The influence of cash flow volatility on firm use of debt of different maturities or zero-debt: International evidence

Michael O'Connor Keefe
Victoria University of Wellington
School of Economics and Finance
PO Box 600, Wellington 6140, NZ
Email: michael.keefe@vuw.ac.nz
Phone: 64 4 463 5708
Fax: 64 4 463 5014

Nguyen Thi Thu Huyen
Victoria University of Wellington
School of Economics and Finance
PO Box 600, Wellington 6140, NZ
Email: huyen.nguyen@vuw.ac.nz
Phone: 64 4 463 5218

Current Draft: 17th November, 2018

Declarations of interest: none

The influence of cash flow volatility on firm use of debt of different maturities or zero-debt: International evidence

Abstract The empirical international literature on the relationship between firm cash flow volatility and debt maturity and firm zero-debt policies is disputed. Using a large international sample, we find that firms with relatively high cash flow volatility use shorter-term debt. Likewise, firms with higher cash flow volatility are more likely to use zero debt. Lastly, the economic importance of cash flow volatility on firm use of debt at different maturities or zero-debt is lower in emerging markets and developing economies.

Keywords: Debt Maturity, Zero Debt, Cash Flow Volatility, Emerging Markets, Developing Economies, Advanced Economies

JEL Codes: G32 Financing Policy; G15 International Financial Markets

Declarations of interest: none

1 Introduction

A firm chooses not only its mixture of debt and equity but also its debt maturity. Theories suggest firms use debt of different maturities to avoid potential corporate liquidation, relieve agency costs, retain financing flexibility and signal earnings quality (Zulfiqar, Yan, Muhammad, and Hashmat, 2018). The screening theory and the trade-off theory are two prominent theories that explain the influence of firm's cash flow volatility on debt maturity. According to the screening theory, low-quality firms are screened out of the long-term debt market and only high-quality firms can borrow using long-term debt (Diamond, 1991, Stiglitz and Weiss, 1981). Guedes and Opler (1996) use cash flow volatility to proxy firms credit quality and posit that firms with high volatile cash flow are of low-quality and can only use shorter-term debt. Moreover, Kane, Marcus, and McDonald (1985) extend the trade-off theory and model that optimal maturity decreases with asset volatility, reflecting the fact that firms with less volatile asset returns re-balance their capital structure less frequently. Both theories suggest that firms with lower volatility use longer-term debt.

We choose to study the influence of cash flow volatility on debt maturity and zero-debt in an international setting because of the disputed empirical evidence and the limited studies of these two relationships involving global approach. Although the effect of cash flow volatility on debt maturity in U.S firms is consistent, the papers studying this relationship in non-U.S economies report mixed results (Antoniou, Guney, and Paudyal, 2006, Deesomsak, Paudyal, and Pescetto, 2009, Kirch and Terra, 2012, Orman and Köksal, 2017, Zulfiqar, Yan, Muhammad, and Hashmat, 2018). Only two papers studying this relationship employ international data. While Zheng, Ghoul, Guedhami, and Kwok (2012) find a negative relationship between return volatility and debt maturity, González (2017) find no evidence that earnings volatility affects debt maturity. The idea that non-US evidence is inconsistent suggest that institutional and country differences might affect the relationship in a way different than in the U.S. For this reason, re-examining the influence of cash flow volatility on debt maturity using an international sample is an important question.

In addition, there are limited understanding of zero-debt firms, especially in considering the influence of cash flow volatility on this prevalent phenomenon. Although corporate finance theories advocate benefits of using debt, the percentage of firms holding zero-debt in their

capital structure has sharply increased over time not only in the U.S but also in other financial markets (Bessler, Drobetz, Haller, and Meier, 2013). Most of the previous studies explain this phenomenon using the U.S data and only three papers investigate the influence of cash flow volatility on this policy. Using the data of U.S firms, Strebulaev and Yang (2013) find that earnings volatility is negatively associated with the probability of firms following almost zero-leverage policy, whereas, Keefe and Yaghoubi (2016) find a positive relationship between cash flow volatility and the probability of firms using zero-debt. In contrast, Dang (2013) find that earnings volatility has no effect on zero-leverage policies of UK firms. Only Ghoul, Guedhami, Kwok, and Zheng (2017) study this phenomenon in a large sample of 73 countries over the 1990-2010 period. They find that earnings volatility is negatively associated with zero-leverage firms. However, Devos, Dhillon, Jagannathan, and Krishnamurthy (2012), Bessler, Drobetz, Haller, and Meier (2013) find evidence that zero-debt firms are unable to secure debt financing, which suggests the positive relationship between cash flow volatility and zero-debt policies. Therefore, in this study, we use the multiple measures of zero-debt policies and cash flow volatility to re-examine the influence of cash flow volatility on zero-debt policies in a global context.

