1.27)	(1.80)	(6.14)	(6.12)	(2.21)	(2.72)
log(Firm Assets)	0.0681***	0.0234***					
	(55.10)	(7.85)					
log(Average Segment Assets)			0.0257***	0.0239***	0.0254***	0.0516***	0.0503***
			(6.98)	(6.62)	(6.93)	(12.19)	(11.54)
log(Number of Segments)			-0.0246**		0.0378***		-0.0188
			(-2.26)		(2.83)		(-1.45)
Proxy 1 for Imputed Value Uncertainty				-0.0801***	-0.1009***		
				(-7.50)	(-7.70)		
Proxy 2 for Imputed Value Uncertainty						-0.0903***	-0.0896***
						(-6.80)	(-6.75)
Profit Margin	0.0639***	-0.0249*	-0.0271	-0.0279	-0.0277	0.0251	0.025
	(4.09)	(-1.82)	(-1.50)	(-1.54)	(-1.53)	(1.15)	(1.15)
Capex	0.3879***	0.5987***	0.5971***	0.5972***	0.5972***	0.5356***	0.5360***
	(34.41)	(38.31)	(33.63)	(33.68)	(33.67)	(25.17)	(25.19)
Leverage Ratio	0.2042***	0.0809***	0.0815***	0.0820***	0.0804***	0.0582***	0.0593***
	(17.35)	(5.88)	(5.34)	(5.38)	(5.27)	(3.50)	(3.56)
ROA	0.3269***	0.3234***	0.3225***	0.3238***	0.3239***	0.2876***	0.2875***
	(17.06)	(22.00)	(17.19)	(17.27)	(17.28)	(13.86)	(13.85)
Liquidity	0.8848***	0.7396***	0.7377***	0.7373***	0.7401***	0.7256***	0.7240***
	(64.68)	(41.66)	(33.51)	(33.54)	(33.64)	(29.11)	(29.02)
Market Return	0.0060	0.0263**	0.0267**	0.0254**	0.0253**	-0.0722***	-0.0721***
	(0.39)	(2.38)	(2.40)	(2.28)	(2.28)	(-5.86)	(-5.85)
Market Return Volatility	5.1132***	5.7380***	5.7811***	5.7469***	5.7609***	3.7970***	3.7885***
	(8.97)	(13.84)	(14.31)	(14.25)	(14.28)	(8.90)	(8.88)
Constant	-0.7454***	-0.4438***	-0.4495***	-0.4356***	-0.4500***	-0.5729***	-0.5616***
	(-65.37)	(-21.60)	(-18.25)	(-18.25)	(-18.29)	(-20.70)	(-19.22)
Firm Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	58,468	58,275	58,275	58,275	58,275	45,620	45,620
Adjusted R2	0.146	0.076	0.077	0.078	0.078	0.075	0.075

Table VII
Regression Analysis 3: Excess Value from Industry Mean Multiple on Diversification Dummy

