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Does Diversification Create Value in the Presence of External Financing Constraints? Evidence from the 2007–2009 Financial Crisis

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We show that the value of corporate diversification increased during the 2007–2009 financial crisis. Diversification gave firms both financing and investment advantages. First, conglomerates became significantly more leveraged relative to comparable focused firms. Second, conglomerates' access to internal capital markets became more valuable, not just because external capital markets became more costly but also because the efficiency of internal capital allocation increased significantly during the crisis. Our analysis provides new evidence on how and why the value of diversification varies with financial constraints and economic conditions, and it suggests that corporate diversification can serve an important insurance function for investors.

1. Introduction

The global financial crisis of 2007–2009 has led academics and practitioners to question many widely held beliefs about business and economics. One such belief relates to the value of corporate diversification. Popular views about it have swung like a pendulum over the past half century, from a generally positive view in the 1960s and 1970s, when many large conglomerates were formed, to a generally negative view in the 1980s and early 1990s, when many such conglomerates were dismantled or fell out of the stock market's favor. In the late 1990s and early 2000s, an active debate sparked off among financial economists about the so-called diversification discount, or lack thereof.[1] In the wake of the global financial crisis, a new view seems to be emerging that conglomerates are ready for a comeback (see Bower et al. 2009, Denning 2009, Jackson 2009).

In this paper we investigate whether the value of diversification has indeed changed as a result of the crisis, and if so, why. We are particularly interested in determining whether any changes in the relative value of diversified and focused firms around the crisis reflect real differences in corporate finance and investment as opposed to simple changes in investor

sentiment or perceptions. The broader question we seek to answer is whether the value of corporate diversification and its underlying drivers vary with external financing constraints and changing economic conditions, in such a way that diversification can provide insurance for investors against bad states of the world. If this is the case, then a "diversification discount" may be justified during stable periods as a form of insurance premium that diversified firm investors are willing to pay. Besides its recency and sheer magnitude, the 2007–2009 crisis is of particular interest to us for this purpose because, unlike other crises or recessions, this one had its origins in consumer finance (housing mortgages) rather than in corporate finance (credit or equity markets) or as a result of demand-side factors (business or economic fundamentals). Thus, as Campello et al. (2010, 2011) suggest, the 2007–2009 financial crisis represents an ideal setting for studying the effects of corporate finance on investment because although the crisis ultimately spilled over onto the corporate domain, the original shock can be considered exogenous to the system.

As documented, for instance, in Acharya et al. (2009), Almeida et al. (2012), Gorton (2010), or Ivashina and Scharfstein (2010a), the extreme market conditions that resulted from the crisis made it very difficult for corporations to obtain credit and access external capital during this time span. This sudden

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[1] See Montgomery (1994), Martin and Sayrak (2003), Stein (2003), and Villalonga (2003) for reviews.

and severe capital rationing suggests two channels through which the financial crisis may have triggered an increase in the intrinsic value of corporate diversification. The first channel is what Stein (2003, p. 138) labels the "more-money" effect arising from the debt coinsurance feature of conglomerates. As first noted by Lewellen (1971), the imperfect correlation among the cash flows of a conglomerate's businesses reduces default risk and thereby increases the group's debt capacity relative to what a comparable portfolio of stand-alone firms could raise. In support of this argument, Berger and Ofek (1995) find that diversified corporations are significantly more leveraged than their focused counterparts in a statistical sense. Yet the low economic significance of their result and Comment and Jarrell's (1995) finding of no association between leverage and diversification have cast doubt on the empirical validity of the argument.

However, the failure to find such an association cannot be interpreted as evidence against diversification's coinsurance effect. First, the effect may manifest itself on prices, rather than quantities. Consistent with this hypothesis, Hann et al. (2013) find that diversified firms have a lower cost of capital than their single-segment counterparts. Second, to the extent that firms' optimal capital structure depends on industry characteristics (Harris and Raviv 1991), conglomerates and their stand-alone peers should have the same leverage in equilibrium—which makes Lewellen's (1971) theory difficult to test in a steady-state context. A more definitive test of the theory can be achieved by comparing how diversified and single-segment firms change their leverage in response to a generalized shortage of credit in the industry or the overall economy—such as that provided by the recent financial crisis. When credit becomes rationed, banks and bondholders may prefer to lend their scarce funds to safer conglomerates than to riskier stand-alone firms. Stand-alone firms will thus have more difficulty than conglomerates reaching their optimal leverage and may become disadvantaged or even financially distressed before conglomerates do so. Therefore, the value of conglomerates relative to stand-alone firms may increase during the crisis as a result of the suboptimal capital structure behavior imposed by the crisis on stand-alone firms.

The second channel through which the financial crisis might have increased the intrinsic value of diversification is through firms' internal capital markets—Stein's (2003) "smarter-money" effect (p. 138). The literature has identified several potential benefits and costs of internal capital allocation (see Stein 2003 for a review). The main benefit is that, by engaging in "winner-picking," corporate headquarters can reallocate funds toward promising projects that might be capital constrained if pursued

within stand-alone firms (Stein 1997). On the other hand, there is a risk that either the chief executive officer or divisional managers may behave as rent-seeking agents and misallocate corporate resources (Rajan et al. 2000, Scharfstein and Stein 2000). Stein (1997) analyzes under what circumstances the benefits of internal capital allocation are most likely to exceed its costs and concludes that this is precisely when credit constraints are binding, which forces individual projects within the firm to compete for the scarce funding and increases headquarters' incentives to choose the most deserving projects.

Whether internal capital allocation makes conglomerates more or less valuable than focused firms depends on the efficiency of such allocation relative to that provided by external capital markets. For instance, Khanna and Palepu (2000) and Fauver et al. (2004) find that international differences in the value of diversification are related to the degree of development of external capital markets. Hubbard and Palia (1999) offer a similar explanation for the different market responses to diversifying acquisitions in the 1960s versus later decades. It is therefore conceivable that, by making external financing more costly or even unavailable, the crisis might have increased the relative value of internal capital markets and thereby the value of corporate diversification. Naturally, the two effects described before are not mutually exclusive and may have complemented each other in making diversification more valuable.

We examine a panel of firms from the first quarter of 2005 through the last quarter of 2009 and find that the diversification discount as measured through ordinary least squares (OLS) regressions declined by a statistically and economically significant amount—to half of its precrisis size during the early phase of the crisis (2007Q3–2008Q3) and even further to almost a third of its size during the later phase (2008Q4–2009Q1). After correcting for the endogeneity of the diversification decision, the precrisis discount disappears and turns into a premium during and after the crisis. We also find that both of the channels described above contributed to the change in the value of corporate diversification. Consistent with the more-money effect, we find a significant increase in conglomerates' leverage relative to comparable portfolios of focused firms and to the precrisis period. Consistent with the smarter-money effect, we find that the efficiency of internal capital markets significantly increased during the crisis. The evidence that both channels played a role suggests that the change in the value of diversification triggered by the financial crisis reflects real differences in corporate finance and investment as opposed to a faddish change in investor sentiment.

We also analyze how our results are affected by other firm characteristics that have been found to

play a significant role during the crisis: cash holdings, credit ratings, and debt maturity structure. Conglomerates had significantly lower cash ratios than their single-segment peers throughout the entire sample period but had ex ante financing advantages in that they were more likely to have (better) credit ratings and less likely to have a substantial fraction of their long-term debt maturing in the two quarters following Lehman Brothers' bankruptcy. Our results show that each of these features interacted with firms' diversification status to create significant heterogeneity in the value of diversification across firms, but in different ways. We find that, during the financial crisis, diversification was particularly valuable to those firms that were more financially constrained in the sense of having low cash or a high fraction of their debt maturing in 2008Q3–2008Q4. However, we find no similar substitution effect for credit ratings.

Our paper makes several contributions. First, it adds to our understanding of the real effects of the 2007–2009 financial crisis. Several studies have found significant decreases in corporate investment resulting from the crisis (Almeida et al. 2012; Campello et al. 2010, 2011; Duchin et al. 2010; Gao and Yun 2009; Ivashina and Scharfstein 2010b). However, none of these studies has examined how the real effects of the crisis differed between conglomerates and single-segment firms. In this respect, our findings complement those of this group of studies and can thus be of interest not only to academics but also to corporate managers, investors, and regulators. Second, we bring new evidence to bear on the debate about the value of corporate diversification and internal capital markets. Earlier research suggests that there are benefits and costs to diversification (including, but not limited to, those of internal capital markets), with the average net effect being largely an empirical question. The answer to this question has proven to be highly contingent on the time period, geographic location, data, and statistical methods used (Villalonga 2003). It may thus be more useful, as Stein (2003) advocates, to pay more attention to the variance in the diversification discount or premium than to its mean value. Looking at the longitudinal variance in the discount around a financial and economic crisis such as the 2007–2009 one is particularly interesting in that it allows us to analyze the insurance role that diversification can play for investors. Three earlier studies have looked at changes in diversified firms' investment behavior over the business cycle: Dimitrov and Tice (2006), Hund et al. (2010), and Hovakimian (2011). However, none of these studies has examined the repercussion of these changes on the value of diversification in the way we do in this paper.

The only other study we are aware of that looks at the impact of the financial crisis on diversification and internal capital markets is Matvos and Seru (2014). Using out-of-sample simulated data, they estimate a structural model of internal capital markets to identify the drivers of resource reallocation decisions triggered by dislocations in external capital markets. Consistent with our findings, they show that internal resource allocation helped conglomerates offset financial market stress during the recent financial crisis. Their findings particularly reinforce the results in this paper about the role played by the smarter-money channel in increasing the value of diversification during the crisis; they show that capital expenditures in diversified firms became relatively more sensitive to productivity and that this sensitivity was higher in conglomerates with greater diversity in productivity across their segments.

