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DOI:
10.1016/j.irfa.2016.05.002

Document Version
Peer reviewed version

Citation for published version (Harvard):
Fosu, S, Danso, A, Ahmad, W & Coffie, W 2016, 'Information asymmetry, leverage and firm value: Do crisis and growth matter?', International Review of Financial Analysis, vol. 46, pp. 140–150.
https://doi.org/10.1016/j.irfa.2016.05.002

Information Asymmetry, Leverage and Firm Value: Do Crisis and Growth Matter?

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Abstract

Drawing on pecking order and agency cost theories, we assess the extent to which information asymmetry is an important determinant of firm value and the extent to which this relationship is conditional on the leverage level of firms. We also assess the impact of information asymmetry on firm value during the pre and post 2007/09 financial crisis period and for high and low growth opportunity firms. Using a large sample of UK firms, our empirical findings suggest that information asymmetry adversely impacts firm value, and that this effect decreases with firm's leverage. We also find that leverage has a negative effect on firm value, and that the marginal effect of leverage is lower for information asymmetric firms. Further, we find that the relation between information asymmetry and firm value is more pronounced in the post-crisis period than the pre-crisis period. Finally, we show that the impact of information asymmetry on firm value is higher (lower) for firms with high (low) growth opportunities**.**

Keywords: *Information asymmetry, leverage, firm value, financial crisis, UK.*

JEL Classification:
G01
G32

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1. Introduction

The central proposition of Myers' (1984) pecking order theory (hereafter POT) is that managers acting as agents of stockholders tend to know more than the market about the value of their firm. Thus, in an attempt to minimise the adverse selection costs of external financing, firms are driven by the desire to finance new investment by using internally generated funds, followed by debt and, finally, equity. In other words, firms tend to follow a hierarchical financing order in which debt has priority over equity. The extant empirical literature (Shen, 2014; Danso and Adomako 2014; Leary and Robert, 2010; Drobetz et al., 2010; Agarwal and O'Hara, 2007) provides support for this view. Within the realm of corporate finance, research on Myers' (1984) information asymmetry has made a significant contribution in the past decade and scholars have pursued diverse objectives. Principal among these are the identification of the impact of information asymmetry on debt issuance and access to public debt (Shen, 2014; Fosu, 2014), the market value of corporate cash holdings (Drobetz et al., 2010), corporate bond yield spreads (Lu et al., 2010) and corporate financial decision (Bharath et al., 2009; Tang, 2009; Agarwal and O'Hara, 2007).

Collectively, as observed in the literature, scholarly evidence depicts that knowledge accumulation around the issue of information asymmetry has been substantial. However, key knowledge voids remain within the realm of corporate finance research. First, literature to date has failed to shed light on the joint effects of information asymmetry and leverage on firm value; thus, understanding of the potential interaction between information asymmetry and leverage remains unexplored. Second, the impact of information asymmetry before and after the 2007/09 financial crisis is yet to receive attention from scholars. Third, evidence on the joint effect of information asymmetry and growth opportunities on firm value is also scarce.

A critical argument in Myers (1984) and Myers and Majluf (1984) is that information asymmetry drives many corporate finance decisions. When corporate insiders have more information about their future performance than is publicly available, investors are less able to accurately assess the firm's fundamental quality. In view of this, information asymmetric firms needing external financing will face higher equity costs. All other things being equal,

therefore, one would expect information asymmetric firms to have suboptimal investments, with a deteriorating effect on their value.

The hypothesised relationship mentioned above does not, however, pay attention to the interaction between information asymmetry and financing decisions. In fact, the POT critically conditions the financing behaviour of firms on their levels of information asymmetry (Myers, 2001). The theory suggests that fulfilling external financing needs with debt rather than outside equity can reduce the adverse selection costs arising from information asymmetry; the cost of debt remains cheaper than outside equity under conditions of information asymmetry (Myers, 1984). This suggests that debt financing can be value-enhancing conditional on the severity of information asymmetry. Under severe asymmetric information conditions, the wedge between cost of debt and cost of equity can be wide (in favour of the former). Hence, in equilibrium, there can be an optimal leverage level that minimises the overall external financing cost.

A direct inference from the above argument is that information asymmetry and leverage interact in a dynamic way to impact firm value. This is the novel path taken in this paper. Primarily, we examine the extent to which information asymmetry impacts firm value and the extent to which this relationship is conditional on the level of leverage. Also, we assess the marginal effect of leverage on firm value conditional on the severity of information asymmetry. Further, we condition the effect of information asymmetry on firm value on the pre- and post-crisis periods, as the marginal adverse selection costs can be expected to vary across the two periods.[1] Finally, we distinguish between the effects of information asymmetry on the value of firms with different growth opportunities. Firms with more growth opportunities can be expected to be more difficult to value and also to have more need for external finance (Core, 2001; D'Mello and Ferris, 2000; MacLaughlin et al., 1996; Krishnaswami and Subramaniam, 1999).

[1] As the crisis exposed significant risk-shifting behaviour and monitoring lapses (Begg, 2009), we can expect the lessons learnt, if any, to make firm value more sensitive to information asymmetry.

The findings in this paper suggest that information asymmetry negatively impacts firm value and the adverse effect of information asymmetry on firm value is significantly moderated by the level of leverage. Further, we find that leverage has an adverse effect on firm value and that this effect is also moderated by asymmetric information. Overall, our findings are consistent with the main assumptions of the POT. We also show that the impact of information asymmetry on firm value is more severe in the post-crisis period than it is in the pre-crisis period. Finally, we show that the effect of information asymmetry is higher (lower) for firms with high (low) growth opportunities**.**

We contribute to the finance literature in three main ways. First, by conditioning the relationship between firm value and information asymmetry on firms' level of financial leverage, this paper provides first-hand evidence of the extent to which the underlying assumptions of the POT are value-enhancing. Second, by assessing the differential effect of information asymmetry on firm value pre- and post-crisis, this paper highlights the extent to which the 2007/09 financial crisis has improved (investors') awareness of, or attention to, risk-shifting behaviour and monitoring lapses. Finally, the paper provides evidence of the sensitivity of the firm value and information asymmetry relationship to growth opportunities. In doing so, we document that contracting and adverse selection costs are increasing in growth opportunities. Moreover, our study is part of a growing body of literature (e.g. Shen, 2014; Drobetz et al., 2010; Lu et al., 2010; Bharath et al, 2009; Tang, 2009; Agarwal and O'Hara, 2007) emphasising the role of information asymmetry in corporate finance research.

The remainder of this article is structured as follows: Section 2 reviews the related literature and derives testable hypotheses. In Section 3, we discuss the sample, empirical design and measurement of key variables. Section 4 presents regression results and offers robustness checks. Finally, Section 5 concludes.

2. Related literature and hypotheses

When corporate insiders are better informed than the outside investors, new equity issues tend to be undervalued, resulting in suboptimal investments (Ryen et al., 1997). Hence, information asymmetry and its relationship with financing decisions and valuation receives

significant attention in the finance literature (e.g., Myers, 1984; Myers and Majluf, 1984; Botosan, 1997; Dierkens, 1991; Bharath et al., 2009). In fact, the pecking order hypothesis (POT) of Myers (1984) and Myers and Majluf (1984) suggests that adverse selection costs arising from information asymmetry result in debt financing having priority over equity financing. This argument has received theoretical and empirical support. For example, information asymmetry has been linked to higher cost of equity capital (Botosan, 1997; Dierkens, 1991; He et al., 2013), high levels of financial leverage (Bharath et al., 2009; Gao and Zhu, 2015) and lower value of cash (Drobetz et al., 2010).