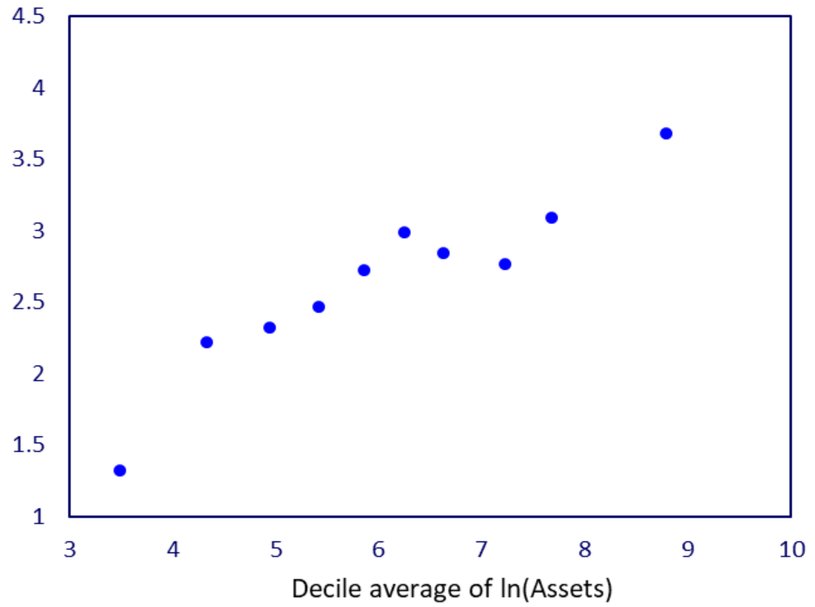
This table presents the results of our regression analysis for the excess value from the real firm sample. Our sample covers the period from 1998 to 2016. Following previous studies, we exclude from the sample financial firms, conglomerates with financial segments, and firms of sales below $20 million. We use the dummy variable for diversified firms as the proxy for diversification. Diversified firms are defined as conglomerates that report segments in two or more different industries based on the 4-digit SIC codes. A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' mean value-to-sales multiple. The excess value is the logarithm of the ratio of the firm's market value over its imputed value. The first two columns present the regressions from a standard model consistent with previous studies, with and without firm fixed effects respectively. The other columns present our revised model regressions, where average segment size, segment number, and a proxy for imputed value uncertainty are controlled, in alternative specifications. We use two alternative proxy variables for imputed value uncertainty. The first proxy variable is the standard deviation of a firm's segments' imputed values in a year, scaled by the average segment imputed value. The second proxy variable is the standard deviation of a firm's lagged imputed values over past five years, scaled by the imputed value mean. Other control variables that are commonly used are as follows: Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Leverage is long-term liability divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Liquidity is cash and its equivalent divided by total assets. Market return is the annual return of the S&P 500 index, compounded from monthly returns. Market return volatility is the standard deviation of the S&P 500 index daily returns. Heteroskedasticity robust *t*-statistics are shown in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(Conventional Model)		(Revised Model)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Diversification Dummy	-0.1036***	-0.0718***	-0.0219	-0.0217*	0.0006	-0.0266***	-0.0031
	(-22.04)	(-10.84)	(-1.51)	(-1.73)	(0.04)	(-2.60)	(-0.18)
log(Firm Assets)	0.0664***	0.0198***					
	(53.57)	(6.69)					
log(Average Segment Assets)			0.0212***	0.0219***	0.0210***	0.0477***	0.0467***
			(5.77)	(6.01)	(5.70)	(11.08)	(10.67)
log(Number of Segments)			-0.0423***		-0.0330**		-0.0298*
			(-2.66)		(-2.03)		(-1.67)
Proxy 1 for Imputed Value Uncertainty				-0.0349***	-0.0314***		
				(-3.38)	(-2.98)		
Proxy 2 for Imputed Value Uncertainty						-0.0767***	-0.0761***
						(-6.08)	(-6.04)
Profit Margin	0.0360**	-0.0660***	-0.0666***	-0.0666***	-0.0664***	-0.0282	-0.0279
	(2.35)	(-4.91)	(-3.75)	(-3.75)	(-3.74)	(-1.32)	(-1.30)
Capex	0.4419***	0.5607***	0.5602***	0.5601***	0.5603***	0.4961***	0.4965***
	(39.78)	(36.49)	(32.72)	(32.71)	(32.72)	(23.69)	(23.71)
Leverage Ratio	0.2197***	0.0886***	0.0885***	0.0873***	0.0880***	0.0698***	0.0703***
	(18.83)	(6.43)	(5.79)	(5.71)	(5.75)	(4.13)	(4.16)
ROA	0.3263***	0.3092***	0.3086***	0.3094***	0.3093***	0.2711***	0.2710***
	(17.35)	(20.51)	(16.58)	(16.63)	(16.63)	(13.15)	(13.15)
Liquidity	0.8375***	0.7865***	0.7865***	0.7884***	0.7873***	0.7624***	0.7612***
	(61.20)	(44.69)	(36.39)	(36.50)	(36.43)	(31.24)	(31.16)
Market Return	(0.0166)	0.0057	0.0061	0.0057	0.0056	-0.0849***	-0.0848***
	(-1.07)	(0.51)	(0.54)	(0.50)	(0.50)	(-6.78)	(-6.76)
Market Return Volatility	2.8993***	3.9129***	3.9430***	3.9361***	3.9291***	2.1457***	2.1444***
	(5.14)	(9.36)	(9.70)	(9.69)	(9.67)	(4.97)	(4.97)
Constant	-0.8682***	-0.5556***	-0.5622***	-0.5688***	-0.5618***	-0.6954***	-0.6880***
	(-76.95)	(-26.75)	(-22.44)	(-23.10)	(-22.43)	(-23.79)	(-23.06)
Firm Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Observations	60,598	60,361	60,361	60,361	60,361	46,901	46,901
Adjusted R2	0.144	0.074	0.075	0.075	0.075	0.068	0.068