We construct a large firm-year sample. To collect firm accounting information, we combine Fundamentals Annual Database from Compustat Global and CRSP/Compustat Merged. To collect the security prices, we use Security Daily Database from Compustat Global. To exchange all local currencies to U.S dollars, we collect exchange rate from International Financial Statistics, which is provided by the IMF.[1] After performing several data filters, we have a final sample of 248,470 firm-year observations in 72 countries over the 1993-2015 period. To mitigate the predominance of the North American observations, we split our sample into three sub-samples; (i) 38 emerging markets and developing economies, (ii) 32 non-US/Canada advanced economies, and (iii) the U.S and Canada.

The variable of interest in our study is cash flow volatility. The prior literature refers to cash flow volatility by different names and estimates it using several methods. Names of cash flow volatility include earning volatility (Miltersen and Torous, 2008, González, 2015), asset volatility (Stohs and Mauer, 1996), industry earnings variability (Guedes and Opler, 1996), return volatility (Zheng, Ghoul, Guedhami, and Kwok, 2012) and cash flow volatility (Minton

[1]Most of our variables are ratios. For the variable which is in absolute value, we exchange its unit from local currencies to U.S dollars.

and Schrand, 1999, Keefe and Yaghoubi, 2016). However, all of these measures use the change in operating cash flow over a period of time. To construct cash flow volatility measures, we follow the approach of Keefe and Yaghoubi (2016). First, we define cash flow as operating income before depreciation. Second, cash flow measures are scaled by net assets. Third, we choose the window size of five years and estimate the volatility of cash flow measures using the rolling standard deviation method of Kim and Sorensen (1986) in the main regressions. Lastly, in robustness tests, we use the other two estimations of cash flow volatility measure using the rolling standard deviation of first difference method of Stohs and Mauer (1996) and using the panel regression method of De Veirman and Levin (2011). We also use different window lengths. We find that our conclusions are qualitatively unchanged regardless of which measure or window is used.

To analyze the influence of cash flow volatility on debt maturity and zero-debt policies, we construct a categorical dependent variable. Using Compustat definitions, we define three categories based on a firm using or not using debt with different maturities. We place a firm in category one if it holds long-term debt. We place a firm in category two if it only uses short-term debt. Lastly, if a firm does not hold any long-term and short-term debt, we place it in category three, which matches the definition of zero-debt firms of Strebulaev and Yang (2013) and Bessler, Drobetz, Haller, and Meier (2013). In summary, as our maturity variable increases from one to three, the firm uses debt of shorter maturity.

After controlling for various firm-level characteristics, we document an important role of cash flow volatility in both cross-sectional and panel data estimation methods. We find that cash flow volatility explains both debt maturity and the use of zero-debt at less than 1% level of significance. Our results are also economically important. A one standard deviation increase in cash flow volatility implies a 3.73% decrease in the probability of firms using long-term debt, but a 1.37% increase in the probability of firms using short-term debt. Likewise, a one standard deviation increase in cash flow volatility implies a 2.36% increase in the probability of firms using no debt. We also find that firms with relatively high cash flow volatility are more likely to pursue zero-leverage policies. Overall, our results are consistent with the screening out theory (Guedes and Opler, 1996) and the trade-off theory (Kane, Marcus, and McDonald, 1985).

Our results differ by sub-sample in terms of firm's characteristics, firm use of zero-debt and the influence of cash flow volatility among groups of countries. To be more specific, the average firm in the U.S and Canada group has the highest growth opportunities and cash flow volatility but the shortest asset maturity, the lowest tangible asset and negative abnormal earnings. The U.S/Canada group has the highest percentage of zero-leverage firms (16%). Also, the influence of cash flow volatility on debt maturity and the probability of firms using zero-debt are highest in this group. In contrast, the average firm in the non-U.S/Canada developed economies has the lowest growth opportunities and profitability but the largest size. Finally, the average firm in the emerging markets and developing economies have the smallest size and the lowest cash flow volatility but they have the longest asset maturity, the highest tangible assets and profitability. We also record the lowest percentage of firms following zero-debt policy (9.48%) and the less importance of cash flow volatility in explaining debt maturity and zero-debt policy in the emerging group. For example, relative to unconditional means of zero-debt policies, one standard deviation increase in cash flow volatility represents a 11.48% actual change in the probability of firms using zero-debt in the emerging group, which is lower compared to the U.S/Can group, of 22.45%.