Our longitudinal approach to the study of corporate diversification also yields stronger evidence in support of the more-money channel—Lewellen's (1971) debt coinsurance theory—than earlier studies have found (if they found any at all). As suggested by our arguments above, we believe that this theory is better tested in an out-of-equilibrium context than in steady-state situations where both conglomerates and focused firms are likely to be operating at their optimal (target) leverage levels. The financial crisis of 2007–2009 provoked a major disruption in such equilibrium, which allows us to uncover new empirical support for the theory.

The rest of this paper is organized as follows. Section 2 describes our sample and measures. Sections 3 and 4 present the results of our empirical analysis of whether and why, respectively, diversification became more valuable during the crisis. Section 5 concludes.

2. Data and Variables

2.1. Data and Sample

Our sample consists of those firms that reported segment data on Compustat's Industry Segment database for the last fiscal year ending before March 31, 2005.[2] We track these firms' quarterly performance until December 31, 2009, or until they are delisted, if that happens earlier. Following Berger and Ofek (1995), we restrict the sample to those firms for which the sum of segment sales was within 1% of the firm's total sales in that year, and that had no financial segments during our sample period. We aggregate all segments

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[2] Villalonga (2004a) shows that using establishment-level data from the U.S. Census Bureau can lead to very different results from those based on Compustat segment data regarding the existence of a diversification discount. Unfortunately, the process of accessing this type of census data can take over a year, and the latest year of data available at this point is 2006, which is incompatible with this paper's goal of analyzing the impact of the 2007–2009 financial crisis on the value of diversification.

Table 1   Descriptive Statistics

	All firms			Mean diversified (1)	Mean single-segment (2)	Difference (1) − (2)	Median diversified (3)	Median single-segment (4)	Difference (3) − (4)
	Mean	Median	Std. dev.						
Market value of firm ($ billion)	3.74	0.34	15.43	8.09	2.51	5.59***	1.19	0.24	0.95***
Total assets ($ billion)	2.48	0.23	9.85	5.41	1.63	3.78***	0.84	0.15	0.69***
Leverage (total debt/assets)	0.20	0.15	0.20	0.23	0.19	0.04***	0.22	0.13	0.10***
Cash and marketable securities/Assets	0.18	0.10	0.19	0.12	0.20	−0.08***	0.07	0.12	−0.06***
Operating income after depreciation/Sales	−1.99	0.01	48.45	−0.17	−2.53	2.37***	0.02	0.01	0.01***
Number of observations	68,724	68,724	68,724	15,303	53,421		15,303	53,421	

Notes. Summary statistics for diversified and single-segment firms in the sample are shown. Diversified firms are those that have two or more segments in different four-digit SIC codes. The sample includes 68,724 firm-quarter observations from Compustat firms that (1) reported segment data for the last fiscal year ending before March 31, 2005; (2) had segment sales whose sum was within 1% of the firm's total sales in that year; and (3) had their fiscal year ending in March, June, September, or December. The tests of differences in means (medians) between diversified and single-segment firms are based on univariate OLS (median) regressions where each firm characteristic is regressed on a diversification dummy, and standard errors are clustered by firm.

    ***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

within a firm that share a common four-digit Standard Industrial Classification (SIC) code (e.g., because the firm in question reports geographical segment data) into a common business segment. To ease the comparison of quarterly financial figures, we further restrict our sample to those firms whose fiscal year ended in March, June, September, or December. These firms represent more than 86% of all firms in Compustat during our sample period. The resulting sample contains 68,724 firm-quarter observations (from 4,370 firms), of which 15,303 observations come from firms that were diversified during that particular quarter, and 53,421 come from single-segment firms.

Table 1 provides descriptive statistics for the sample. As can be expected, diversified firms are significantly larger than single-segment firms in their book and market value of assets. They also have significantly higher leverage and operating profits and lower cash holdings relative to their asset size.[3]

2.2.   Empirical Strategy and Measures

Our main empirical approach consists of regressions of a dependent variable on diversification, a measure of the crisis, and the interaction between the two, along with a number of control variables. We use three different dependent variables that have been introduced in prior studies, which we adapt for these measures as required by the quarterly frequency of our data; namely, we use quarterly data when they are available, which is for those components of the measures that are at the firm level.[4]

2.2.1.   Excess Values. Following Berger and Ofek (1995), we compute excess values for both diversified and single-segment firms in each quarter as the natural logarithm of the ratio between a firm's market value and its imputed value at the end of the quarter. A firm's imputed value is the sum of its segments' imputed values, which are obtained by multiplying the segment's most recent annual sales or assets by the median market-to-sales or market-to-assets multiplier of single-segment firms in the same industry. The industry matching is carried out using the narrowest SIC grouping that includes at least five single-segment firms. We exclude from the analyses based on asset multipliers those observations for which the sum of operating segment assets for a firm deviates from the firm's total assets by more than 25%. If the sum of segment assets deviates from the firm's total asset base by less than 25%, imputed values are grossed up or down by that percentage deviation.

2.2.2.   Industry-Adjusted Leverage. Industry-adjusted leverage is computed as the difference between a firm's actual leverage and its imputed leverage in each quarter. A firm's imputed leverage is the asset-weighted average of its segments' imputed leverage ratios, which are the product of the segment's most recent annual assets and the median leverage of single-segment firms in the same industry and quarter. In our leverage regressions, the leverage ratio of single-segment firms in the industry is defined as gross book leverage, which is the ratio of total debt to total book assets at the end of each quarter. In our univariate analyses, however, we also report industry-adjusted leverage ratios using three alternative measures: gross market leverage, net book leverage, and

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[3] For consistency with our analyses of leverage and cash, the summary statistics we report in Table 1 for these two variables exclude outliers (observations that are more than two standard deviations away from the mean).

[4] The components that are at the segment level need to be measured at the end of the last fiscal year, since there are no quarterly segment data available for them. In all of our regressions, we also exclude from the analysis those firm-quarter observations for

which the dependent variable falls more than two standard deviations away from the mean and can therefore be considered outliers. For consistency, we also exclude these outliers from our univariate analyses of the same variables.

net market leverage, as well as industry-adjusted cash ratios. Like Berger and Ofek (1995), if either the imputed gross leverage or cash ratios or the resulting industry-adjusted measures are greater than 1, we truncate them to 1.

2.2.3. Absolute Value Added by Internal Capital Allocation. Following Rajan et al. (2000), the measure of absolute value added by internal capital allocation (*AVA*) is computed as the asset-weighted sum across each firm's segments of the product of the segment's industry-adjusted investment rate by the difference between the median market-to-assets ratio of single-segment firms in the same industry and the number one. The investment rate of a segment is the ratio of the segment's capital expenditures to its total assets at the end of the last fiscal year. This ratio is adjusted by subtracting the average investment rate of single-segment firms in the same industry and year. The market-to-assets ratio of single-segment firms is measured at the end of each quarter.

2.2.4. Diversification. Following prior studies of the diversification discount, we measure diversification by a dummy, *Diversified*, which equals 1 if the firm reported two or more business segments in different four-digit SIC codes at the end of its last fiscal year. In some analyses, we split diversified firms into two: *Unrelated Diversified* (those that reported two or more business segments in different two-digit SIC codes at the end of their last fiscal year) and *Related Diversified* (all others).

2.2.5. Crisis Period Measures. In this paper, we measure the crisis period in four alternative ways. First, we use a set of dummy variables to divide our sample period into four distinct subperiods: *Early Crisis* (2007Q3–2008Q3), *Late Crisis* (2008Q4–2009Q1), and *Postcrisis* (2009Q2–2009Q4); the precrisis period of 2005Q1–2007Q2 thus serves as the baseline category. Our division of the actual crisis period into two distinct phases follows the approach and the cutoff date used in recent studies, such as Almeida et al. (2012) and Duchin et al. (2010), of the real effects of the financial crisis.[5]

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[5] The rationale for the division is that, during the later stage of the crisis, it is difficult to discern the extent to which changes in firms' investment behavior are attributable to changes in external financing versus a response to changes in investment opportunities. (Even though the financial crisis as such peaked during 2008Q4 and 2009Q1 (Ivashina and Scharfstein 2010a, Kahle and Stulz 2013), by then, the crisis had spilled over to the demand side.) On the other hand, any changes in investment behavior and outcomes observed during the earlier phase of the crisis can more confidently be attributed to the exogenous shock in external financing, which is what makes the recent crisis a particularly interesting research laboratory for studying the real effects of financial contracting.

We also use three different continuous variables as alternative measures of the intensity of the crisis: the *TED spread* (difference between the three-month London Interbank Offered Rate (LIBOR) and the yield on three-month treasury bills), the spread of three-month commercial paper over treasury bills of the same maturity, and the Chicago Board Options Exchange Volatility Index (*VIX*). As shown, for example, in Almeida et al. (2012), the TED and commercial paper spreads series are highly correlated during this period and yield very similar results for our analyses. Thus, we only report the results based on the commercial paper spread for our first (and main) analysis. For all subsequent analyses, we report only the results based on the three other measures (crisis period dummies, TED spread, and VIX).