Botosan (1997) reports that cost of equity capital is lower for firms with greater disclosure level than for firms with lower disclosure level. Likewise, Dierkens (1991) observes that firms time their equity issuance announcement at a point when their information asymmetry is relatively low. He et al. (2013) find that the dispersion of analysts' forecasts increases ex-ante cost of capital. Shen (2014) observes that firms substitute equity capital with debt capital when information asymmetry increases.

Other scholarly developments have tested the impact of information asymmetry on capital structure. For instance, Bharath et al. (2009) find that the degree of firm-specific information asymmetry of some US firms is positively associated with debt finance. In a related study, Gao and Zhu (2015) add that firms with a high level of information asymmetry tend to use more debt in their capital structure, but less long-term debt. Relatedly, Krishnaswami et al. (1999) find that firms with favourable information about their value and future earnings may rely on private debt as opposed to public debt. These findings suggest that firms prefer securities that are less sensitive to information asymmetry. This conjecture is consistent with the POT.

Other empirical extensions in the literature have looked at the link between information asymmetry and agency cost as the latter increases managerial discretion and risk-shifting behaviour (Leary and Roberts, 2010; Saam, 2007). Agency costs arise from the conflict of interest between shareholders and managers (Jensen and Meckling, 1976). In relation to agency costs of information asymmetry, Fauver and Naranjo (2010) show that derivative

usage leads to loss in firm value. Also, Drobetz et al. (2010) find that the marginal value of cash reduces with increasing severity of information asymmetry.

In response, and departing from extant literature, we contend that information asymmetry is an important determinant of firm value as it can exert a negative effect on firm value, and that this relationship can be moderated by the leverage level of the firm. Further, we argue that the information asymmetry and firm value relationship is moderated by growth opportunities and financial crisis.

2.1. Information asymmetry and firm value

It is generally argued that the existence of information asymmetry between managers of firms and their shareholders drive many corporate decisions (Myers, 1984; Myers and Majluf, 1984). For instance, when corporate insiders (managers) have more information than is publicly available about their firm's future performance, their prediction could be more realistic than that of the market. In keeping with this, new equity issue is likely to be under-priced and, therefore, shifts wealth from existing shareholders to the new ones. Consequently, the under-pricing would lead to existing shareholders rejecting projects that could generate a positive net present value (NPV). In this regard, the cost of external finance becomes excessive for information asymmetric firms.

There is evidence to support the above argument. Several empirical studies (Drobetz et al., 2010; Fauver and Naranjo 2010; Ryen et al., 1997) have shown that information asymmetry is costly to firms since the adverse selection cost impedes firms from raising cheap external capital. In this case, the adverse selection cost compels firms to make sub-optimal investment decisions which might be detrimental to the firm value. This leads to our first hypothesis:

H1: Information asymmetry will be negatively related to firm value

2.2. Information asymmetry, leverage and firm value

One of the key objectives of this paper is to test the validity of the underlying assumption of the POT: whether debt financing help firms minimise adverse selection costs of information asymmetry. Myers (1984) and Myers and Majluf (1984) note that, if managers know more

than the rest of the market about their firm's value, then a less information-sensitive source of finance (e.g. debt) should be used to cover any financing deficit. Since equity capital is the most information-sensitive security, information asymmetry makes firms unwilling to issue new equity to finance positive net present value projects as the higher adverse selection costs associated with equity may outweigh the added value arising from the new investment.

The validity of the POT assumption has been tested in a few ways (e.g. Gao and Zhu, 2015; Bharath et al., 2009). For instance, Bharath et al. (2009) test this assumption by investigating the extent to which information asymmetry drives firms' capital structure choice. They find that information asymmetry has significant predictive power in capital structure decisions. In a related work, Gao and Zhu (2015) find that capital structure decisions (including debt maturity choice) are, to a large extent, driven by information asymmetry. These findings are consistent with the view that debt financing minimises adverse selection costs as much as it signals positive private information about quality (Ross, 1977; Ryen et al., 1997) and serves as a commitment mechanism (Grossman and Hart, 1982) and disciplinary device (Opler and Titman, 1994). If prioritising debt over external equity financing under severe information asymmetry is value-generating, we expect leverage to moderate the negative effect of information asymmetry on firm value. Hence, we form our second hypothesis as follows:

H2. The effect of information asymmetry on firm value is moderated by financial leverage

Corporate finance literature provides different perspectives on the role of leverage as a corporate financing instrument. Myers (1977) argues that high levels of leverage create a potential underinvestment problem.[2] This suggests that leverage has a negative effect on firm value. This conclusion contrasts sharply with the view that leverage is value-enhancing as it curtails overinvestment problems arising from managerial incentive to overinvest (Jensen, 1986). Put together, these arguments suggest that leverage can have both positive and negative effects on firm value. In fact, Stulz (1990) shares this view by arguing that, whilst

[2] This underinvestment arises from managers' disincentive to pursue all positive NPV projects; the project return has to be sufficiently larger than the debt holders' claim on the firm to provide any incentive for their undertaking.

leverage mitigates the overinvestment problem, it also has the tendency to worsen the underinvestment problem.

However, in view of the interactions between leverage and information asymmetry suggesting a lower adverse selection cost under debt-financing than under equity-financing, we expect the adverse (positive) effect of leverage to be moderated (accentuated) under conditions of higher information asymmetry. This leads us to our third hypothesis:

H3. The adverse (positive) effect of leverage on firm value is moderated (accentuated) by information asymmetry

2.3. Information asymmetry, financial crisis and firm value

Recent scholarly works in finance (e.g. Vithessonthi and Tongurai, 2015; Cerutti et al., 2015; Bremus and Fratzscher, 2015; Bergman and Hutchison, 2015; Cerutti, 2015; Kahle and Stulz, 2013; Begg, 2009**)** have attempted to shed light on the impact of the recent global financial crisis.

As shown by Vithessonthi and Tongurai (2015), the extent to which new external finance could be obtained was constrained by the global financial crisis due to the contraction of credit for firms. This credit squeeze ultimately had consequences for firms' pursuit of growth strategies (Wiklund and Shepherd, 2003). Prior to the recent financial crisis, lenders may have been less attentive in assessing the fundamental value of firms (Begg, 2009). Hence, it can be expected that the impact of information asymmetry on firm value may have been less pronounced in the pre-crisis period than in the post-crisis period. In view of the forgoing argument, we hypothesise that:

H4. Information asymmetry will be more negatively related to firm value in the post-crisis period than in the pre-crisis period.

2.4. Information asymmetry and firm value: the role of growth

We take the view that the marginal effect of information asymmetry on firm value is likely to differ for firms with high growth and those with low growth opportunities. In other words,

depending on the level of growth opportunities, adverse selection may or may not be a concern. High-growth firms may have higher contracting costs due to underinvestment and risk-shifting. Shareholders of high-growth firms are likely to forgo a project with a positive NPV if the gains predominantly accrue to bondholders (Krishnaswami et al., 1999; McConnell and Servaes, 1995; Myers, 1977).

In terms of the information hypothesis, Krishnaswami and Subramaniam (1999) observe that firms with high growth opportunities are more likely to engage in spin-off. Since spin-off is a mechanism to mitigate monitoring problems and enhance transparency (D'Mello, 2008; Krishnaswami and Subramaniam, 1999), it follows that firms with high growth opportunities are more likely highly information asymmetric and most likely bear higher adverse selection costs than do firms with low growth opportunities. This is due to the inherent unpredictability associated with new projects or growth opportunities (Core, 2001; D'Mello and Ferris, 2000; MacLaughlin et al., 1996).