This study employs several tests to investigate the robustness of our findings. First, we include a tax variable as a proxy for the possible effect of tax on debt maturity.[2] Second, we use an alternative measure of debt maturity and three different measures of cash flow volatility using window lengths of one to five years to re-estimate the influence of cash flow volatility on debt maturity. Finally, we re-estimate the influence of cash flow volatility on the zero-debt policy using the alternative zero-debt measure of Devos, Dhillon, Jagannathan, and Krishnamurthy (2012). While applying these various robustness tests, our results remain qualitatively unchanged.

We organize the remainder of this paper as follows. The following section briefly reviews the literature, then develops our hypotheses. We describe the data and variable construction in Section 3. Section 4 discusses the methodology we employ and reports our main results. We use several robustness checks in Section 5. Finally, Section 6 provides the concluding remarks.

[2]We use two main theories which are the agency cost theory and the signaling theory to build a set of control variables. The effect of the tax theory on determining debt maturity are inconclusive, thus we we check it in our robustness section.

2 Related literature and hypotheses development

Although a growing body of literature using US data studies the determinants of debt maturity, only a few studies examine the influence of cash flow volatility in explaining debt maturity. These studies draw upon different theoretical frameworks. Based on the screening out hypothesis, Guedes and Opler (1996) argue that cash flow volatility is a proxy for firm credit quality. Because the rate of return required to compensate investors for bearing long-term credit risk can induce substitution into risky low-quality projects (Diamond, 1991, Stiglitz and Weiss, 1981), Guedes and Opler (1996) argue that low-quality firms are screened out of the long-term debt market and only high-quality firms are able to borrow in the long-term credit market. They exploit the new debt issues in U.S firms and find that the industry earnings volatility is negatively associated with the probability of firms issuing debt of 30-year or more maturity compared to debt of 1-9 year maturity.[3] Also, Johnson (2003) uses cash flow volatility to measure credit risk and argue that firms with more volatile cash flows are likely to experience more states of the world where repaying debt is difficult. They predict a negative relationship between cash flow volatility and debt maturity. However, they find the opposite empirical evidence that cash flow volatility is statistically significant and positively associated with debt maturity, and this relationship is insignificant in fixed effects model.[4]

Based on the trade-off theory, Kane, Marcus, and McDonald (1985) develop a continuous time model which determines endogenously optimal debt maturity and incorporates bankruptcy cost, issuing debt cost and tax advantage. They establish that optimal debt maturity increases as firm value volatility decreases, which is consistent with a firm with less asset return volatility re-balancing its capital structure less frequently. Using the U.S data, Stohs and Mauer (1996) test this model and use cash flow volatility as a proxy for firm assets volatility. They find that cash flow volatility is negatively associated with debt maturity, however, this relationship is only statistically significant in pooled time-series cross-sectional regression and not significant in time series average cross-sectional regression.[5]

[3]Guedes and Opler (1996) use multinomial logit regression predicting whether an issue is in a maturity class of 1-9 years, 10-19 years, 20-29 years, or 30 years or more. Using 1-9 years class as a baseline model, they find that industry earning volatility is negative related to long-term debt, but only significantly in firms issuing 30 or more years debt and insignificantly in other groups.

[4]Johnson (2003) measure debt maturity as the proportion of total debt maturing in three years or less.

[5]Note that Stohs and Mauer (1996) measure cash flow volatility as a purely cross-sectional variable since there is one observation per firm in the panel.

More recently, Miltersen and Torous (2008) report evidence that U.S firms with higher EBIT volatility have debt with shorter average maturity. Similarly, Keefe and Yaghoubi (2016) find that the probability using long-term debt in the U.S firms decreases with cash flow volatility whereas the probability of holding short-term debt increases with volatility. This relationship is statistically significant at less than 1% in both cross-sectional and panel data tests. In summary, the literature finds the negative relation between cash flow volatility and the use of long-term debt and the positive relation between cash flow volatility and the use of short-term debt in U.S firms.