2.2.6. Control Variables. In addition to our measures of diversification, the crisis, and the interaction between them, our excess value and *AVA* regressions include the following control variables: the ratio of cash and marketable securities relative to the book value of assets; leverage (measured as total debt (short-term plus long-term) relative to the book value of assets); a dummy indicating whether the firm paid dividends; cash flow volatility (measured as the standard deviation of the ratio of operating income after depreciation to assets over the four quarters ending in 2007Q2); CAPEX/sales; operating income after depreciation/sales; log of total assets; and a set of dummy variables indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline category). Our industry-adjusted leverage regressions also use these control variables, with the exception of leverage (which is now built into the dependent variable) and with the addition of two dummy variables to indicate whether the firm's credit rating in any given quarter was investment grade (S&P ratings of AAA to BBB−) or speculative grade (BB+ to selective default), with ungraded firms serving as the baseline category.

All these variables are at the firm level and are measured at the end of the same fiscal quarter as the dependent variable, when available, or else at the end of the last fiscal year. The exception is cash flow volatility, which we measure prior to the beginning of the crisis because a contemporaneous measure can be considered as an outcome of diversification itself, rather than as a control variable.

3. Did the Value of Diversification Increase During the 2007–2009 Financial Crisis?

Figure 2 shows the evolution of the discount at which diversified firms traded relative to single-segment firms during our sample period. The underlying data—the mean excess values of diversified and

single-segment firms and the difference between them in each quarter—are reported in Table A.1 of the online appendix (available as supplemental material at http://dx.doi.org/10.1287/mnsc.2015.2165). The discount or premium at which diversified firms trade relative to single-segment firms is thus computed as the difference in mean excess values between the two groups of firms.

Panels A and B of Figure 2 show results based on sales and asset multipliers, respectively. Both panels show a marked increase in the excess value of diversified firms relative to single-segment firms during the crisis period of 2007Q3–2009Q1, at which point the trend begins to revert to precrisis levels. When excess values are computed using sales multipliers, diversified firms trade at a discount during the entire sample period. The discount ranges between −24.7% in 2006Q2 and −10.3% in 2008Q2 (see Table A.1, panel A). The spike is more pronounced when excess values are computed using asset multipliers, with the discount disappearing altogether (0.1%) in 2008Q4, the peak period of the crisis (see Table A.1, panel B).[6] In the remainder of the paper, we report only the results based on sales multipliers and relegate the asset-based results to the online appendix as a robustness check.

Figure 2 and Table A.1 provide prima facie evidence that diversified firms increased in value relative to single-segment firms during the financial crisis. In the remainder of this section, we estimate more precisely the size and significance of this increase, and we investigate whether it can indeed be attributed to diversification or is due to other factors.

3.1. Impact of the Crisis on the Value of Diversification: Multivariate OLS Regressions
Table 2 shows the results of ordinary least squares (OLS) regressions of sales-based excess value on diversification, a measure of the crisis, and the interaction between the two, along with our set of control variables. Each of the four columns in Table 2

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[6] Table A.1 also shows that the average discount over the entire sample period of 2005Q1–2009Q4 is −19.2% (−13.2%) when measured using sales (asset) multipliers. The sales-based discount is considerably larger than what Berger and Ofek (1995) report for the period 1986–1991 (10% for sales and 12% for assets). The main reason for this discrepancy is that, unlike Berger and Ofek, we do not require our sample firms to have minimum sales of $20 million. Imposing this condition on our sample reduces our estimated discount by over a half, i.e., below Berger and Ofek's estimates. This lower discount is consistent with other studies' finding of a decrease in the raw diversification discount during the 1990s (e.g., Campa and Kedia 2002, Graham et al. 2002), and it suggests that much of the so-called diversification discount is in fact attributable to size. Despite the loss in comparability to earlier studies, we do not impose the $20 million sales threshold on our sample because such a condition biases the sample so that diversified firms' segments are smaller than the stand-alone segments to which there are matched.

shows results based on a different measure of the crisis: the set of crisis period dummies, the TED spread, the commercial paper spread, and VIX. As can be expected from Figure 2, the coefficient of *Diversified* is negative and significant in all four regressions. Yet after controlling for other factors that influence excess values through a multivariate regression, the discount is reduced in size relative to the univariate statistics reported in Table A.1: it now ranges between −14% and −17%, depending on the measure of the crisis used in the regression.

The effect of the crisis by itself on excess values also depends on how the crisis is measured: relative to the precrisis period, excess values *for all firms* are significantly lower during the early crisis period (2007Q3–2008Q3) by six percentage points, during the late crisis period (2008Q4–2009Q1) by eight percentage points, and especially after the crisis—by 30 percentage points. Table A.1 helps us to understand what is driving these results: during the crisis, diversified firms' excess values increase while single-segment firms' excess values decrease. As soon as the crisis is over, however, there is a sharp decrease in excess values for both groups of firms. The combination of both trends accounts for the decrease in the discount—the difference in excess values between diversified and single-segment firms—during the crisis and for the subsequent increase shown in Figure 2. But it also accounts for the decrease in excess values during the crisis implied by our regression coefficients in Table 2: these excess values are essentially an unweighted average across all firms in the sample, in which single-segment firms outnumber diversified firms by a factor of approximately 3.5 (53,421/15,303). The decrease in excess values of single-segment firms during the crisis is therefore what is driving the decrease for the sample as a whole. Excess values for all firms are also significantly lower when the intensity of the crisis is measured by VIX but not when it is measured by the TED or commercial paper spreads.

In contrast to the effect on excess values of the crisis per se, the effect of interest to us—the interaction between diversification and the crisis—is positive and statistically significant in all four regressions, i.e., regardless of how the crisis is measured. The first column of Table 2 shows that the coefficients of *Diversified × Early Crisis* and *Diversified × Late Crisis* are 0.07 and 0.09, respectively, indicating that the discount at which diversified firms traded relative to single-segment firms during the precrisis period was reduced by seven percentage points during the purely financial crisis period and even further (by an additional two percentage points) once the crisis spilled over to the demand side of the economy. The second and third columns show that the *Diversified × Credit Spread* coefficient is 0.05 for the TED spread

Table 2   Impact of the Crisis on the Value of Diversification: OLS Regressions

|	Crisis period dummies	TED spread	Commercial paper spread	VIX
Diversified	−0.14***	−0.15***	−0.14***	−0.17***
	(−4.14)	(−4.61)	(−4.42)	(−4.03)
Early Crisis	−0.06***			
	(−4.37)			
Late Crisis	−0.08***			
	(−3.82)			
Postcrisis	−0.30***			
	(−11.54)			
Diversified × Early Crisis	0.07**			
	(2.45)			
Diversified × Late Crisis	0.09**			
	(2.34)			
Diversified × Postcrisis	0.03			
	(0.89)			
Credit spread or VIX		0.01	0.02	−4.E−3***
		(0.90)	(1.55)	(−5.30)
Diversified × Credit Spread or VIX		0.05***	0.08***	3.E−3**
		(3.43)	(2.99)	(2.34)
Cash and Marketable Securities/Assets	1.03***	1.01***	1.01***	1.00***
	(16.07)	(15.80)	(15.81)	(15.74)
Leverage	0.55***	0.55***	0.55***	0.56***
	(9.57)	(9.57)	(9.58)	(9.62)
Dividends Paid	0.06**	−0.02	−0.02	−0.02
	(2.36)	(−0.80)	(−0.72)	(−0.75)
Cash-Flow Volatility	0.03**	0.03**	0.03**	0.03**
	(2.08)	(2.14)	(2.14)	(2.09)
CAPX/Sales	8.E−5	−1.E−5	−1.E−5	−1.E−5
	(1.20)	(−0.17)	(−0.15)	(−0.18)
OIAD/Sales	−3.E−3***	−3.E−3***	−3.E−3***	−3.E−3***
	(−3.61)	(−3.57)	(−3.57)	(−3.62)
Log Assets	0.02***	0.03***	0.03***	0.03***
	(3.43)	(3.72)	(3.71)	(3.82)
Constant	−0.50***	−0.55***	−0.55***	−0.47***
	(−6.99)	(−7.59)	(−7.65)	(−6.40)
N	42,326	42,326	42,326	42,326
Adjusted R^2	0.10	0.09	0.09	0.09

Notes. Multivariate OLS regressions of excess value on the interaction of a diversification dummy with various measures of the crisis are shown. The first model includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The remaining three models use credit spreads or VIX as continuous measures of the intensity of the crisis. The TED spread (commercial paper spread) is the difference between the three-month LIBOR (nonfinancial commercial paper yield) and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. Excess value is the natural logarithm of the ratio of a firm's market value to its imputed value. A firm's imputed value is the sum of its segments' imputed values, which are the product of the segment's most recent annual sales and the median market-to-sales ratio of single-segment firms in the same industry. Market-to-sales is the ratio of the firm's market value at the end of each quarter to its total sales during the last four quarters. All models also include dummies indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses. OIAD refers to operating income after depreciation.
   ***Statistically significant at the 1% level; **statistically significant at the 5% level; , *statistically significant at the 10% level.

or 0.08 for the commercial paper spread, indicating that a one-percentage-point increase in these spreads was associated with a reduction in the diversification discount of five and eight percentage points, respectively. The fourth column shows a 0.003 coefficient for the interaction term *Diversified × VIX*, indicating that a 10-point increase in the index (which ranged between 9.89 and 80.86 during our sample period) was associated with a three-percentage-point

reduction in the diversification discount. Table A.2 in the online appendix shows that the results in Table 2 are robust, when not stronger, to using asset multipliers in lieu of sales multipliers to compute excess values.