Therefore, consistent with Myers and Majluf's (1984) argument that high growth opportunity firms have a greater level of information asymmetry, we form our fifth hypothesis as follows:

H5. The effect of information asymmetry on firm value is higher (lower) for firms with high (low) growth opportunities.

3. Sample and empirical methodology

3.1. Sample

In order to test the hypotheses formulated in the paper, we collect firm-level data and analysts' forecasts data for UK firms from Worldscope and Institutional Brokers Estimate System (IBES) International databases, respectively, for the period 1995 to 2013. The sample period is guided by the availability of data that ensures a fair representation of the sample firms. Whilst some firms have longer series of data, these firms represent a much smaller proportion of the entire firms. We start with all firms for which data is available in DataStream. Following the extant literature (e.g. Fosu, 2013; Drobetz et al., 2010), we apply a few exclusion criteria: First, we drop firms from the financial industry. Next, we drop firms

with negative equity.[3] Also, firms with fewer than three consecutive firm-year observations are also dropped from the sample. Finally, we drop firm-year observations with missing values for the dispersion of analysts' forecasts, our main measure of information asymmetry.

3.2. Measurements of variables

3.2.1. Measuring information asymmetry

In order to test the relationship between information asymmetry and firm value, we follow Drobetz et al. (2010) and Krishnaswami and Subramaniam, (1999) and use the dispersion of analysts' forecast (**Asy-Disp**) and analysts' forecast error (**Asy-Er**) as our main measures of information asymmetry. The dispersion of analysts' forecasts is the standard deviation of analysts' forecast earnings per share for the fiscal year. A larger dispersion represents a higher degree of information asymmetry (Drobetz et al., 2010; Krishnaswami et al., 1999).

Analysts' forecast error is the difference between the analysts' forecast earnings per share and the actual earnings per share for the fiscal year (Drobetz et al., 2010; Krishnaswami et al., 1999). A larger forecast error represents a higher degree of information asymmetry. For each fiscal year, we use the most recent updated forecast to ensure that the forecast relates to the fiscal year-end. Also, to ensure comparability of these measures of information asymmetry across firms, we scale them by the median forecast for the fiscal year, as in Drobetz et al. (2010).

We add a third measure of information asymmetry (**Asy-Dum**) as a dummy variable which takes the value one if the dispersion of analysts' forecasts is greater than the industry median forecast. This measure effectively captures firms with high information asymmetry relative to their counterparts in the same industry. We follow the International Industry Classification Benchmark (ICB) to classify the firms into eight main industries: oil and gas, basic materials,

[3] These firms are most likely extremely distressed, and their inclusion will potentially bias the results.

industrials, consumer goods, healthcare, consumer services, telecommunications and technology.

3.2.2. Firm value and other control variables

We measure firm value (**Value**) as the ratio of market value of assets to book value of assets as in Muray and Pajuste (2005). Market value of assets is measured as the sum of market value of equity and book value of debt.

As we seek to relate a firm's leverage to the firm's value, we adopt book leverage in this paper to mitigate the potential reverse causation from firm value to leverage (Opler and Titman, 1994). Hence, we measure a firm's leverage (**Lev**) as the ratio of book value of debt to book value of assets. This measure is consistent with the extant literature (e.g., Danso and Adomako, 2014; Fosu, 2013; Opler and Titman, 1994).

Following Maury and Pajuste (2005), we control for non-hypothesised variables including firm size, tangibility of assets, and sales growth in the estimations that follow. We measure firm size (**Size**) as the natural logarithm of the book value of total assets. Larger firms are likely to be mature firms for which corporate valuation tends to be low (Murray and Pajuste, 2005). Hence, we expect a negative relationship between firm size and firm value.

Tangibility (**Tang**) of assets is measured as the ratio of tangible assets to total assets. Firms with a larger proportion of tangible assets have fewer value-generating intangible assets such as human capital (Muarray and Pajuste, 2005). This argument suggests a negative relationship between tangibility and firm value. However, firms with more tangible assets may be less information asymmetric, hence more value-generating. Therefore, the expected effect of tangibility on firm value is ambiguous.

Sales growth rate (**Growth**) is the annual growth rate of a firm's sales. We express this measure in fractions. We expect a positive relationship between growth rate and firm value because high-growth firms tend to have higher valuation (Murray and Pajuste, 2005).

As we seek to assess the effect of information asymmetry on firm value across the pre-crisis and post-crisis periods, we also construct two categorical variables: **Pre-crisis and Post-**

crisis. Pre-crisis takes the value one for the period prior to the recent (2007-2009) financial crisis and zero otherwise. **Post-crisis** takes the value one for the period after the recent financial crisis and zero otherwise. Thus, the period 2007-2009 inclusive becomes the reference period.

3.2.3 Descriptive statistics and correlations

Table 1 presents the summary statistics of the variables used in this study[4]. The average Value across firm-years is 1.438 and the mean Leverage is 0.174. On average, tangible assets (Tang) in any given year amount to 30.1% of the total assets and average annual sales growth (Growth) is 12.2%. The mean values of the two continuous information asymmetry measures (Asy-Disp and Asy-Er) are 0.193 and 0.262 respectively. The average value of 0.503 for the third binary measure of information asymmetry shows that, for half of the sample firm years, the dispersion of analysts' forecasts is greater than the industry median forecast.

[Table 1 about here]

The correlations among the variables in our models are presented in Table 2. The table reveals that all three measures of information asymmetry are significantly negatively correlated with Value and provide preliminary support for H1. Moreover, leverage is also significantly negatively correlated with Value. The table also shows that the correlation coefficients among variables are modest and multicollinearity does not appear to be an issue in our analysis.

[Table 2 about here]

3.3 Empirical methodology

We formulate empirical models in this section to test out our main hypotheses. We adopt a panel data approach in our analysis to take advantage of the variations in the variable of interest over time. In order to test our first hypothesis (H1), we follow Murray and Pajuste

[4] We Winsorise all variables at a 2% level on either tail in order to mitigate the effect of outliers.

(2005) and model firm value as a function of firm size (*Size*), tangibility of assets (*Tang*) and growth rate of sales (*Growth*), collectively termed *Controls*, and leverage (*Lev*) with further extensions to account for the effects of information asymmetry (*Asy*). Thus, our baseline model is given as follows:

$$Value_{it} = \alpha + \lambda_t + \beta_1 Lev_{it} + \sum_{k=2}^{4} \beta_k Controls_{kit} + \gamma Asy_{it} + \varepsilon_{it} \quad (1)$$

where *Asy* is either the dispersion of analysts' forecasts (*Asy-Disp*) or analysts' forecast error (*Asy-Er*); ε is the composite error term comprising firm fixed effect (μ_i) and a component assumed to be independent and identically distributed (ν_{it}); α, β, and γ are parameters; and the subscripts i and t indicate the ith firm and tth time period. k indicates the k[th] control variable.