Several papers investigate the relationship between cash flow volatility and debt maturity in other countries than the U.S, however, these studies report the mixed evidence of this relationship. For example, Antoniou, Guney, and Paudyal (2006) study the determinants of debt maturity in France, Germany and the UK. They find that the effect of earnings volatility on debt maturity is not significantly in German firms, is positively in French firms and is negatively in British firms. Deesomsak, Paudyal, and Pescetto (2009) study debt maturity structure of Pacific Basin countries, including Singapore, Thailand, Malaysia and Australia and they find that earnings volatility has a negative effect on debt maturity only in Singapore and has no effect in other countries. Orman and Köksal (2017) find that firm value volatility[6] is not significant in explaining debt maturity of Turkish firms. Kirch and Terra (2012) find a statistically significant and positive relationship between the standard deviation of profitability and debt maturity across five South American countries between 1996 and 2007. To date, Zulfiqar, Yan, Muhammad, and Hashmat (2018) find the negative relationship between cash flow volatility and debt maturity in Chinese firms. Overall, these papers outline a disputed role of cash flow volatility in determining debt maturity.

The studies comparing the use of debt at different maturities in an extensive number of countries are limited. For example, Demirgüç-Kunt and Maksimovic (1999) examine debt maturity in 30 countries during the period 1980-1991. This study provides evidence that large firms which have high ratios of net fixed assets to total assets use debt at longer maturity. Fan, Titman, and Twite (2012) conduct an international comparison between 39 developed and developing countries in debt maturity choices over the period 1991-2006. At the firm level, they

[6] which is calculated by the standard deviation of operating income over total assets over the current and past two years

find evidence that long-term debt is used more by firms with greater asset tangibility, larger size and higher profit. Cash flow volatility is not tested in either study as a factor to explain debt maturity. Two papers test the relationship between cash flow volatility and debt maturity in an international setting but find the different results. Zheng, Ghoul, Guedhami, and Kwok (2012) find a negative relationship between return volatility and debt maturity in 40 countries from 1991 to 2006. Conversely, González (2017) study debt maturity determinants in 39 countries during the period 1995-2012 and find that earnings volatility is insignificantly associated with debt maturity.

Most of the prior literature measure debt maturity as the ratio $R = \frac{LTD(CFV)}{TD(CFV)}$ of long-term debt to total debt. Both the denominator and the numerator are functions of cash flow volatility. To understand the effect of a change in cash flow volatility on the ratio R, we take the derivative of R with respect to cash flow volatility CFV to find

$$\frac{\partial R}{\partial CFV} = \frac{\overbrace{\frac{\partial LTD(CFV)}{\partial CFV}}^{\text{A}}}{TD(CFV)} - \frac{\overbrace{\frac{\partial TD(CFV)}{\partial CFV}}^{\text{B}}}{[TD(CFV)]^2} LTD(CFV). \tag{1}$$

If $\frac{\partial LTD(CFV)}{\partial CFV}$ is negative, the first term (A) of Eq. (1) is negative. According to Keefe and Yaghoubi (2016), $\frac{\partial TD(CFV)}{\partial CFV}$ is negative, which implies the second term (-B) of Eq. (1) is positive. The sign of $\frac{\partial R}{\partial CFV}$ depends on the relative magnitudes of the first and the second terms and thus the effect of cash flow volatility on R is ambiguous.

In addition to the measurement of debt maturity noted above, the mixed evidence of the impact of cash flow volatility on debt maturity in non U.S economies maybe relate to institutional and country differences. For this reason, re-examining this relationship using an international sample is an important question. Based on the consistent evidence in U.S firms, we expect that firms with high volatile cash flow use shorter-term debt, implying:

Hypothesis 1. *The probability of a firm using debt of shorter (longer) maturity increases (decreases) with cash flow volatility, ceteris paribus.*

At the extreme, the shortest debt maturity a firm can choose to use is zero-debt. Although corporate finance theories such as the trade-off theory (Kraus and Litzenberger, 1973) or the pecking order theory (Myers and Majluf, 1984) explain the benefits of using debt by either tax