These results are significant not just statistically but also economically. The observed diversification discount is reduced to a half of its precrisis size during the early phase of the crisis and even further,

Figure 1   Evolution of the TED Spread and VIX from January 2005 Until June 2009
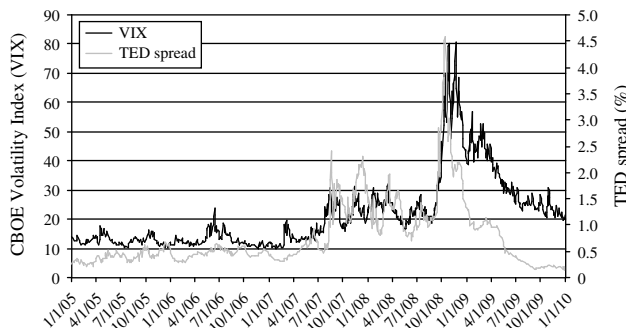

Notes. The TED spread is the difference between three-month LIBOR and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange (CBOE) Volatility Index.

to almost a third of its size, during the later phase, 2008Q4–2009Q1. As shown in Figure 1, both the TED and VIX reached historically high levels after the Lehman Brothers collapse. Specifically, the TED spread reached a maximum of 4.58% on October 13, 2008, and VIX reached its 80.86 maximum on November 20, 2008. These figures are 3.79 percentage points and 59.40 points higher than the sample-period averages of 0.78% and 21.46, respectively. The TED spread maximum would imply a 21-percentage-point reduction on the diversification discount on the date the maximum was reached, or a net diversification premium of 6%, given the baseline discount of −15% implied by the *Diversified* coefficient of −0.15 in the TED spread regression. Likewise, the VIX maximum would imply a 19-percentage-point reduction on the diversification discount on date the maximum was reached, or a net diversification premium of 2%, given the baseline discount of −17% implied by the VIX regression.

The results in Table 2 suggest that the value of diversification significantly increased during the crisis. It is possible, however, that the value increase of diversification may differ across different types of firms or that it may be driven by confounding factors that are correlated with being diversified, beyond those that we have included as control variables in our multivariate regressions. We examine these possibilities in the remainder of this section.

3.2.   Impact of the Crisis on the Value of Related and Unrelated Diversification

In this subsection we examine how the value increase of diversification during the crisis varied across related and unrelated diversified firms. We can think about the relatedness among a diversified firm's segments as a proxy for either quantity or quality of the firm's diversification strategy. Pure conglomerates, i.e., unrelated diversifiers, are more diversified

Figure 2   (Color online) Discount of Diversified Firms Relative to Single-Segment Firms
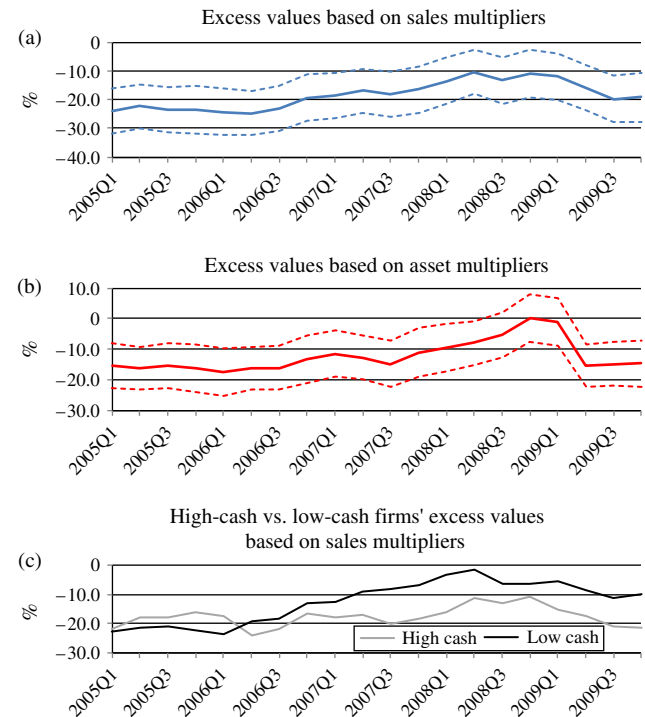
Notes. Shown is the difference in mean excess values between diversified and single-segment firms in each quarter. The discontinuous lines in panels A and B show 95% confidence intervals around the mean obtained from quarterly regressions of excess value on a diversification dummy. Diversified firms are those that have two or more segments in different four-digit SIC codes. Excess value is the natural logarithm of the ratio of a firm's market value to its imputed value. A firm's imputed value is the sum of its segments' imputed values, which are the product of the segment's most recent annual sales (assets) and the median market-to-sales (assets) ratio of single-segment firms in the same industry. Market-to-sales (assets) is the ratio of the firm's market value at the end of each quarter to its total sales during the last four quarters (total assets at the end of the last fiscal year). Firms are classified as high- or low-cash based on whether they are above or below the median ratio of cash and marketable securities to assets as of 2007Q2 (before the financial crisis started). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005.

(or better so) than related diversifiers in that their businesses are more different from one another—in SIC codes, investment opportunities, cash flows, etc. Thus, if our finding that diversified firms increased in value relative to single-segment firms during the crisis is indeed attributable to diversification, we would expect to see a greater effect of the crisis on the value of conglomerates than on the value of related diversified firms.

More fundamentally, both of the theoretical explanations for such an increase that we advance in the introduction and test later in the paper are more likely to apply to pure conglomerates than to related diversifiers. First, conglomerates are likely to provide greater debt coinsurance than related diversifiers

Table 3   Impact of the Crisis on the Value of Related and Unrelated Diversification

	Crisis period dummies	TED spread	VIX
Unrelated Diversified	−0.15*** (−4.02)	−0.16*** (−4.35)	−0.19*** (−4.02)
Related Diversified	−0.12** (−2.00)	−0.14** (−2.45)	−0.14* (−1.80)
Early Crisis	−0.06*** (−4.37)		
Late Crisis	−0.08*** (−3.82)		
Postcrisis	−0.30*** (−11.54)		
Unrelated Diversified × Early Crisis	0.07** (2.21)		
Unrelated Diversified × Late Crisis	0.10** (2.42)		
Unrelated Diversified × Postcrisis	0.04 (1.03)		
Related Diversified × Early Crisis	0.07 (1.37)		
Related Diversified × Late Crisis	0.05 (0.85)		
Related Diversified × Postcrisis	0.01 (0.17)		
TED Spread or VIX		0.01 (0.90)	−4.E−3*** (−5.30)
Unrelated Diversified × TED Spread or VIX		0.05*** (2.98)	4.E−3** (2.38)
Related Diversified × TED Spread or VIX		0.06** (2.19)	2.E−3 (0.95)
Controls from prior models	Yes	Yes	Yes
N	42,326	42,326	42,326
Adjusted R^2	0.10	0.09	0.09

Notes. Shown are multivariate OLS regressions of excess value on the interaction of related and unrelated diversification dummies with various measures of the crisis. Diversified firms are those that have two or more segments in different four-digit SIC codes; unrelated diversified are firms that have two or more segments in different two-digit SIC codes, the remaining diversified firms are related diversified. The first model includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The remaining models use TED spreads or VIX as continuous measures of the intensity of the crisis. The TED spread is the difference between the three-month LIBOR and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. Excess value is the natural logarithm of the ratio of a firm's market value to its imputed value. A firm's imputed value is the sum of its segments' imputed values, which are the product of the segment's most recent annual sales and the median market-to-sales ratio of single-segment firms in the same industry. Market-to-sales is the ratio of the firm's market value at the end of each quarter to its total sales during the last four quarters. The control variables are cash and marketable securities/assets; leverage; a dummy indicating whether the firm paid dividends; cash flow volatility (measured as the standard deviation of operating income after depreciation/assets over the four quarters ending in 2007Q2); CAPEX/sales; operating income after depreciation/sales; log of total assets; and a set of dummy variables indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline category). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses.

***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

because the correlation among segment cash flows should increase with the degree of relatedness among them. Second, internal capital markets theories and evidence also suggest that both the benefits and the costs of internal capital allocation increase with diversity in segments' cash flow and/or investment opportunities (Rajan et al. 2000, Duchin 2010). Since we expect the benefits of internal capital allocation to exceed its costs in the presence of external financing constraints, we expect the effect of the crisis to be greater for conglomerates than for related diversifiers for this reason as well.

Table 3 reports selected coefficients from OLS regressions similar to those in Table 2, but instead of one diversification dummy we have two, *Unrelated Diversified* and *Related Diversified*, each of which is interacted with each of our alternative measures of the crisis. All regressions include the same control variables as before, but for the sake of parsimony, we only report the coefficients of the diversification dummies, the crisis, and their interactions. As before, the first column of Table 3 shows the results of a model where the crisis is measured using period dummies. Although all interaction terms have a positive sign, only the interactions of the two phases of the crisis

with unrelated diversification are statistically significant. None of the interactions with related diversification is significant. Likewise, when VIX is used to proxy for the intensity of the crisis, only its interaction with unrelated diversification is significant. The only one of the three models where the interaction between the crisis and both related and unrelated diversification is statistically significant is the one based on the TED spread. Overall, the results seem consistent with our priors about conglomerates driving the results in Table 2 and support the view that these results are attributable to diversification. They are also consistent with Matvos and Seru's (2014) finding that conglomerates' sensitivity of investment to productivity during the crisis increases with the diversity in productivity across their segments.

3.3. Impact of Cash Reserves on the Value of Diversification During the Crisis

In this subsection we analyze how the value increase of diversification during the crisis varied with firms' cash reserves. The gist of this paper is that diversification may have become more valuable during the global financial crisis because being diversified can help firms attenuate the external financing constraints

that affected them as well as their focused peers. If diversified firms happen to be less financially constrained ex ante for reasons other than diversification itself, however, our inferences could be confounded. We note that our regressions include several control variables to mitigate this concern: cash reserves, leverage, and the dividend dummy. Nevertheless, some of these variables may interact with diversification itself in one direction or another, creating heterogeneity in the value of diversification across the sample. On the one hand, if diversified firms' lower financing constraints were driving our results, we would expect less constrained diversified firms to have higher excess values (a complementarity effect). On the other hand, the value of diversification may depend on whether or not firms have other means to ride out the liquidity or credit crunch, so that we might expect the more financially constrained diversified firms to have higher excess values (a substitution effect).