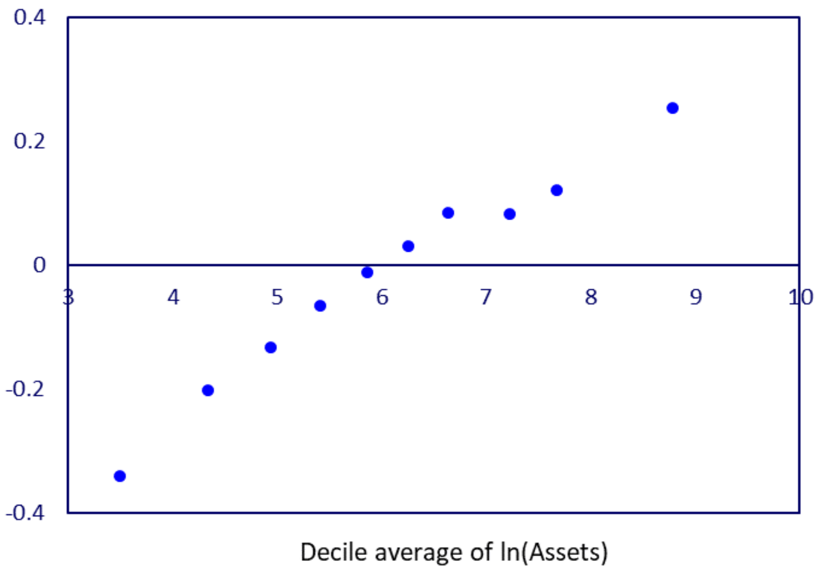
Table VIII
Regression Analysis 4: Excess Value from Industry Mean Multiple on Diversity

This table presents the results of our regression analysis for the excess value from the real firm sample. Our sample covers the period from 1998 to 2016. Following previous studies, we exclude from the sample financial firms, conglomerates with financial segments, and firms of sales below $20 million. We use the diversity measure proposed by Rajan et al. (2000) as the proxy for diversification. A firm's business diversity is computed as the standard deviation of the segment asset-weighted q's divided by the equally weighted average q of all segments in the firm, where the segment q's are their corresponding industry median Tobin's q's. A firm's imputed value is the sum of its segments' imputed values, of which each is computed as the segment's sales multiplied by its industry peers' mean value-to-sales multiple. The excess value is the logarithm of the ratio of the firm's market value over its imputed value. The first two columns present the regressions from a standard model consistent with previous studies, with and without firm fixed effects respectively. The other columns present our revised model regressions, where average segment size, segment number, and a proxy for imputed value uncertainty are controlled, in alternative specifications. We use two alternative proxy variables for imputed value uncertainty. The first proxy variable is the standard deviation of a firm's segments' imputed values in a year, scaled by the average segment imputed value. The second proxy variable is the standard deviation of a firm's lagged imputed values over past five years, scaled by the imputed value mean. Other control variables that are commonly used are as follows: Profit margin is earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by sales. Leverage is long-term liability divided by total assets. Capex is capital expenditure divided by sales. Return on assets (ROA) is net income divided by total assets. Liquidity is cash and its equivalent divided by total assets. Market return is the annual return of the S&P 500 index, compounded from monthly returns. Market return volatility is the standard deviation of the S&P 500 index daily returns. Heteroskedasticity robust *t*-statistics are shown in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(Conventional Model)		(Revised Model)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Diversity	-0.1464***	-0.0453***	0.0509***	0.1443***	0.1462***	0.0345*	0.0811***
	(-12.68)	(-3.28)	(2.82)	(6.13)	(6.22)	(1.82)	(3.82)
log(Firm Assets)	0.0641***	0.0168***					
	(50.33)	(5.51)					
log(Average Segment Assets)			0.0200***	0.0207***	0.0198***	0.0498***	0.0462***
			(5.27)	(5.56)	(5.21)	(11.38)	(10.23)
log(Number of Segments)			-0.0777***		-0.0240*		-0.0572***
			(-6.94)		(-1.76)		(-4.26)
Proxy 1 for Imputed Value Uncertainty				-0.1014***	-0.0888***		
				(-9.23)	(-6.66)		
Proxy 2 for Imputed Value Uncertainty						-0.0793***	-0.0775***
						(-6.13)	(-6.00)
Profit Margin	0.0432***	-0.0712***	-0.0750***	-0.0754***	-0.0755***	-0.0335	-0.0339
	(2.77)	(-5.19)	(-4.15)	(-4.18)	(-4.18)	(-1.53)	(-1.55)
Capex	0.4577***	0.5609***	0.5586***	0.5580***	0.5580***	0.4936***	0.4945***
	(40.75)	(36.25)	(32.37)	(32.37)	(32.37)	(23.36)	(23.42)
Leverage Ratio	0.2202***	0.0801***	0.0816***	0.0790***	0.0801***	0.0600***	0.0630***
	(18.38)	(5.66)	(5.19)	(5.03)	(5.10)	(3.47)	(3.64)
ROA	0.3111***	0.3082***	0.3069***	0.3084***	0.3083***	0.2680***	0.2678***
	(16.03)	(19.92)	(16.07)	(16.16)	(16.15)	(12.76)	(12.73)
Liquidity	0.8676***	0.7911***	0.7874***	0.7906***	0.7889***	0.7581***	0.7533***
	(61.96)	(43.56)	(35.39)	(35.59)	(35.48)	(30.32)	(30.11)
Market Return	(0.0165)	0.0065	0.0073	0.0061	0.0061	-0.0804***	-0.0802***
	(-1.03)	(0.57)	(0.63)	(0.52)	(0.52)	(-6.27)	(-6.26)
Market Return Volatility	2.7146***	3.6770***	3.7400***	3.7132***	3.7057***	2.0735***	2.0429***
	(4.67)	(8.58)	(8.96)	(8.90)	(8.88)	(4.69)	(4.62)
Constant	-0.8761***	-0.5506***	-0.5547***	-0.5634***	-0.5543***	-0.7171***	-0.6833***
	(-75.06)	(-25.89)	(-21.56)	(-22.61)	(-21.57)	(-24.76)	(-22.36)
Firm Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,915	56,656	56,656	56,656	56,656	44,193	44,193
Adjusted R2	0.142	0.073	0.075	0.076	0.076	0.067	0.068