shields or lower costs of asymmetric information, these theories are unable to explain why firms use zero-debt in their capital structure. Recent empirical studies find the explanations for this increasingly prevalent phenomenon (Devos, Dhillon, Jagannathan, and Krishnamurthy, 2012, Strebulaev and Yang, 2013, Bessler, Drobetz, Haller, and Meier, 2013, Dang, 2013, Keefe and Yaghoubi, 2016). Strebulaev and Yang (2013) include earnings volatility, which is computed as the volatility of earnings before interests, taxes and depreciation to book assets ratio calculated for the past 10 years in the U.S during the period of 1962-2009 and find that earnings volatility is negatively associated with the likelihood to follow almost zero-leverage policy of U.S firms. In contrast to Strebulaev and Yang (2013), Dang (2013) find that earnings volatility plays no role in a firm's zero-leverage policy in the UK, whereas, Keefe and Yaghoubi (2016) find the positive relationship between cash flow volatility and the probability of U.S firms using zero-debt. Likewise, Ghoul, Guedhami, Kwok, and Zheng (2017) study this phenomenon across 73 developed and developing countries over the 1990-2010 period and they find that earnings volatility is statistically significant and negatively associated with the probability of firms choosing zero book debt. However, Devos, Dhillon, Jagannathan, and Krishnamurthy (2012), Bessler, Drobetz, Haller, and Meier (2013) report that zero-debt firms are unable to secure debt financing. Thus, in this study, we expect that when firms have high cash flow volatility, they are more likely to hold zero-debt, which leads to:

Hypothesis 2. *The probability of a firm using zero-debt increases with cash flow volatility, ceteris paribus.*

3 Sample and variable construction

This section describes our data sources; explains our sample selection procedures; provides the methods used to construct the dependent variable, the main explanatory variables and other control variables. Also, it presents and discusses the summary statistics of these variables employed in our empirical models.

3.1 Sample Construction

The primary source we use to collect data is Wharton Research Data Service (WRDS). First, we collect accounting information for firms in all countries from Compustat Global - Fundamentals

Annual. Second, we collect accounting information for firms in the U.S and Canada from Center for Research in Securities Price (CRSP)/Compustat Merged - Fundamentals Annual. Third, to obtain the market value of equity information for firms in countries other than the U.S and Canada, we collect the common stock price and the number of outstanding shares from Compustat Global - Security Daily. We append the U.S/Canada dataset to the international dataset and then merge with the stock market price dataset. We obtain average annual exchange rates of each currency per U.S dollar of each country from International Financial Statistics (IFS) provided by IMF.

We follow the literature and perform several data filters. We exclude utilities (Standard Industrial Classification(SIC) codes 4000-4999), financial (SIC code 6000-6999) and public sector entities (SIC code 9000-9999). We eliminate firms with negative and missing total assets (at) and revenue ($revt$). We drop firms with the missing value of operating income before depreciation ($oibdp$). We drop countries with less than 20 observations. The final sample consists of 248,470 firm-year observations in 72 countries over the period 1993-2015.[7] In comparison, Fan, Titman, and Twite (2012) have 224,527 firm-year observations from 39 countries and during the period of 1991-2006. We note our cash flow volatility variable requires 5 years of firm-year data.

Table 1 provides the number of firm-year observations for each country. Similar to other international studies, the U.S makes up the largest share of the entire sample (26.58%) with 66,045 observations. In order to mitigate the predominance of the U.S observations, we split our sample into three sub-samples: (i) 38 emerging markets and developing economies, (ii) 32 non-U.S/Canada advanced economies, and (iii) the U.S and Canada. We use the classification into emerging markets and developing economies and advanced economies based on the IMF's World Economic Outlook and the CIA World Factbook (Döring, Drobetz, Janzen, and Meier, 2017).[8] The emerging market and developing countries account for 28.66% of the number of observations whereas the figure for the non-U.S/Canada advanced economies group is 43.9%.

[7]We only report the final sample of the main regression. The number of firm-year observations can vary depending on regressions.

[8]Other papers use Morgan Stanley Composite Index (MSCI) market classification which only has 23 developed markets and 24 emerging markets or World Bank/Union Nations classification which is only based on gross national income (GNI) level.

3.2 Dependent variable - Debt maturity

Finance researchers use several measures of debt maturity. Most of the previous studies define debt maturity as the proportion of long-term debt over total debt (Barclay and Smith, 1995, Demirgüç-Kunt and Maksimovic, 1999, Valev, 2007, Fan, Titman, and Twite, 2012, Kirch and Terra, 2012). Demirgüç-Kunt and Maksimovic (1999) and Fan, Titman, and Twite (2012) follow the accounting classification and define debt that matures in greater than one year as long-term. Barclay and Smith (1995) calculate debt with a maturity of more than three years as long-term debt whereas Valev (2007) takes into account long-term debt if that debt is due in 5 years or more. In contrast, using hand-collected data, Stohs and Mauer (1996) measure debt maturity structure as the weighted average maturity of its entire liability structure, including all debt, debt-like obligations and current liabilities.[9]

As we mentioned in Section 2, the ratio of long-term debt to total debt is not a clean measure of debt maturity. Although Zheng, Ghoul, Guedhami, and Kwok (2012) and González (2017) use this ratio, they report the inconsistent evidence of the influence of cash flow volatility on debt maturity. We use the ratio of long-term debt to total assets as a modification of this measure in the robustness tests section.