In the case of cash reserves, we know from Duchin (2010) that diversified firms have significantly lower cash ratios than single-segment firms, a fact that Table 1 shows is also true for our sample. Thus, one cannot argue that diversified firms had an ex ante advantage in that regard. Yet the substitution hypothesis may be at play; namely, diversification is likely to be less valuable for firms that have substantial cash reserves than for those firms that are cash-strapped.

Panel C of Figure 2 shows the evolution of the discount of diversified relative to single-segment firms after splitting the sample into high- and low-cash firms. Firms are classified as "high-cash" or "low-cash" based on whether they were above or below the median ratio of cash and marketable securities to assets in 2007Q2, before the financial crisis started. The underlying data for panel C are reported in Table A.1, as they are for the rest of Figure 2. Both the figure and the summary statistics in Table A.1 show that, prior to the crisis, the discount was very comparable in size across high-cash and low-cash firms; in fact, diversification was relatively more valuable for high-cash firms until 2006Q2, when it started to be more valuable for low-cash firms. The difference in the value of diversification across the two subsamples became noticeably wider after the financial crisis broke out in 2007Q3, which is consistent with our hypothesized impact of cash on the value of diversification during the crisis.

To analyze the role played by cash in a more rigorous way, we estimate regression models similar to those in Table 2 but where we also include our measure of firms' cash reserves at the outset of the crisis (the cash ratio in 2007Q2) and interact it with diversification, our crisis measures, and the interaction of diversification with the crisis measures. Table 4

reports selected coefficients from these regressions for our three alternative measures of the crisis. Of particular interest are the triple-interaction terms. Consistent with the pattern shown in Figure 2, all such coefficients have a negative sign, suggesting that the value increase of diversification during the crisis was indeed attenuated by firms' cash reserves. The statistical significance of the coefficients varies, however: it is significant for the late crisis period dummy, the postcrisis period dummy, and VIX, but it is nonsignificant for the early crisis period dummy or the TED spread. The interaction of diversification with the crisis (and without cash) remains significant across all models and all measures of the crisis, and even in the postcrisis period.

3.4. Impact of Credit Ratings on the Value of Diversification During the Crisis

The role of credit ratings in our results seems particularly important to ascertain for at least two reasons. First, the high-yield bond market closed down more completely than the investment-grade bond market during the financial crisis. Second, during our sample period, diversified firms were significantly more likely than single-segment firms to have (higher) credit ratings: Table A.3 in the online appendix shows that 21.3% (19.5%) of the diversified firms in our sample have investment-grade (speculative-grade) debt compared with 7.8% (11.2%) of single-segment firms. Regardless of whether the superior credit ratings of diversified firms are attributable to diversification (for instance, because of the debt coinsurance they provide) or to the fact that they are larger and more established firms, it could be that the relative value increase experienced by these firms during the crisis might be explained, in whole or in part, by the financing advantage that their superior credit ratings gave them. In that case, we would expect the positive interaction coefficients of Table 2 to be driven by the firms with (higher) ratings—the complementarity hypothesis. On the other hand, to the extent that credit ratings measure financial constraints, one might expect diversification to be more valuable to the most constrained firms, i.e., those with lower or no ratings—the substitution hypothesis.

To test these alternative hypotheses about the role of credit ratings in our results, we estimate regression models similar to the previous ones where we divide each of the diversified and single-segment groups of firms into three categories based on their credit ratings—investment grade, speculative grade, or unrated. Unrated single-segment firms serve as the baseline category, and each of the other five categories is captured by a dummy variable.

Panel A of Table 5 shows the estimated coefficients for each of these five dummy variables. The results

Table 4   **Impact of Cash Reserves on the Value of Diversification During the Crisis**

	Crisis period dummies	TED spread	VIX
Diversified	−0.24*** (−5.44)	−0.22*** (−5.27)	−0.30*** (−5.65)
Cash Reserves	0.92*** (11.83)	0.95*** (12.32)	0.93*** (9.13)
Diversified × Cash Reserves	0.56*** (2.84)	0.43** (2.35)	0.80*** (3.10)
Early Crisis	−0.11*** (−5.64)		
Late Crisis	−0.09*** (−3.57)		
Postcrisis	−0.36*** (−11.63)		
Diversified × Early Crisis	0.12*** (3.49)		
Early Crisis × Cash Reserves	0.07 (1.01)		
Diversified × Early Crisis × Cash	−0.25 (−1.19)		
Diversified × Late Crisis	0.18*** (3.83)		
Late Crisis × Cash Reserves	−0.05 (−0.55)		
Diversified × Late Crisis × Cash	−0.62** (−2.39)		
Diversified × Postcrisis	0.14*** (2.94)		
Postcrisis × Cash Reserves	0.14 (1.46)		
Diversified × Postcrisis × Cash	−0.54** (−2.07)		
Credit Spread		0.00 (-0.15)	−0.01*** (−5.36)
Diversified × TED Spread or VIX		0.07*** (3.54)	0.01*** (4.01)
TED Spread or VIX × Cash Reserves		−0.03 (−0.61)	7.E−5 (0.02)
Diversified × Credit Spread or VIX × Cash		−0.11 (−0.90)	−0.02** (−2.27)
Controls from prior models	Yes	Yes	Yes
N	42,310	42,310	42,310
Adjusted R^2	0.10	0.09	0.09

Notes. Shown are multivariate OLS regressions of excess value on interactions of a diversification dummy, cash reserves, and various measures of the crisis. The first model includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The remaining models use TED spreads or VIX as continuous measures of the intensity of the crisis. The TED spread is the difference between the three-month LIBOR and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. Excess value is the natural logarithm of the ratio of a firm's market value to its imputed value. A firm's imputed value is the sum of its segments' imputed values, which are the product of the segment's most recent annual sales and the median market-to-sales ratio of single-segment firms in the same industry. Market-to-sales is the ratio of the firm's market value at the end of each quarter to its total sales during the last four quarters. Cash reserves are measured by the ratio of cash and marketable securities to assets as of 2007Q2 (before the financial crisis started). The control variables are cash and marketable securities/assets; leverage; a dummy indicating whether the firm paid dividends; cash flow volatility (measured as the standard deviation of operating income after depreciation/assets over the four quarters ending in 2007Q2); CAPEX/sales; operating income after depreciation/sales; log of total assets; and a set of dummy variables indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline category). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses.

***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

suggest that part, but not all, of the increase in the relative value of diversified firms during the financial crisis can be attributed to their superior credit ratings. Firms with investment-grade debt saw a statistically significant increase in excess values during and after the crisis regardless of whether they were diversified and regardless of how the crisis is measured. The exception is the category of single-segment firms during the early phase of the crisis, for which the increase was not significant. Still, the coefficients for diversified firms are about twice the size of those for single-segment firms. Moreover, the effects of credit ratings are nonmonotonic across the ordinal categories of investment grade, speculative grade, and unrated: the positive effect of the crisis on the relative value of diversified firms is more frequently significant and often higher for unrated diversified firms than it is for diversified firms with speculative-grade debt. This result could be interpreted as evidence that diversification was more valuable to firms that were more financially constrained as reflected by

their lack of credit ratings, but the fact that diversification was most valuable to firms with investment-grade debt challenges this interpretation. Altogether, it seems that our results cannot be easily explained by credit ratings.

3.5. Impact of Debt Maturity Structure on the Value of Diversification During the Crisis

In their study of the real effects of the financial crisis, Almeida et al. (2012) find that firms that had more than 20% of their long-term debt maturing in the four months following Lehman Brothers' bankruptcy reduced their investment significantly more than other firms. Table A.3 shows that diversified firms had an additional ex ante financing advantage over single-segment firms in that, by choice or by accident, they were less likely to have a substantial fraction of their long-term debt maturing in the two quarters following Lehman Brothers' bankruptcy (2008Q3–2008Q4). In light of these facts and of the findings of Almeida et al., we also examine the role played by firms' debt maturity structures in our results.