Our second hypothesis (H2) attempts to capture the interaction effect on firm value of information asymmetry and leverage. We test H2 by extending Eq. (1) further to include an interaction term between information asymmetry and leverage as follows:

$$Value_{it} = \alpha + \lambda_t + \beta_1 Lev_{it} + \sum_{k=2}^{4} \beta_k Controls_{kit} + \gamma Asy_{it} + \varphi Lev_{it} \times Asy_{it} + \varepsilon_{it} \quad (2)$$

We obtain the marginal effects of information asymmetry by differentiating Eq. (2) with respect to information asymmetry as follows:

$$\frac{\partial(Value)}{\partial(Asy)} = \gamma + \varphi Lev_{it} \quad (3)$$

where the parameter φ captures the moderating effects of leverage on the information asymmetry and value relationship. Similarly, we obtain the marginal effects of leverage on firm value by differentiating Eq. (2) with respect to leverage as follows:

$$\frac{\partial(Value)}{\partial(Lev)} = \beta_1 + \varphi Asy_{it} \quad (4)$$

where, this time, the parameter φ captures the moderating effects of information asymmetry on the leverage-value relationship.

We modify Eqs. (2) to (3) to test the differential impact of the marginal effects of information asymmetry pre- and post-crisis. Specifically, we include pre- and post-crisis dummy variables and their interactions with information asymmetry in Eq. (2) and modify Eq. (3) accordingly.

We can estimate Eqs. (1) and (2) using OLS. However, the firm fixed effect could be correlated with the explanatory variables, inducing biased and inconsistent estimates (Wooldridge, 2009, p. 465). Hence, we estimate these equations using panel fixed effect estimation, and pooled OLS estimations for robustness checks. We base our inference on standard errors robust to heteroscedasticity and clustering within firm.

4 Results and discussion

4.1. Effects of information asymmetry on firm value

Table 3 presents the estimation results of Eq. 1. Columns 1, 3 and 5 are based on OLS estimation and columns 2, 4 and 6 present panel fixed effect estimations. The dispersion of analyst forecast (Asy-Disp) is used as the main measure of information asymmetry in columns 1 and 2; analysts' forecast error (Asy-Er) in columns 3 and 4; and the dummy variable for high information asymmetry in columns 5 and 6.

[Table 3 about here]

All the information asymmetry variables have a negative sign and are statistically significant. This suggests that information asymmetry negatively impacts firm value. The coefficient of Asy-Disp ranges between -0.245 and -0.183 for the OLS and fixed effect estimations respectively. These effects are also economically significant: a one standard deviation increase in Asy-Disp will cause a decrease in firm value that is between 5.02% (for the fixed effect) and 6.74% (for the pooled OLS) of the mean firm value.

Our results are confirmed when we use Asy-Er as the main measure of information asymmetry. The coefficients on Asy-Er range between -0.176 and -0.113 and are highly

significant, statistically and economically: a one standard deviation increase in Asy-Er is associated with about a 3.10% to 4.82% decline in firm value. The results from the models using the high information asymmetry dummy variable provide further support. The corresponding coefficients range between -0.270 and -0.197. This suggests that a move from a low information asymmetry regime to a high information asymmetry regime is associated with a remarkable 13.72% to 18.79% decline in firm value. Overall, these findings provide support for Hypothesis 1 and are broadly consistent with Drobetz et al. (2010).

On the relevance of leverage, the results in Table 3 suggest that leverage has a negative effect on firm value: the coefficient on leverage is negative and statistically significant across all models. Interpreting this result in terms of economic impact, we find that a one standard deviation increase in leverage is associated with between a 3.23% and 8.02% decline in firm value. It is worth mentioning that this result for leverage does not take into account interactions with information asymmetry. We deal with this issue subsequently.

The coefficients on the control variables have the predicted signs. Tangibility of assets has a negative coefficient across all models. This suggests that the information content of tangible assets does not sufficiently compensate for the loss of value-generating intangible assets. However, the coefficients are significant in the OLS models only; hence we treat the above inference with a fair amount of caution. Consistent with Murray and Pajuste (2005), the results further suggest that firm size has a negative effect on firm value. This effect is statistically significant across all models, and it suggests that most of the firms in our sample are at, or approaching, their mature stage. Finally, the results suggest that sales growth has a positive effect on firm value. This finding is consistent with the view that firms with higher sales growth have higher valuation (Murray and Pajuste, 2005).

4.2. Information asymmetry and firm value – the moderating role of leverage

In Section 2.2, we hypothesise that the adverse effects of information asymmetry on firm value are moderated by debt-financing since debt is less sensitive to adverse selection costs (Myers, 1984). Table 4 provides the results of Eq. 2 that tests this hypothesis. The coefficient on the interaction term between leverage and information asymmetry is positive across all

models, albeit statistically significant only for the fixed effect models for the continuous measures of information asymmetry. However, the coefficient on the interaction between leverage and information asymmetry dummy variable is statistically significant for both OLS and FE models. Besides, all the coefficients on the interaction terms and the coefficients on the measures of information asymmetry are jointly statistically significant.

[Table 4 about here]

These finding suggests that leverage moderates the value-deteriorating effects of information asymmetry. Applying Eq. 3, we present the marginal effects of information asymmetry at various percentiles of leverage in Table 5 to corroborate this finding.

The marginal effect estimates based on the fixed effect model suggest that the marginal effect of Asy-Disp on firm value is -0.240 at the 25th percentile of leverage. This adverse effect reduces to - 0.132 at the 75th percentile of leverage. The economic impact of this change is significant. At the 25th percentile of leverage, a one standard deviation change in Asy-Dips induces about a 6.59% reduction in firm value whilst, at the 75th percentile of leverage, the resulting reduction in firm value is 3.62%. Thus, a move from the 25th percentile of leverage to the 75th percentile of leverage reduces the value-deteriorating effects of information asymmetry by about 2.97 percentage points. Similar results are obtained for the models involving Asy-Er: a move from the 25th percentile to the 75th percentile of leverage reduces the marginal effect of information asymmetry by 0.07 points from -0.154 to -0.085. In economic terms, this represents a 2.93 percentage point decrease in the adverse effects of information asymmetry on firm value.

The moderating effect of leverage is even more pronounced when we use a dummy measure of information asymmetry. In the fixed effect model where Asy-Dum is interacted with leverage, a move from the 25th percentile of leverage to the 75th percentile reduces the adverse marginal effect of high information asymmetry from -0.264 to -0.153 (estimates using model 6). In economic terms, this represents a 7.71 (18.36% - 10.65%) percentage

point decrease in the adverse effect of information asymmetry on firm value.[5] These findings provide strong support for our Hypothesis 2.

[Table 5 about here]

The coefficient on leverage in Table 4 maintains its negative sign and is statistically significant across all models. However, the effect of leverage is less adverse for information asymmetric firms. Applying Eq. 4 to the fixed effect estimates, the results suggest that a one standard deviation increase in leverage at the 25th percentile of Asy-Disp will induce a 4.57% reduction in firm value. However, this effect reduces to 3.99% at the 75th percentile of Asy-Disp, representing about a 0.58 percentage point decrease in the adverse effect of information asymmetry on firm value. We obtain similar results for models in which leverage is interacted with Asy-Er. However, the result involving an interaction with the high information asymmetry dummy, Asy-Dum, is dramatic: the marginal effect of leverage falls to a low -0.101, representing a 1% value reduction per one standard deviation increase in leverage, and is indistinguishable from zero.

The results discussed above suggest that the adverse effect of leverage is moderated under asymmetric information. This finding thus confirms that the key assumption of the POT (Myers, 1984; Myers and Majluf, 1984) is value-enhancing. Overall, the findings provide support for Hypothesis 3.