Recently, Keefe and Yaghoubi (2016) classify debt maturity into five categories. Category 1 a firm uses debentures and might possibly use both debentures and notes; Category 2 a firm holds notes, but does not hold debentures; Category 3 a firm holds long-term debt but does not hold debentures or notes; Category 4 a firm holds debt in current liabilities and Category 5 a firm holds zero long or short-term debt. We follow the approach of Keefe and Yaghoubi (2016) to construct our debt maturity variable.

Due to data limitations in Compustat Global - Fundamentals Annual, we modify the debt maturity measure of Keefe and Yaghoubi (2016) and construct the ordered categorical measure *DebtMaturity(1/3)*. Compustat Global - Fundamentals Annual provides the following debt categories: *dlc* - debt in current liabilities, which represents the total amount of short-term notes and the current portion of long-term debt (debt due in one year); *np* represents the total amount of short-term notes and is a component of *dlc*; *cmp* - commercial paper, also is a component of *dlc*; *dd1* represents the total long-term debt falling due within the first year;

[9]This level of detail is not available in our Global Compustat.

dltt represents debt obligations due in more than one year; *lt* represents current liabilities plus long-term debt plus other non-current liabilities, including deferred taxes and investment tax credits. *DebtMaturity(1/3)* is set to one when a firm uses long-term debt and possibly both long and short-term debt, to two when a firm holds only short-term debt, and to three when a firm uses no debt in its capital structure. Our Category 3 criterion matches the definition of zero-leverage firms of Strebulaev and Yang (2013) and Bessler, Drobetz, Haller, and Meier (2013). As a robustness test, we follow Devos, Dhillon, Jagannathan, and Krishnamurthy (2012) and define a firm-year as zero-debt (Category 3) if the firm does not use any short-term or long-term debt for three consecutive years ending in that year. Table 2 provides the construction of these dependent variables.

3.3 Variable of interest - Cash flow volatility

The main variable of interest in our research is cash flow volatility, which researchers measure in several ways. Some researchers define cash flow volatility by the coefficient of variation of cash flow over a period of time. For example, Kim and Sorensen (1986) proxy business risk as the coefficient of variation in earnings before interest and taxes (*ebit*) measured over the years 1970 to 1980. Kale, Noe, and Ram (1991) use the standard deviation of cash flow (operating income before depreciation, interest and taxes) in the 19-year period before two years of 1984 and 1985 scaled by the mean of the current year cash flow. Minton and Schrand (1999) use the coefficient of variation in a firm's quarterly operating cash flow over the six-year period preceding each of the seven sample years from 1989 to 1995. They scale their measure by the absolute value of the mean over the same period. Others scale cash flow volatility by total assets. For instance, Stohs and Mauer (1996) measure cash flow volatility by the standard deviation of first differences in earnings before interest, taxes and depreciation (*ebitd*), scaled by the average book value of assets. Wald (1999) use the standard deviation of first differences in the ratio of *ebit* divided by total assets as the measure of risk. de Jong, Kabir, and Nguyen (2008) use the standard deviation of operating income over book value of total assets during the sample period of five years between 1997 and 2001. Keefe and Yaghoubi (2016) evaluate three method to construct cash flow volatility including Kim and Sorensen (1986), Stohs and Mauer

(1996) and De Veirman and Levin (2011). Using these different methods as well as different window lengths, they find qualitatively identical results.

To construct our cash flow volatility variable, we follow four steps. First, we use *ebitda* (earnings before interest, taxes, depreciation and amortization) to measure firm cash flow, which adds back non-operating expenses. Note that *ebitda* is equal to operating income before depreciation (*oibdp*) in Compustat Global - Fundamentals Annual database. Second, prior papers scale volatility by either expected cash flow (which may be negative) or total assets. Because cash flow is generated by operational assets of firms (or net assets), we scale our measure by net assets. This makes cash flow volatility comparable across firms who hold different levels of cash.[10] Third, in estimating volatility, the literature uses a variety of window lengths. We choose a window length of five years in the main regressions, based on the idea that a five-year window is a plausible period of time for firms to adjust toward their target debt ratio. We also test using different window lengths in robustness checks.