Table 5   Impact of the Financial Crisis on the Value of Diversification for Firms with Different Credit Ratings or Debt Maturity Structures

	Crisis period dummies			TED spread	VIX
	Early Crisis	*Late Crisis*	*Postcrisis*		
	Panel A: Credit rating				
Single segment and speculative grade	0.05	0.09*	−0.05	0.07***	3.E–3
	(1.39)	(1.95)	(−0.97)	(3.19)	(1.41)
Single segment and investment grade	0.06	0.16***	0.15***	0.04*	5.E–3***
	(1.40)	(3.09)	(2.80)	(1.84)	(2.72)
Diversified and unrated	0.08**	0.05	0.00	0.06***	2.E–3
	(2.04)	(0.98)	(−0.04)	(2.90)	(1.20)
Diversified and speculative grade	0.04	0.08	0.01	0.05*	3.E–3
	(0.87)	(1.32)	(0.19)	(1.73)	(1.16)
Diversified and investment grade	0.11**	0.29***	0.18***	0.09***	9.E–3***
	(2.37)	(5.67)	(2.99)	(3.71)	(4.55)
	Panel B: Debt maturity				
Single segment with high debt maturity	−0.02	−0.07	0.09	−0.06**	−2.E–3
	(−0.56)	(−1.19)	(1.49)	(−2.24)	(−0.77)
Diversified with high debt maturity	0.17**	0.12	0.19*	0.06	6.E–3
	(2.14)	(1.28)	(1.93)	(1.49)	(1.55)
Diversified with low debt maturity	0.10***	0.17***	0.13***	0.06***	6.E–3***
	(3.16)	(3.86)	(2.80)	(3.41)	(3.85)

Notes. Interaction coefficients from multivariate OLS regressions of excess value on interactions of different categories of firms with various measures of the crisis are shown. Firms in each of the categories indicated in the table are compared with the baseline categories of single-segment firms with single-segment firms with unrated credit (in panel A) or single-segment firms with low debt maturity (in panel B). Firms are considered to have high (low) debt maturity when more (less) than 20% of their long-term debt as of their fiscal year end between 2007Q3 and 2007Q4 was due in one year. Within each panel, the first three columns are from the same regression, which includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The other two models are each from a different regression that uses credit spreads or VIX as continuous measures of the intensity of the crisis. The TED spread (commercial paper spread) is the difference between the three-month LIBOR (nonfinancial commercial paper yield) and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. Excess value is the natural logarithm of the ratio of a firm's market value to its imputed value. A firm's imputed value is the sum of its segments' imputed values, which are the product of the segment's most recent annual sales and the median market-to-sales ratio of single-segment firms in the same industry. Market-to-sales is the ratio of the firm's market value at the end of each quarter to its total sales during the last four quarters. All models also include dummies indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses.

  ***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

To that end, we estimate regression models similar to the ones in Table 3 but where diversified and single-segment firms are divided into categories based on whether the firm had high or low debt maturity. Following Almeida et al. (2012), firms are classified as having high (low) debt maturity when more (less) than 20% of their long-term debt as of their fiscal year end between 2007Q3 and 2007Q4 was due in one year. The coefficients of interest are reported in panel B of Table 5.

This analysis shows that our results cannot be attributed to diversified firms' advantageous debt maturity structure. Rather, we find evidence of a substitution effect similar to the one we find for cash holdings. Other than when the TED spread is used to proxy for the intensity of the crisis, the excess values of single-segment firms with high debt maturity were not significantly lower than those of single-segment firms with low debt maturity (the baseline category), which suggests that maturity by itself did not play a significant role in our results. The interaction of the

"diversified, low maturity" category with the crisis measures is positive and statistically significant across all measures of the crisis and even in the postcrisis period. However, so is the interaction of diversification with high maturity and with the early crisis and postcrisis dummies, and the coefficients are larger in magnitude than those of the low maturity interaction terms. This finding is consistent with the notion that that diversification was all the more valuable to those firms that had a higher exposure to the credit crunch, just as it was for firms that had lower cash reserves to begin with.

3.6.   Controlling for Self-Selection

The analyses we have presented thus far provide evidence that the discount at which diversified firms traded relative to their focused peers was reduced by a significant amount—7% to 9%—during the 2007–2009 financial crisis. As Campa and Kedia (2002) and Villalonga (2004b) have shown, however, one needs

to be wary of interpreting this so-called diversification discount as evidence of a discount to diversification itself, because firms self-select into (or out of) the diversified status.

We use two different types of econometric models to analyze the robustness of our results to self-selection biases. As a preliminary step, we examine the impact of self-selection on the value of diversification during our sample period by estimating a treatment-effects model where the selection equation models firms' propensity to be diversified and the performance equation models the effect of the diversification "treatment" on firms' excess value. The model is similar to those in Campa and Kedia (2002) and Villalonga (2004b), and it is estimated using Heckman's (1979) two-step approach. Heckman's approach requires the application of exclusion restrictions to at least one variable, which is included in the first-stage selection model but can legitimately be excluded from the second-stage regression because it is uncorrelated with the outcome.[7] We apply this exclusion restriction to two variables that have been shown to meet such conditions in prior studies of the diversification discount: the fraction of all firms in an industry that are diversified (Campa and Kedia 2002) and an indicator for whether the firm reports a nonzero amount for minority interest on its balance sheet (Dimitrov and Tice 2006, Hund et al. 2010). In addition, we include the three crisis period dummies and all the control variables from Table 2 as additional predictors of a firm's propensity to be diversified.

The results of this estimation are reported in Online Appendix Table A.4. The key result of interest in this table is that, after correcting for self-selection, the diversification discount disappears. Using sales-based excess values as the second-stage dependent variable, the discount is reduced to 4% and becomes statistically nonsignificant. Using asset-based excess values, the discount, in fact, turns into a positive premium of 7%, although the premium is not statistically significant either. These results imply that diversification did not destroy value prior to the crisis, which is consistent with the findings of Campa and Kedia (2002) and Villalonga (2004b) for earlier periods.

The main focus of our paper, however, is not on whether an overall diversification discount existed or not, but on whether the discount was reduced around the time of the financial crisis. In other words, the coefficients of greatest interest for us in the regressions of Table 2 are not those of the *Diversified* dummy per se but those of its interaction with the various measures of the crisis. These interaction terms are

exogenous to the extent that the financial crisis represented an exogenous shock and that firms had no time during the crisis period to adjust their diversification status in response to the shock (only 47 firms, or 1% of the sample, became diversified between 2007Q2 and 2009Q1, and 31 firms became single-segment during the same period). Still, one could argue that some firms might have diversified in anticipation of a downturn. The lack of significance of the coefficient of the crisis indicators in the probit models of Table A.4 suggests that this was not the case. Nevertheless, to correct for possible selection bias in our estimates of the effect of the financial crisis on the value of diversification, we use a switching regressions approach.

The probit model we use to estimate the selection equation in our switching regression models is the same one as in the treatment-effects models reported in Table A.4. The second stage involves estimating the effect of the financial crisis on excess values through separate regressions for the treatment and control groups (diversified and single-segment firms, respectively). This approach allows for the possibility that the outcome regression coefficients may differ across the two groups (Hamilton and Nickerson 2003, Li and Prabhala 2007). Given that our focus is on an interaction term whose individual components are also included in the regression, we believe it is important to incorporate this flexibility into our models. The effect of the financial crisis on the value of diversification in these switching regression models is given by the difference between diversified and single-segment firms in the marginal effects of the crisis on excess value. The statistical significance of this effect is determined by a Wald test of the difference in coefficients between the two regressions.

Table A.5 of the online appendix reports these coefficients and the differences between them, along with other regression statistics from the second stage of our switching regression models. The dependent variable in these regressions is sales-based excess value. For robustness, we also report results based on asset multipliers in Table A.6 of the online appendix. This table shows that the difference between diversified and single-segment firms in the effects that the crisis had on their excess values is positive and significant across all measures of the crisis, and the effects are practically identical in size to the OLS estimates shown in Table 2. The switching regression coefficients also confirm the univariate results of Table A.1: the decrease in the discount is driven by the decrease in the excess values of single-segment firms, not by the increase in excess values of diversified firms, which is not statistically significant. In fact, as Table A.1 also shows, diversified firms as well experienced a significant decrease in excess values after the

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[7] We obtain similar results to those reported in the online appendix if we use propensity-score matching to estimate our treatment-effects models.

crisis, but the increase for single-segment firms during the same period was even greater. An important difference with the OLS results is that the value increase of diversification now appears to persist beyond the crisis: the *Postcrisis* effect is 11% and is statistically significant.

4. Why Did Diversification Become More Valuable in the 2007–2009 Financial Crisis?

In this section we investigate two possible channels through which diversification may have become intrinsically more valuable during the financial crisis: the more-money effect (debt coinsurance provided by conglomerates) and the smarter-money effect (internal capital allocation becoming more efficient when external financing is constrained).

4.1. The Role of Debt Coinsurance

Table 1 shows that diversified firms have significantly higher leverage than single-segment firms. This seems consistent with Lewellen's (1971) hypothesis that conglomerates have higher debt capacity because the imperfect correlation among their diverse businesses reduces default risk. However, to test Lewellen's hypothesis in a more precise way, diversified firms need to be compared to portfolios of single-segment firms in the same industries. We do this using the industry-adjusted leverage measures described in §2.

Online Appendix Table A.7 reports differences in means between diversified and single-segment firms in various industry-adjusted measures of leverage and cash holdings. The table shows that diversified firms were significantly more leveraged than comparable portfolios of single-segment firms during the entire sample period in terms of net book, gross market, and net market leverage, and that the differences between the two groups of firms became much larger during and after the crisis. In terms of gross book leverage, the differences are only significant since 2008Q4, when the financial crisis peaked and became a generalized economic crisis. The differences between diversified and single-segment firms in their industry-adjusted cash ratios stay relatively constant throughout the period, which suggests that the trends in net leverage are largely driven by the evolution of firms' debt, not cash. Moreover, since these differences are always negative, it is not surprising that the differences in leverage are much larger in net than in gross terms.

Figure 3 shows the evolution of these five measures for diversified and single-segment firms separately, to help us understand what is driving the differences in Table 7. The underlying data for the figure are shown in Table A.8 of the online appendix. The bottom panel of Figure 3 shows that the stability of the industry-adjusted cash ratios reported in Table 7 comes from both the diversified and the single-segment firms. Other than in 2008Q1, both groups of firms were able to maintain a fairly steady industry-adjusted cash ratio throughout the sample period. This result may seem surprising in light of the findings of Ivashina and Scharfstein (2010b) and Kahle and Stulz (2013) that firms significantly increased their cash holdings after Lehman Brothers' bankruptcy. In unreported analysis where we do not adjust for industry, we also find that firms' cash ratios increased after the peak of the financial crisis, although not by much. Our industry-adjusted statistics therefore suggest that firms' industry affiliation may have played an important role in the results reported in these studies.