4.3 Information asymmetry and firm value – financial crisis and the moderating role of growth

In section 2.3, we argue that the recent global financial crisis may have exacerbated the information asymmetry problem, making firm value more sensitive to information asymmetry in the post-crisis period (H4). Moreover, we also hypothesise in section 2.4 that the adverse effect of information asymmetry is likely to be higher for firms with high growth

[5] Note that we measure economic impact as the product of marginal effect and one standard deviation of the independent variable in question all divided by the mean firm value.

opportunities and lower for firms with low growth opportunities (H5). We present the results of the formal tests of these hypotheses in this section.

4.3.1. Information asymmetry and firm value – impact of financial crisis

In Table 6, we build on our baseline regression in Table 3 by including pre- and post-crisis dummy variables as well as interaction terms between these variables and our measures of information asymmetry. In model 1, the coefficient of Asy-Disp is significant only via the interactions term. The coefficient on the interaction term between Asy-Disp and Pre-crisis is negative and statistically significant. However, the coefficient on the interaction between Asy-Disp and Post-crisis is more negative and highly significant. Hence, the marginal effect of Asy-Disp is -0.181 pre-crisis but -0.284 post-crisis. In economic terms, a one standard deviation increase in Asy-Disp is associated with a 5.00% reduction in firm value pre-crisis but 7.80% post-crisis. Thus, firm value is about 2.80 percentage points more sensitive to information asymmetry in the post-crisis period compared to the pre-crisis period.

[Table 6 about here]

We find similar results in models 3 and 5. However, in these models, the interaction term between Asy-Er and Pre-crisis (model 3) is insignificant and indistinguishable from the crisis period, as is the interaction term between Asy-Dum and Pre-crisis (model 5). On the contrary, the interaction between Asy-Er and Post-crisis and that between Asy-Dum and Post-crisis are highly significant, statistically and economically.

The marginal effect of Asy-Er is -0.092 and -0.210 pre-crisis and post-crisis respectively. This represents a 3.87% and 8.80% reduction in firm value per one standard deviation increase in Asy-Er. Thus, the sensitivity of firm value to Asy-Er is about 4.92 percentage points higher post-crisis than pre-crisis.

Further, the marginal effect of Asy-Dum is -0.184 and -0.281 pre-crisis and post-crisis respectively. This suggests that a move from a low information asymmetry regime to a high information asymmetry regime is associated with about a 12.82% and 19.54% reduction in firm value pre-crisis and post-crisis respectively. This further suggests that the sensitivity of

firm value to information asymmetry is about 6.72 percentage points higher in the post-crisis period than the pre-crisis period. We extend the analysis by including the interaction between Asy and Lev in models 2, 4 and 6 and find similar results to those previously discussed. Overall, these findings provide support for Hypothesis 4. This is consistent with the view that exposure of risk-shifting behaviour and monitoring lapses during the recent financial crisis (Begg, 2009) has made firm value more sensitive to information asymmetry in the post-crisis period.

The extensions in models 2, 4 and 6 help us to ascertain whether the moderating role of leverage in the relationship between firm value and information asymmetry still holds after controlling for the pre-crisis and post-crisis interactions: the interaction terms between leverage and all the measures of information asymmetry are negative and statistically significant. Table 7 reveals that leverage still remains a useful tool to reduce adverse selection costs.

[Table 7 about here]

Table 7 shows that the marginal effect of information asymmetry on firm value is decreasing in firms' leverage levels: the difference in marginal effects at the 25th and 75th percentiles of leverage is highly significant. For instance, the value reduction per one standard deviation increase in Asy-Disp (As-Er) at the 75th percentile is about 2.90 (2.78) percentage points less than that at the 25th percentile. Also, the reduction in value for the firms with high information asymmetry (Asy-Dum) can be about 7.33 percentage points less at the 75th percentile of leverage. This finding further supports Hypothesis 3.

4.3.2 Information asymmetry and firm value – the moderating role of growth

We test hypothesis (H5) by extending the previous models to include an interaction term between the measures of information asymmetry (Asy) and dummies for high and low growth opportunities. The result is presented in Table 8. We follow McConnell and Servaes (1995) and use the ratio of share price to earnings per share (P/E ratio) as the proxy for growth opportunities. Specifically, firms in the top one-third quantile of the price earnings ratio are marked as those with high growth opportunities, whilst those at the bottom one-third

quantile are those with low growth opportunities. Accordingly, we use a dummy variable, High Growth, equal to one for the firm-year observations in the top one-third quantile of P/E ratio and zero otherwise; and another dummy variable, Low Growth, equal to one for the firm-year observations in the bottom one-third quantile of P/E ratio.

The results in Table 8 show that the coefficient on the interaction terms between the continuous measures of information asymmetry and High Growth are negative but largely insignificant; the coefficients on the dummy measure of information asymmetry, however, retain their sign and significance across all models. Thus, the sensitivity of firm value to information asymmetry for the firms with high growth opportunities is indistinguishable from that of the firms with intermediate growth opportunities. However, the coefficients on all the measures of information asymmetry and Low Growth interaction terms are positive and significant across all models. The results suggest that firm value is less sensitive to information asymmetry for firms with low growth opportunities. In model 1 of Table 8, the marginal effect of Asy-Disp is -0.026 for low-growth firms, representing a 0.73% reduction in firm value per one standard deviation increase in Asy-Disp. In fact, this effect is statistically insignificant. However, the marginal effect is significantly different from that for firms with high growth opportunities (- 0.358), which represents a 9.58% reduction in firm value per one standard deviation increase in Asy-Disp. This effect is significant at the 1% level. We obtain similar results when we control for the interaction between Asy-Disp and Lev (model 2).

[Table 8 about here]

In model 3 of Table 8, we further control for the interactions of Asy-Disp with Pre-crisis and Post-crisis. We find qualitatively similar results. The additional results suggest that a one standard deviation increase in Asy-Disp is associated with up to a 4.82% reduction in the value of low-growth firms post-crisis (depending on the level of leverage), but not pre-crisis; and that the value reduction in high-growth firms per one standard deviation increase in Asy-Disp can be as high as 14.07% post-crisis but 10.84% pre-crisis. All of these findings support Hypothesis 5, and further corroborate Hypothesis 4.

We obtain similar results in models 4 to 6 where Asy-Er is used as the measure of information asymmetry: in model 4, the marginal effect of Asy-Er for low-growth firms is indistinguishable from zero whilst that of high-growth firms is -2.86, which is significant at the 1% level and represents about a 12.00% reduction in firm value per one standard deviation increase in Asy-Er. Similarly, the results in model 5 suggest that a one standard deviation increase in Asy-Er is associated with about a 10.54% and 12.92% reduction in the value of high-growth firms at the 25th and 75th percentiles of leverage respectively, but has insignificant effect on low-growth firms. Model 6 shows the marginal effect of Asy-Er for low-growth firms is significant post-crisis only and ranges from -0.088 to -0.139. This yields about a 3.70 % and 5.85% reduction in firm value per one standard deviation increase in Asy-Er at the 25th and 75th percentiles of leverage respectively. For high-growth firms, the reduction in firm value per one standard deviation increase in Asy-Er is up to 16.77% post-crisis but 11.68% pre-crisis (at the 25th percentile of leverage).