The fourth issue relates to how to measure volatility, we follow Keefe and Yaghoubi (2016) and estimate cash flow volatility using three methods. First, we follow Kim and Sorensen (1986) and estimate the rolling standard deviation of *oibdp* over the last five years. In the main body of this paper, we test our hypotheses using this measure. Second, we follow Stohs and Mauer (1996) and estimate the rolling standard deviation of first differences of *oibdp* over the last five years. As an alternative to the rolling approach, we estimate cash flow volatility using the method of De Veirman and Levin (2011).[11] We use the measures of Stohs and Mauer (1996) and De Veirman and Levin (2011) in the robustness tests section. To denote the method used to construct cash flow volatility measures, we include *KS, SM, DL* and the length of window in the variable names. In summary, we have eleven cash flow volatility measures using three methods and different window lengths from one to five years: *CFV_KS_oi_3*, *CFV_KS_oi_4*, *CFV_KS_oi_5*, *CFV_SM_oi_3*, *CFV_SM_oi_4*, *CFV_SM_oi_5*, *CFV_DL_oi_1*, *CFV_DL_oi_2*, *CFV_DL_oi_3*, *CFV_DL_oi_4* and *CFV_DL_oi_5*.[12] To address the effect of outliers, we winsorize each measure at the 1% level in both tails. In Section 4, we test our hypotheses using *CFV_KS_oi_5*. In Section 5, we explore if our findings are sensitive to the choice of volatility measures.

[10] net asset (*na*) = total assets (*at*) - cash and short-term investment (*che*).
[11] For a discussion of this measure, see De Veirman and Levin (2011) and Keefe and Yaghoubi (2016).
[12] Note that we use the same variables name with Keefe and Yaghoubi (2016).

Table 3 reports the pairwise correlations between our eleven volatility measures. Table 3 shows that all measures are positively correlated. Overall, the variables that are constructed by the same method are the most highly correlated and the variables measured by the method of De Veirman and Levin (2011) have the highest correlation coefficients. For instance, the correlation coefficient between *CFV_DL_oi_3* and *CFV_DL_oi_2* is 94.64 %. Meanwhile, the variables constructed by the different methods are less correlated. For example, the correlation coefficient between *CFV_DL_oi_1* and *CFV_SM_oi_5* is 67.7%, and between *CFV_SM_oi_4* and *CFV_KS_oi_3* is 71.39%.

3.4 Firm-level control variables

To isolate the influence of cash flow volatility on debt maturity, we control for other firm-level characteristics which are motivated by existing theories and empirical studies. Two theories relevant to our paper are the agency cost theory and the signaling theory. According to the agency cost theory, Myers (1977) argues that firms' growth opportunities affect debt maturity choice because of the underinvestment problem. The underinvestment problem occurs when managers forgo a positive net present value project because they are not offered a sufficient return after creditors capture a rent from funding the project. Myers proposes that firms can reduce this incentive problem in several ways: issuing less debt, agreeing to restrictive covenants or decreasing debt maturity. From this perspective, higher growth firms, who have greater conflicts between managers and creditors, should employ shorter-term debt. We follow Smith and Watts (1992) to use the market to book ratio which is computed by the sum of total liabilities and market value of equity to total assets as a proxy for the firm's growth opportunities. Due to the underinvestment incentive, we expect that the probability of firms using debt of shorter (longer) maturity increases (decreases) with the firm's growth.

Asset maturity also plays a pivotal role in the agency theory of debt maturity. Myers (1977) argues that maturity matching relieves agency conflicts by scheduling debt repayments in correspondence with the decline in value of assets in place. Thus, firms with longer-lived assets use debt with longer maturity and firms with shorter-lived assets issue shorter-term debt (Stohs and Mauer, 1996, Guedes and Opler, 1996, Scherr and Hulburt, 2001). We follow Stohs and Mauer (1996) and calculate asset maturity as the weighted average of the maturities of

current and long-term assets. We expect that the probability of firms using debt of shorter (longer) maturity decreases (increases) with asset maturity.