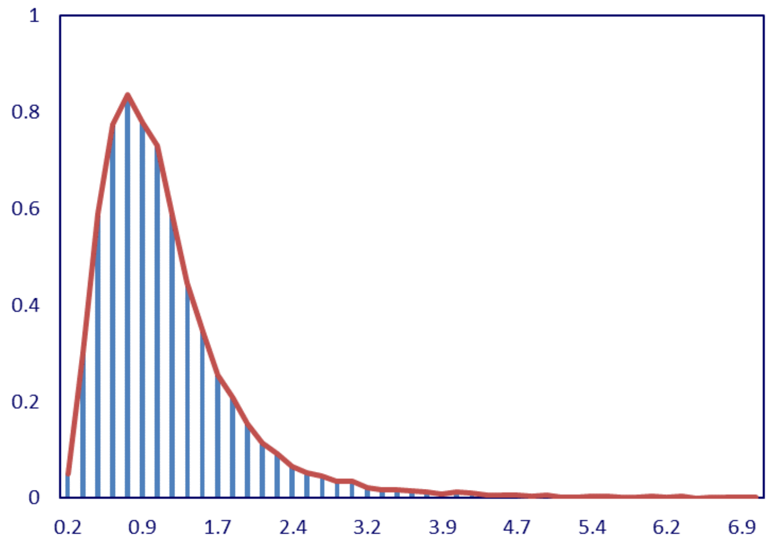


A. Within-Industry Relation of the Value/Sales Multiple with Firm Assets

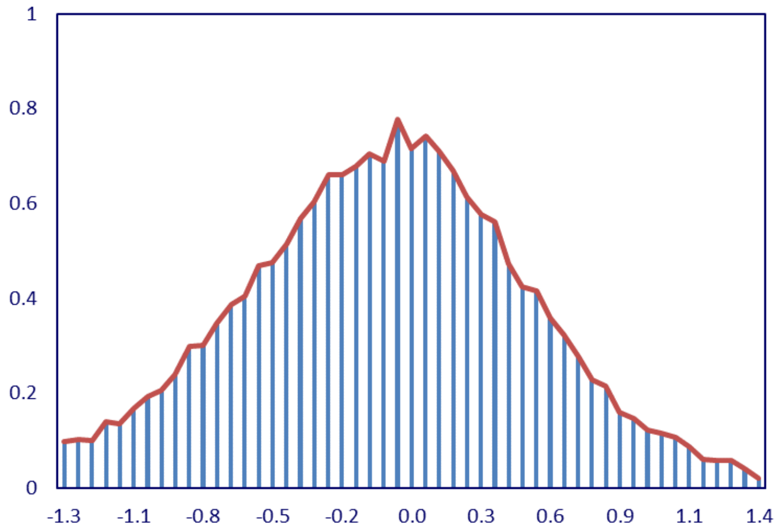


B. Within-Industry Relation of Excess Value with Firm Assets

Figure 1. The Within-Industry Relationships from Standalone Firms. Our sample for this figure consists of standalone firms during the period from 1998 to 2016. To show the within-industry relationships with respect to firm size, for each industry we compute each firm's average of log(Assets) as a proxy for the firm's average size and then divide the industry's all standalone firms into deciles according to their average size. Within each industry, we obtain each decile's average value-to-sales multiple and average excess value. After normalizing the decile multiple and excess value by their corresponding industry means, we take the cross-industry average to obtain each decile's value-to-sales multiple and excess value. They are shown in Panel A and B respectively.



A. Distribution of Value/IV



B. Distribution of log(Value/IV)