The results in model 7 yield similar findings as above. Firm value is more sensitive to high information asymmetry for high-growth firms than low-growth firms. For instance, low-growth firms that become highly information asymmetric can lose 2.58% of their value. This figure is far less (27.41 percentage points) than the 30% value loss for high-growth firms which becomes highly information asymmetric. Model 8 suggests that the value loss can be as high as 6.45% for low-growth firms at the 25th percentile of leverage but 33.43% for high-growth firms at the 25th percentile of leverage. In model 9, the coefficient on the interactions between Low Growth and Asy-Dum is positive and significant whilst the coefficient on the interaction between High Growth and Asy-Dum is negative and significant. It is also worth noting that the interaction term between Asy-Dum and Pre-crisis is insignificant whilst the one between Asy-Dum and Post-crisis is significant and negative. Further, the interaction of Asy-Dum and Lev is positive and significant. Overall, these results confirm that the sensitivity of firm value to high information asymmetry is low for low-growth firms but high for high-growth firms; that the sensitivity (for both low- and high-growth firms) is lower pre-crisis but higher post-crisis; and that the sensitivity decreases in firm's leverage. Model 9 shows that the marginal effect of Asy-Dum for low-growth firms is significant post-crisis only and ranges from -0.175 to -0.091. This yields about a 12.17% and 6.31% reduction in

firm value for a move from a low to a high asymmetric information regime. For high-growth firms, a similar shift in information asymmetry regime will lead to value loss of 39.03% and 33.17% at the 25th and the75th percentiles of leverage respectively. These findings further provide support for Hypothesis 5 and are consistent with high contracting cost due to underinvestment and risk-shifting associated with high-growth firms (Krishnaswami et al., 1999; McConnell and Servaes, 1995; Myers, 1977).

4.4 Robustness checks

We present the results of some robustness checks to verify the findings in this paper. Mainly, we address the potential endogeneity between firm value and leverage. It is likely that firms with high value generate high internal funds sufficient to keep leverage levels low, thus causing a reverse feedback from value to leverage. We address this concern by employing Two-step Generalised Methods of Moments (GMM) to retest our key hypotheses.

In treating leverage as endogenous, we employ one-period lagged leverage, effective tax rate and non-debt tax shield as instruments. We modify the interaction terms with leverage accordingly, as suggested by Bun and Harrison (2014). The results are provided in Table 9.[6]

[Table 9 about here]

The GMM estimations results yields similar results as those previously discussed. As before, we find that information asymmetry adversely impacts firm value. Further, we find that the adverse impact of information asymmetry on firm value is decreasing in the level of leverage. Additionally, we find support for the hypothesis that the value-deteriorating effect of information asymmetry is higher in the post-crisis period than in the pre-crisis period. Moreover, the results show that the adverse effect of information asymmetry on firm value is

[6] The results in Table 9 confirm that that the instruments are valid and relevant: the Hansen J-statistics p-values are all in excess of 0.1, suggesting that the over-identifying restrictions are valid (see Baum et al., 2003). Also, the Kleibergen-Paap rk Wald F statistic, compared with the Stock-Yogo IV critical values, rules out weak instrument problems; they are all larger than the rule-of-thumb minimum of 10 (Baum, 2006).

higher for high-growth firms than lower-growth firms. Finally, we find support that the adverse effect of leverage on firm value is moderated by information asymmetry. In sum, we can safely conclude that the results obtained so far are not biased by endogeneity.

We also test the robustness of our main finding to differences in the sensitivity of firm value to information asymmetry across different firm-size classes due to the possibility that small firms may be more information asymmetric and have higher need for external finance. Our results are qualitatively similar to the previous findings.

Finally, we re-run our estimations using the random effect panel model approach and find qualitatively similar results. We must mention that the Hausman specification test performed provided support for the fixed effect estimation, suggesting that the differences in the coefficients of the fixed effect and the random effect estimations are systematic. As a result, and for brevity, we do not report the random effect estimates.[7]

5. Conclusion

Despite the apparent theoretical connection between information asymmetry and leverage in influencing the value of a firm, existing empirical studies have so far given scant attention to this connection. Accordingly, this study expands the knowledge on the interplay between information asymmetry, leverage and firm value. We theoretically motivate and empirically test the relationship between information asymmetry, leverage and firm value using a large UK sample. Our results clearly show that information asymmetry adversely impacts firm value, however, this adverse effect is significantly moderated by the level of leverage. We also find that information asymmetry has a more negative relation to firm value in the post-crisis period than in the pre-crisis period. In other words, the relationship between information asymmetry and firm value tends to be more pronounced in the post-crisis period than in the pre-crisis period. Further, our findings suggest that the firms with high growth opportunities are more adversely affected by information asymmetry compared to their counterparts with low growth opportunities. Finally, we employ two step GMM to address

[7] All unreported results in this section are available on request from the corresponding author.

the potential endogeneity between firm value and leverage and find that our results are qualitatively similar to the main conclusions in this study. In sum, our evidence suggests that the level of information asymmetry is imperative to the value of the firm and it is also important to account for the moderating effect of leverage.

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Table 1: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Value	11231	1.438	1.181	0.310	6.381
Lev	11278	0.174	0.145	0.000	0.531
Tang	11261	0.301	0.250	0.000	0.980
Size	11287	12.25	1.873	6.891	19.41
Growth	9578	0.122	0.298	-0.494	1.313
Asy-Disp	11235	0.193	0.395	0.000	2.194
Asy-Er	10779	0.262	0.604	0.001	3.399
Asy-Dum	11314	0.503	0.500	0.000	1.000

This table presents the descriptive statistics for the data. The sample comprises 1,446 UK firms (N_clust) over the period 1995 to 2013. Value is the ratio of market value of assets to book value of assets, where value of assets is measured as the market value of equity plus the book value of debt; Lev is the ratio of book value of total debt to book value of total assets; Tang is the ratio of tangible assets to book value of total assets; Growth is the annual growth rate of total assets; Asy-Disp is the standard deviation of analysts' forecast earnings per share scaled by the median earnings forecast for the fiscal year; Asy-Er is the difference between the analysts' forecast earnings per share and the actual earnings per share scaled by the median forecast for the fiscal year. Asy-Dum is a dummy variable which takes the value one if the dispersion of analysts' forecasts is greater than the industry median forecast.

Table 2: Correlation matrix

	Value	Lev	Tang	Size	Growth	Asy-Disp	Asy-Er	Asy-Dum
Value	1.000							
Lev	-0.206***	1.000						
Tang	-0.131***	0.333***	1.000					
Size	-0.216***	0.344***	0.189***	1.000				
Growth	0.188***	-0.020	0.002	-0.036***	1.000			
Asy-Disp	-0.037***	-0.050***	-0.032***	-0.173***	-0.054***	1.000		
Asy-Er	-0.053***	-0.031***	-0.036***	-0.170***	-0.041***	0.647***	1.000	
Asy-Dum	-0.113***	0.002	-0.008	-0.115***	-0.045***	0.412***	0.277***	1.000

This table presents the correlation matrix for the data. The sample and variable definitions are as described in Table 1.
*** Indicates significance at 1%.