Figure 3 further shows that the industry-adjusted leverage of single-segment firms also stayed relatively constant regardless of the measure of leverage used. By contrast, the figure shows a marked increase in the industry-adjusted leverage of diversified firms during the crisis. This result is consistent with our hypothesis that, relative to comparable single-segment firms, diversified firms had excess debt capacity that they were able and willing to exploit once credit became rationed in the economy.

To test more formally for the effect of the crisis on the leverage of diversified firms relative to comparable portfolios of single-segment firms, we estimate multivariate regressions similar to those in Tables 2–5 but using industry-adjusted gross book leverage as the dependent variable. The results are reported in Table 6. As before, we only report the coefficients of our variables of interest—diversification, the crisis, and their interaction. We also report the coefficients of the credit rating dummies, which seem particularly important in this analysis.

The interaction coefficients are positive and statistically significant for the late phase of the crisis, the postcrisis period, the TED spread, and VIX. As can be expected from the univariate analysis of industry-adjusted gross book leverage in Table A.7, the *Diversified × Early Crisis* interaction term, although positive, is not statistically significant.

The results are also economically significant. During the late phase of the crisis and even beyond it, diversified firms' gross book leverage was 4% greater than that of comparable single-segment firms, whereas before the crisis, this difference averaged −2% (as given by the diversification coefficient in Table 6). It is also worth noting that these results are not driven by conglomerates' superior credit ratings. In fact, Table 6 shows that whereas having speculative-grade debt increased firms' industry-adjusted leverage by 12%, having an investment-grade rating had no significant effect.

Figure 3   Industry-Adjusted Leverage and Cash Ratios of Diversified Firms and Single-Segment Firms
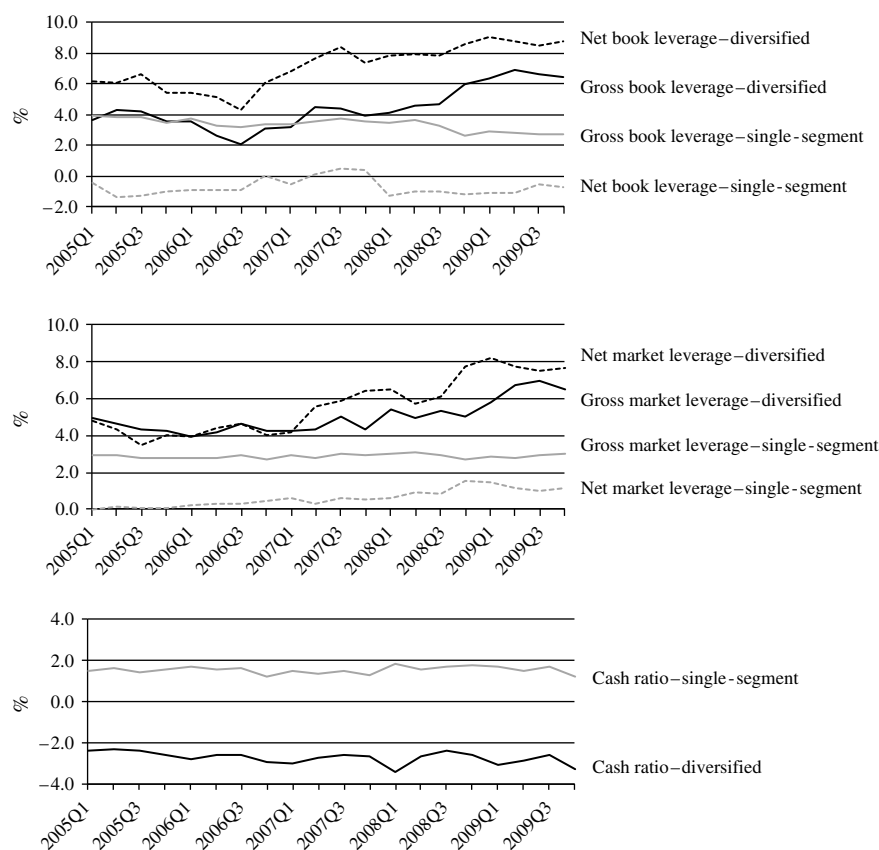
Notes. Industry-adjusted leverage (cash ratio) is the difference between a firm's actual leverage (cash ratio) and its imputed leverage (cash ratio). A firm's imputed leverage (cash ratio) is the sum of its segments' imputed leverage (cash ratios); these ratios are the product of the segment's most recent annual assets and the median leverage (cash ratio) of single-segment firms in the same industry. Gross book (market) leverage is the ratio of total debt to total book assets (market value of assets) at the end of each quarter. Net book (market) leverage is the ratio of total debt minus cash and marketable securities to total book assets (market value of assets). The cash ratio is the ratio of cash and marketable securities to total book assets. The industry matching is carried out using the narrowest SIC grouping that includes at least five single-segment firms. The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005.

In the online appendix, we examine the heterogeneity in these results across different types of diversified firms. Online Appendix Table A.9 shows that, as is the case for excess values, the positive effect of the crisis on industry-adjusted leverage is entirely attributable to unrelated diversified firms. We also examine the sensitivity of our results to controlling for firms' self-selection into the diversified group using switching regression models. The results of these models, which are in Online Appendix Table A.10, show that the interaction term coefficients are almost identical in size and significance to the OLS coefficients reported in Table 6.

Altogether, the results are consistent with our hypothesis that the crisis made the debt coinsurance feature of conglomerates more valuable to lenders who, by giving priority to diversified firms in the allocation of scarce credit, allowed them to gain a competitive advantage over their focused rivals.

4.2. The Role of Internal Capital Markets

To understand the role that internal capital markets may have played in the value increase of diversification during the financial crisis, we analyze whether these markets became more efficient during the crisis. Our hypothesis is that internal capital markets become more efficient because, as shown by Stein (1997), a credit-constrained setting is precisely the situation where corporate headquarters can add most value by actively reallocating scarce funds across projects. If this is the case, internal capital markets can play an insurance role that mirrors that of corporate diversification: diversified firms' shareholders may be willing to accept the costs of internal capital allocation during stable periods in exchange for the ability to reap its benefits when external capital becomes constrained. Hovakimian (2011) and Matvos and Seru (2014) provide evidence in support of this hypothesis. On the other hand, when firms are financially constrained, they may have the incentive to reallocate

Table 6   Impact of the Crisis on the Industry-Adjusted Leverage of Diversified Firms Relative to Single-Segment Firms

	Crisis period dummies	TED spread	VIX
Diversified	−0.02**	−0.01	−0.03***
	(−2.35)	(−1.04)	(−3.27)
Early Crisis	−2.E–3		
	(−0.70)		
Late Crisis	−0.01*		
	(−1.80)		
Postcrisis	3.E–3		
	(0.53)		
Diversified × Early Crisis	0.01		
	(1.56)		
Diversified × Late Crisis	0.04***		
	(3.69)		
Diversified × Postcrisis	0.04***		
	(4.30)		
Credit Spread or VIX		−4.E–3*	−2.E–4
		(−1.69)	(−1.44)
Diversified × Credit Spread or VIX		2.E–3	1.E–3***
		(0.37)	(−3.39)
Investment-grade credit rating	0.02	0.01	0.01
	(1.55)	(1.46)	(−1.46)
Speculative-grade credit rating	0.12***	0.12***	0.12***
	(12.05)	(12.02)	(−12.04)
Controls from prior models	Yes	Yes	Yes
N	43,693	43,693	43,693
Adjusted R²	0.07	0.07	0.07

Notes. Multivariate OLS regressions of industry-adjusted leverage on the interaction of a diversification dummy with various measures of the crisis are shown. The first model includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The remaining models use TED spreads or VIX as continuous measures of the intensity of the crisis. The TED spread is the difference between the three-month LIBOR and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. Industry-adjusted leverage is the difference between a firm's actual leverage and its imputed leverage. A firm's imputed leverage is the sum of its segments' imputed leverage, that is, the product of the segment's most recent annual assets and the median leverage of single-segment firms in the same industry. Leverage in these regressions is gross book leverage, which is the ratio of total debt to total book assets at the end of each quarter. The control variables from prior models included here are a dummy indicating whether the firm paid dividends; cash flow volatility (measured as the standard deviation of operating income after depreciation/assets over the four quarters ending in 2007Q2); CAPEX/sales; operating income after depreciation/sales; log of total assets; and a set of dummy variables indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline category). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses.