Figure 2. Distribution of the Value/IV Ratio and Excess Value. Our sample for this figure consists of conglomerate firms during the period from 1998 to 2016. Histogram A shows the distribution of the ratio of market value (value) to imputed value (IV) for conglomerates. Histogram B shows the distribution of the excess value, which is the logarithm of the Value/IV ratio, for conglomerates. The horizontal axis represents the values of each variable and the vertical axis represents the corresponding density levels.

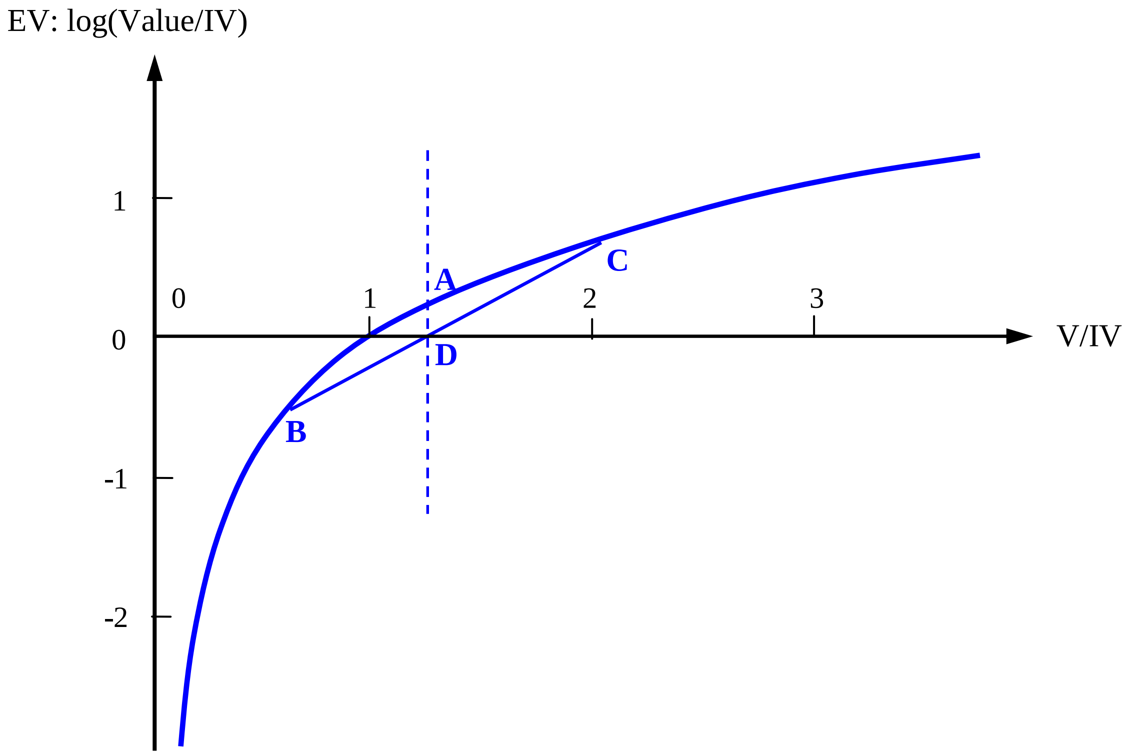


Figure 3. Concavity of the Excess Value Function. This figure illustrates the concavity of the excess value function and the effect of imputed value uncertainty on the average excess value through the concavity. Point A illustrates a conglomerate with a premium (of which the market value is greater than the imputed value) in the absence of uncertainty. When the imputed value is estimated with error, then the point shifts either down to Point B (when the imputed value becomes larger) or up to point C (when the imputed value becomes smaller). Consequently, the average excess value is smaller and the point moves down to point D.