Table 3: Information asymmetry, leverage and firm value

	OLS Model 1	FE Model 2	OLS Model 3	FE Model 4	OLS Model 5	FE Model 6
Lev	-0.798***	-0.359**	-0.783***	-0.365**	-0.792***	-0.321*
	(0.169)	(0.178)	(0.173)	(0.184)	(0.168)	(0.175)
Tangibility	-0.229***	-0.235	-0.220**	-0.246	-0.227***	-0.273
	(0.085)	(0.208)	(0.086)	(0.209)	(0.084)	(0.208)
Size	-0.056***	-0.275***	-0.062***	-0.286***	-0.054***	-0.264***
	(0.015)	(0.046)	(0.015)	(0.047)	(0.014)	(0.045)
Growth	0.543***	0.371***	0.528***	0.383***	0.546***	0.365***
	(0.056)	(0.043)	(0.057)	(0.043)	(0.056)	(0.041)
Asy-Disp	-0.245***	-0.183***				
	(0.038)	(0.031)				
Asy-Er			-0.176***	-0.113***		
			(0.023)	(0.020)		
Asy-Dum					-0.270***	-0.197***
					(0.032)	(0.021)
Constant	2.193***	5.045***	2.285***	5.215***	2.216***	4.946***
	(0.224)	(0.575)	(0.230)	(0.597)	(0.216)	(0.569)
N	9469	9469	9098	9098	9527	9527
R^2	0.167	0.176	0.171	0.181	0.174	0.182
N_clust	1409	1409	1388	1388	1410	1410

This table presents the OLS and FE estimation results of the effects of information asymmetry and leverage on firm value. Models 2, 4 and 6 include firm fixed effect. Time dummies are included in all estimations. Standard error robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4: Information asymmetry, leverage and firm value with interactions

	OLS	FE	OLS	FE	OLS	FE
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lev	-0.814***	-0.467**	-0.793***	-0.464**	-1.003***	-0.576***
	(0.189)	(0.182)	(0.192)	(0.191)	(0.233)	(0.201)
Tang	-0.229***	-0.246	-0.220**	-0.257	-0.228***	-0.276
	(0.085)	(0.208)	(0.086)	(0.210)	(0.084)	(0.209)
Size	-0.056***	-0.275***	-0.062***	-0.286***	-0.054***	-0.265***
	(0.015)	(0.046)	(0.015)	(0.047)	(0.014)	(0.046)
Growth	0.543***	0.374***	0.528***	0.386***	0.546***	0.365***
	(0.056)	(0.043)	(0.057)	(0.043)	(0.056)	(0.041)
Asy-Disp	-0.258***	-0.258***				
	(0.063)	(0.050)				
Lev x Asy-Disp	0.076	0.462**				
	(0.235)	(0.182)				
Asy-Er			-0.181***	-0.166***		
			(0.043)	(0.032)		
Lev x Asy-Er			0.034	0.298***		
			(0.147)	(0.108)		
Asy-Dum					-0.343***	-0.283***
					(0.061)	(0.040)
Lev x Asy-Dum					0.404*	0.475***
					(0.234)	(0.144)
Constant	2.196***	5.068***	2.286***	5.241***	2.258***	5.015***
	(0.224)	(0.575)	(0.230)	(0.595)	(0.218)	(0.570)
N	9469	9469	9098	9098	9527	9527
R^2	0.167	0.177	0.171	0.182	0.175	0.184
N_clust	1409	1409	1388	1388	1410	1410

This table presents the OLS and FE estimation results for the main and interaction effects of information asymmetry and leverage on firm value. Models 2, 4 and 6 include firm fixed effect. Time dummies are included in all estimations. Standard error robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 5: Effects of information asymmetry on firm value at specified levels of leverage

Leverage at:	25th%	50th%	75th%	25th% - 75th%	Based on reg:
Asy variable:					
Asy-Disp	-0.255***	-0.245***	-0.237***	-0.017	Table 4, column 1
Asy-Disp	-0.240***	-0.183***	-0.132***	-0.108***	Table 4, column 2
Asy-Er	-0.792***	-0.791***	-0.787***	-0.008	Table 4, column 3
Asy-Er	-0.154***	-0.118***	-0.085***	-0.070***	Table 4, column 4
Asy-Dum	-0.327***	-0.278***	-0.233***	0.094*	Table 4, column 5
Asy-Dum	-0.264***	-0.206***	-0.153***	0.111***	Table 4, column 6

This table presents the marginal effect analysis of the results presented in Table 4. Marginal effects are evaluated at the 25th, 50th and 75th percentiles of leverage. Standard errors are in parentheses. The sample and variable definitions are as described in Table 1

* Indicates significance at 10%.
*** Indicates significance at 1%.

Table 6: Information asymmetry, leverage and firm value - pre-crisis, crisis and post-crisis

	ASY-Disp		ASY-Er		ASY-Dum	
	FE	FE	FE	FE	FE	FE
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lev	-0.354**	-0.460**	-0.359*	-0.453**	-0.321*	-0.563***
	(0.178)	(0.183)	(0.185)	(0.192)	(0.175)	(0.202)
Tang	-0.226	-0.238	-0.237	-0.247	-0.266	-0.270
	(0.206)	(0.206)	(0.209)	(0.209)	(0.207)	(0.208)
Size	-0.276***	-0.275***	-0.287***	-0.287***	-0.265***	-0.266***
	(0.046)	(0.046)	(0.047)	(0.047)	(0.045)	(0.046)
Growth	0.373***	0.376***	0.386***	0.389***	0.366***	0.365***
	(0.043)	(0.042)	(0.044)	(0.043)	(0.041)	(0.041)
Asy	-0.035	-0.099	-0.083**	-0.126***	-0.138***	-0.222***
	(0.065)	(0.073)	(0.042)	(0.045)	(0.041)	(0.051)
Pre-crisis	0.043	0.047	0.468***	0.470***	0.042	0.041
	(0.032)	(0.032)	(0.041)	(0.041)	(0.038)	(0.037)
Post-crisis	-0.241***	-0.243***	0.188***	0.188***	-0.224***	-0.228***
	(0.049)	(0.049)	(0.032)	(0.032)	(0.051)	(0.052)
Pre-crisis x Asy	-0.147**	-0.166**	-0.009	-0.021	-0.047	-0.046
	(0.073)	(0.074)	(0.049)	(0.051)	(0.047)	(0.047)
Post-crisis x Asy	-0.249***	-0.240***	-0.126***	-0.127***	-0.143***	-0.131***
	(0.081)	(0.080)	(0.049)	(0.049)	(0.050)	(0.050)
Lev x Asy		0.453**		0.282**		0.451***
		(0.184)		(0.114)		(0.146)
Constant	5.043***	5.061***	4.784***	4.805***	4.963***	5.029***
	(0.555)	(0.555)	(0.581)	(0.580)	(0.551)	(0.551)
N	9469	9469	9098	9098	9527	9527
R^2	0.178	0.179	0.183	0.184	0.183	0.185
N_clust	1409	1409	1388	1388	1410	1410

This table presents the fixed effect estimation results for the main and interaction effects of information asymmetry, leverage and crisis on the firm value. Year dummies are included in all estimations. Standard error robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 7: Pre- and post-crisis effects of information asymmetry on firm value at specified levels of leverage

Leverage at:	25th%	50th%	75th%	25th% - 75th%	Based on regression:
Asy variable:					
Asy-Disp:	-0.247***	-0.192***	-0.141***	-0.106**	Table 6, column 2
	-0.321* **	**-0.266*** **	**-0.216*** **	**-0.106** **	**Table 6, column 2**
Asy-Er:	-0.136***	-0.102***	-0.070***	-0.066**	Table 6, column 4
	-0.242* **	**-0.207*** **	**-0.176*** **	**-0.066** **	**Table 6, column 4**
Asy-Dum:	-0.250***	-0.196**	-0.145***	0.105***	Table 6, column 6
	-0.335* **	**-0.280*** **	**-0.230*** **	**0.105*** **	**Table 6, column 6**

This table presents the marginal effect analysis of the results presented in Table6. Marginal effects are evaluated at the 25th, 50th and 75th percentiles of leverage. Standard errors are in parentheses. The text in bold fonts shows the post-crisis effects whilst that in non-bold font shows the pre-crisis effects. The sample and variable definitions are as described in Table 1