***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

Table 7   Impact of the Crisis on the Efficiency of the Internal Capital Market

	Crisis period dummies	TED spread	VIX
Diversified	−7.E–3**	−8.E–3***	−1.E–2**
	(−2.46)	(−3.12)	(−2.55)
Early Crisis	−4.E–3***		
	(−2.76)		
Late Crisis	8.E–5		
	(0.06)		
Postcrisis	1.E–4		
	(0.07)		
Diversified × Early Crisis	7.E–3**		
	(2.17)		
Diversified × Late Crisis	6.E–3*		
	(1.90)		
Diversified × Postcrisis	2.E–3		
	(0.76)		
Credit Spread or VIX		−2.E–3***	−5.E–5
		(−2.88)	(−0.93)
Diversified × Credit Spread or VIX		5.E–3***	3.E–4**
		(2.63)	(−2.10)
Controls from prior models	Yes	Yes	Yes
N	44,544	44,544	44,544
Adjusted R²	0.03	0.03	0.03

Notes. Multivariate OLS regressions of AVA on the interaction of a diversification dummy with various measures of the crisis. AVA is measured, following Rajan et al. (2000), as the asset-weighted sum across each firm's segments of the product of the segment's industry-adjusted investment rate by the difference between the median market-to-assets ratio of single-segment firms in the same industry and the number one. The investment rate of a segment is the ratio of segment capital expenditures to total segment assets, which is adjusted for industry effects by subtracting the average investment rate of single-segment firms in the same industry. The first model includes three crisis period dummies: early crisis (2007Q3–2008Q3), late crisis (2008Q4–2009Q1), and postcrisis (2009Q2–2009Q4). The remaining three models use credit spreads or VIX as continuous measures of the intensity of the crisis. The TED spread (commercial paper spread) is the difference between the three-month LIBOR (nonfinancial commercial paper yield) and three-month Treasury bill yield. VIX is the Chicago Board Options Exchange Volatility Index. The control variables are cash and marketable securities/assets; leverage; a dummy indicating whether the firm paid dividends; cash flow volatility (measured as the standard deviation of operating income after depreciation/assets over the four quarters ending in 2007Q2); CAPEX/sales; operating income after depreciation/sales; log of total assets; and a set of dummy variables indicating whether the firm's fiscal year ended in June, September, or December (March is the baseline category). The sample includes 68,724 firm-quarter observations from firms that reported segment data for the last fiscal year ending before March 31, 2005. *t*-Statistics from standard errors clustered by firm are in parentheses.

***Statistically significant at the 1% level; **statistically significant at the 5% level; *statistically significant at the 10% level.

capital toward segments with greater cash production ability regardless of their investment opportunities. Peyer and Shivdasani (2001) show that this is exactly what happens in firms that undergo leveraged recapitalizations.

Most prior empirical studies of internal capital markets have used one of two approaches to gauge their efficiency. The first approach, which was introduced by Shin and Stulz (1998) building on the investment-cash flow sensitivity regression tradition started by Fazzari et al. (1988), consists of comparing the sensitivity of a segment's investment to its own cash flow across diversified and single-segment firms (either

cross-sectionally or longitudinally, as Gertner et al.
2002 do by comparing the diversified and single-
segment phases of firms undergoing spinoffs). One
variation of this approach that Shin and Stulz (1998)
also introduced consists of testing the sensitivity of
a segment's investment on the investment opportuni-
ties and cash flows of other segments in the firm as
well as its own. Although this is obviously a refine-
ment of the basic approach, it has the limitation that
it can only be applied to diversified firms. Thus, it
does not allow for comparisons between diversified
and single-segment firms or phases within a firm's
history. Moreover, an important caveat to all the vari-
ations of this approach is that most if not all of the
results based on it have been shown to be artifacts of
measurement error in Tobin's q, the proxy for invest-
ment opportunities (see Erickson and Whited 2000,
Whited 2001, Colak and Whited 2007).

The second approach, which was introduced by
Rajan et al. (2000) and is not subject to Whited's (2001)
measurement error critique, directly measures the effi-
ciency of internal capital markets through one of two
measures, *AVA*, which is described in detail in §2, or
relative value added by internal capital allocation (*RVA*),
which is described in Rajan et al. (2000). This is the
approach we follow in this paper. In essence, *AVA*
measures the extent to which firms over- or underal-
locate capital relative to the investment opportunities
in their segments' industries. *RVA* measures capital
allocation relative not just to the industry's invest-
ment opportunities but also to the firm's own invest-
ment opportunities.[8] The measure also allows for the
possibility that the crisis may have changed the rela-
tive growth opportunities across segments during our
sample period.

As a preliminary analysis, in Table A.9 we show the
evolution of *AVA* for diversified and single-segment
firms, and the difference between the two, over our
sample period. The univariate results in this table
suggest that diversified firms allocated capital more
efficiently than single-segment firms in almost every
quarter—and significantly so when all quarters are
pooled together. The table also shows that this sta-
tistical significance is coming entirely from the crisis

period (2007Q3–2009Q1) and disappears again after
the crisis.

To test more directly how the crisis affected the effi-
ciency of internal capital markets, we estimate mul-
tivariate regressions similar to those in Tables 2–5
using *AVA* as the dependent variable. Our approach
is similar in spirit to Peyer and Shivdasani (2001) and
Hovakimian (2011), who use the *RVA* measure to ana-
lyze how the efficiency of internal capital markets
changes before and after leveraged recapitalizations
or over the business cycle, respectively.[9]

Table 7 reports the coefficients of interest from these
regressions, which also include the same control vari-
ables shown in Table 2. In contrast with the univariate
results of Online Appendix Table A.11, the *Diversi-
fied* dummy by itself has a negative and statistically
significant coefficient in all three models, suggesting
that, prior to the crisis, the costs of internal capital
allocation for diversified firms well exceeded its bene-
fits. The interaction of diversification with the crisis is
positive and significant for all measures of the crisis,
including both the early and late subperiod dummies.
However, the increase is not sufficiently large to over-
power the negative effect that diversification seems to
have in steady state after controlling for other factors.
Only in the crisis period dummies model shown in
the first column does the coefficient of *Diversified* ×
Early Crisis (0.007) exactly offset the *Diversified* coef-
ficient, which is −0.007 in that regression. In the
other two models, the coefficient of the interaction
of diversification with either the TED spread or VIX
are smaller than the diversification coefficients in their
respective regressions.

Table 7 also shows that, as the crisis waned, the
efficiency of internal capital markets began to revert
to its precrisis levels. These findings are consistent
with the evidence in Hovakimian (2011) that the effi-
ciency of these markets increases during recessions
and decreases during boom periods. The reverse is
also consistent with the OLS evidence from Table 2
that, whereas diversified firms increased in value rel-
ative to single-segment firms during the 2007–2009
financial crisis, the increase did not last beyond the
crisis. As shown in Table 6, however, after controlling
for self-selection, the increase in the value of diver-
sification does last beyond the crisis. As a robust-
ness check, we estimate switching regression models
of internal capital market efficiency similar to those
shown in Table A.5 for excess values. The results,
which are reported in Table A.12 of the appendix,
show that the sign, size, and significance of the

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[8] Similar to the refined version of the investment-cash flow sensitiv-
ity approach, whereas the comparison to the investment opportu-
nities of other segments within the firm seems a desirable feature,
it effectively means that the *RVA* measure can only be computed
for diversified firms, since for single-segment firms it takes a value
of 0 by construction. As a result, the studies that use *RVA* restrict
their samples for any analysis based on such a measure to diversi-
fied firms only (e.g., Rajan et al. 2000, Peyer and Shivdasani 2001,
Duchin 2010, or Hovakimian 2011). Because the focus of our study
is on differences in value between diversified and single-segment
firms, we cannot impose this restriction on our sample, and there-
fore we choose to use the *AVA* measure instead.

[9] Matvos and Seru (2014) use a third approach, which is a variant
of the structural investment model with costly external financing
of Hennessy and Whited (2007).

coefficients in Table 7 are robust to controlling for self-selection.

Overall, the results reported in this section are consistent with the existence of an internal capital market channel through which the value of diversification increased during the financial crisis and with the complementary evidence in Matvos and Seru (2014) about the importance of this channel. The sudden and severe shock experienced by both credit and equity markets during 2007–2009 made it difficult if not impossible for net present value-positive opportunities to find external finance. Whereas diversified firms were able to tap into their internal capital markets to make sure these opportunities got sufficient funding, single-segment firms were not. Our results suggest that diversified firms indeed made efficient use of this option and were thus able to increase their value relative to their single-segment peers.

5. Conclusion

In this paper we examine whether and why the value of corporate diversification changed during the 2007–2009 financial crisis. In support of an emergent popular view that conglomerates are ready for a comeback, we find that the value of diversified firms relative to single-segment firms significantly increased during the crisis. Using switching regression models, we confirm that these results are not driven by firms' self-selection into the diversified status. In fact, after controlling for self-selection, we find that the value increase of diversification lasted beyond the crisis. To the extent that the financial crisis represented an exogenous shock to external capital markets, our results cannot be attributed either to endogenous differences in firms' financing constraints.

We find that the value increase did not simply reflect changes in investor sentiment or perceptions but real differences in corporate finance and investment. Specifically, we find evidence of two channels through which the financial crisis increased the intrinsic value of corporate diversification: (1) better access to credit markets than single-segment firms had, as a result of the debt coinsurance provided by conglomerates, and (2) access to, and more efficient use of, internal capital markets. Although these financing alternatives are always available to diversified firms, the evidence suggests that they became particularly valuable during the crisis. Our study provides evidence that corporate diversification can play an important insurance role for investors by providing them with protection against bad states of the world.

A question that remains open for future research is how long the value advantage gained by conglomerates during the crisis will last. Our results provide only limited evidence in this regard. On the one hand,

we find that the efficiency of internal capital markets after 2009Q2 has practically reverted to its precrisis level—a result that can be expected as external capital markets return to their steady-state efficiency and availability, and also perhaps because of the reduced pressure to allocate internal funds efficiently. On the other hand, although one might also have expected the excess leverage of diversified firms relative to comparable single-segment firms to revert to its precrisis level after 2009Q2, as credit became cheaper and more broadly available, we find that this has not been the case, at least not yet. Moreover, the value of the financing advantage that conglomerates have enjoyed during the crisis may have allowed them to tackle unique investment opportunities that can give them a sustainable competitive advantage over their focused rivals—or even put some of those rivals out of business. It is too early for us to be able to analyze in this study some of these long-term effects, but the shift in the relative pricing of diversified and single-segment firms suggests that the stock market anticipates that the advantage gained by conglomerates will last well beyond the crisis.

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