** Indicates significance at 5%.
*** Indicates significance at 1%.

Table 8: Information asymmetry, leverage and firm value – interactions with growth opportunities

	Asy-Disp			Asy-Er			Asy-dum		
	FE	FE	FE	FE	FE	FE	FE	FE	FE
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Lev	-0.237	-0.323*	-0.311*	-0.248	-0.329*	-0.317*	-0.187	-0.395**	-0.382**
	(0.169)	(0.172)	(0.174)	(0.175)	(0.183)	(0.184)	(0.166)	(0.189)	(0.190)
tang	-0.204	-0.213	-0.203	-0.226	-0.233	-0.224	-0.253	-0.255	-0.249
	(0.201)	(0.201)	(0.199)	(0.202)	(0.202)	(0.201)	(0.199)	(0.200)	(0.199)
Size	-0.263***	-0.263***	-0.264***	-0.275***	-0.275***	-0.277***	-0.251***	-0.252***	-0.254***
	(0.044)	(0.044)	(0.044)	(0.046)	(0.046)	(0.046)	(0.043)	(0.043)	(0.043)
Growth	0.325***	0.327***	0.329***	0.340***	0.342***	0.345***	0.317***	0.316***	0.317***
	(0.042)	(0.042)	(0.042)	(0.043)	(0.043)	(0.043)	(0.041)	(0.041)	(0.041)
Asy	-0.363***	-0.418***	-0.290***	-0.247***	-0.289***	-0.268***	-0.185***	-0.257***	-0.222***
	(0.049)	(0.059)	(0.084)	(0.046)	(0.051)	(0.064)	(0.022)	(0.035)	(0.048)
Low Growth	-0.211***	-0.209***	-0.209***	-0.220***	-0.220***	-0.220***	-0.239***	-0.240***	-0.241***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.027)	(0.027)	(0.027)
High Growth	0.416***	0.415***	0.417***	0.415***	0.413***	0.413***	0.530***	0.525***	0.525***
	(0.030)	(0.030)	(0.030)	(0.031)	(0.031)	(0.031)	(0.038)	(0.037)	(0.037)
Low Growth x Asy	0.337***	0.327***	0.323***	0.239***	0.235***	0.238***	0.148***	0.149***	0.149***
	(0.053)	(0.053)	(0.054)	(0.047)	(0.049)	(0.050)	(0.037)	(0.037)	(0.038)
High Growth x Asy	0.005	0.004	-0.014	-0.039	-0.029	-0.022	-0.247***	-0.239***	-0.237***
	(0.065)	(0.065)	(0.065)	(0.065)	(0.066)	(0.067)	(0.043)	(0.043)	(0.043)
Lev x Asy		0.372**	0.337*		0.242**	0.220**		0.387***	0.361***
		(0.174)	(0.177)		(0.103)	(0.108)		(0.136)	(0.137)
Prec-crisis			0.008			0.295***			-0.005
			(0.031)			(0.044)			(0.036)
Post-crisis			-0.166***			0.135***			-0.152***
			(0.048)			(0.031)			(0.050)

Pre-crisis x Asy			-0.103			0.003			-0.010
			(0.077)			(0.051)			(0.046)
Post-crisis x Asy			-0.221***			-0.118**			-0.116**
			(0.083)			(0.047)			(0.048)
Constant	4.739***	4.758***	4.761***	4.926***	4.948***	4.656***	4.605***	4.664***	4.700***
	(0.557)	(0.557)	(0.537)	(0.576)	(0.575)	(0.560)	(0.541)	(0.542)	(0.525)
N	9469	9469	9469	9098	9098	9098	9527	9527	9527
R^2	0.235	0.236	0.237	0.242	0.243	0.244	0.247	0.248	0.249
N_clust	1409.000	1409.000	1409.000	1388.000	1388.000	1388.000	1410.000	1410.000	1410.000

This table presents the fixed effect estimation results for the main and interaction effects of information asymmetry, leverage, crisis and growth on the value of firms with different degrees of growth opportunities. Low-growth firms are defined as firms at the bottom one-third quantile of growth opportunities. High-growth firms are defined as firms at the top one-third quantile of growth opportunities. Growth opportunity is measured as the ratio of share price to earnings per share (P/E ratio). Year dummies are included in all estimations. Standard error robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 9: Information asymmetry, leverage and firm value - 2-Step GMM

	Asy-Disp			Asy-Er			Asy-Dum		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Lev	-0.724**	-0.737**	-0.436	-0.601*	-0.593*	-0.309	-0.816**	-0.816**	-0.431
	(0.311)	(0.312)	(0.295)	(0.318)	(0.319)	(0.302)	(0.327)	(0.326)	(0.306)
Tang	-0.214	-0.228	-0.218	-0.266	-0.258	-0.254	-0.246	-0.238	-0.246
	(0.208)	(0.208)	(0.202)	(0.211)	(0.210)	(0.203)	(0.211)	(0.211)	(0.202)
Size	-0.253***	-0.248***	-0.252***	-0.259***	-0.259***	-0.267***	-0.236***	-0.236***	-0.237***
	(0.045)	(0.045)	(0.044)	(0.047)	(0.047)	(0.045)	(0.045)	(0.045)	(0.043)
Growth	0.375***	0.377***	0.330***	0.384***	0.388***	0.345***	0.365***	0.365***	0.318***
	(0.043)	(0.043)	(0.043)	(0.044)	(0.044)	(0.044)	(0.042)	(0.042)	(0.042)
Asy	-0.299***	-0.138*	-0.471***	-0.189***	-0.142***	-0.318***	-0.277***	-0.229***	-0.235***
	(0.054)	(0.073)	(0.059)	(0.036)	(0.047)	(0.054)	(0.042)	(0.053)	(0.037)
Lev X Asy	0.690***	0.690***	0.618***	0.436***	0.413***	0.394***	0.460***	0.442***	0.295**
	(0.211)	(0.212)	(0.205)	(0.134)	(0.139)	(0.128)	(0.160)	(0.161)	(0.149)
Prec-crisis		0.499***			0.479***			0.469***	
		(0.044)			(0.041)			(0.049)	
Post-crisis		0.450***			0.450***			0.434***	
		(0.047)			(0.045)			(0.050)	
Pre-crisis x Asy		-0.175**			-0.028			-0.031	
		(0.074)			(0.051)			(0.047)	
Post-crisis x Asy		-0.243***			-0.134***			-0.120**	
		(0.077)			(0.049)			(0.050)	
Low Growt			-0.211***			-0.219***			-0.240***

			(0.022)			(0.022)			(0.027)
High Growth			0.417***			0.416***			0.533***
			(0.030)			(0.031)			(0.037)
Low Growth x Asy			0.334***			0.235***			0.145***
			(0.052)			(0.050)			(0.037)
High Growth x Asy			0.007			-0.021			-0.253***
			(0.063)			(0.067)			(0.043)
N	9287	9287	9287	8899	8899	8899	9357	9357	9357
R^2	0.178	0.179	0.237	0.182	0.183	0.243	0.184	0.185	0.250
Hanen J P-value	0.192	0.117	0.533	0.159	0.134	0.652	0.130	0.115	0.381
K-P W F-stat	209.336	260.019	254.055	266.027	265.689	257.785	261.130	260.847	254.788

This table presents the GMM estimation results for the main and interaction effects of information asymmetry, leverage and crisis on firm value. Year dummies are included in all estimations. Standard error robust to heteroscedasticity and clustering within firm are given in parentheses. The sample and variable definitions are as described in Table 1.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.