According to the signaling theory, a firm's choice of debt maturity can signal private information about firm quality to creditors. Flannery (1986) develops a model in which high-quality firms signal their quality by issuing short-term debt. Under the impact of asymmetric information, long-term debt tends to be overpriced and short-term debt tends to be under-priced. Low-quality firms want to issue more overpriced long-term debt and high-quality firms want to issue less under-priced short-term debt. The literature uses several proxies for credit quality, such as: size, bond ratings, leverage (Flannery, 1986, Guedes and Opler, 1996) and abnormal earnings (Barclay and Smith, 1995). Barclay and Smith (1995) argue that high-quality firms have positive future abnormal earnings and low-quality firms have negative future abnormal earnings. We follow Zheng, Ghoul, Guedhami, and Kwok (2012) and specify abnormal earnings as the change in earnings before interest, taxes, depreciation and amortization as a proxy for insiders' information. We also use firm size which is computed by the natural logarithm of total assets in US dollars, as another proxy for the firm's credit quality (Flannery, 1986, Guedes and Opler, 1996) and expect that the probability of firms using debt of shorter (longer) maturity decreases (increases) with abnormal earnings and firm size.

Although there are no theoretical studies that predict how the fixed assets ratio and the profitability ratio influence debt maturity (Johnson, 2003), financial researchers find the empirical evidence of these determinants. Demirgüç-Kunt and Maksimovic (1999) and Kirch and Terra (2012) argue that firms with more tangible assets have more valuable collateral, consequently, lower bankruptcy cost and greater borrowing capacity than firms with fewer assets. Collateral has greater impacts on reducing risk for long-term than short-term lending, and thus firms with higher tangibility have improved access to borrow in long-term debt markets. Demirgüç-Kunt and Maksimovic (1999), Fan, Titman, and Twite (2012) and Kirch and Terra (2012) find the positive association between the use long-term debt and tangibility. We follow these studies to compute tangibility as the ratio of fixed assets to total assets and expect that the probability of firms using debt of shorter (longer) maturity decreases (increases) with tangibility. Also, Demirgüç-Kunt and Maksimovic (1999) and Kirch and Terra (2012) find that profitability is negatively associated with the use long-term debt, whereas, Fan, Titman, and Twite (2012)

find the opposite relationship. We follow Demirgüç-Kunt and Maksimovic (1999) and Kirch and Terra (2012) and calculate profitability as the ratio of earnings before interest and taxes to total assets. We expect that the probability of firms using debt of shorter (longer) maturity increases (decreases) with profitability based on the idea that profitability is one of the firm's liquidity indicators (Demirgüç-Kunt and Maksimovic, 1999).

Beside the agency cost theory and the signaling theory, the role of the tax benefit theory in determining debt maturity is inconclusive. Although Brick and Ravid (1985) provide a tax-based rationale for an optimal maturity structure, Lewis (1990) conversely argues that taxes have no effect on the optimal debt maturity. Furthermore, Demirgüç-Kunt and Maksimovic (1999) critique that "the complexity of tax systems, with both federal and local taxes, makes it difficult to compare the benefits of debt across a large sample of countries", also "the implications of different tax systems for the composition of debt and debt maturity are not clear-cut." Therefore we do not include the tax rate variable in the main tests, however, we examine its role in the robustness section.

Table 4 provides more details about definitions, constructions and data sources for firm-level explanatory variables. We report the summary statistics for all firm-level explanatory variables in Table 5. Following Kale and Shahrur (2007), we winsorize all firm-level variables at the 1% level in both tails of the distribution.

3.5 Univariate statistics

Table 5 reports the descriptive statistics of the full sample and each sub-sample for the main variables used in this paper. Overall, our sample is similar to prior international research. Cash flow volatility is the highest in the U.S and Canada group with the mean of 11.36%. Meanwhile, the mean of cash flow volatility is 7.41% in the advanced economies group and 6.27% in the emerging economies group. The emerging group has the highest asset maturity with the mean of 17.09%, compared with 15.55% in the advanced group and only 9.44% in the U.S and Canada group. Besides, firms in the U.S and Canada group have the highest growth with the mean of 2.03%, which is 1.46% and 1.82% for the advanced group and the emerging group, respectively. Other variables are relatively similar amongst groups

Table 6 reports the frequency of firms using debt at different maturities in the full sample and each sub-sample. The percentage of unlevered firms is 11.79% for the full sample, which is higher than the percentage of firms who only use short-term debt (10.25%). This table also reveals that the percentage of zero-leverage firms is higher in developed countries. More specifically, the number of zero-debt firms is 15.99% in the U.S and Canada, 10.43 % in the advanced economies, and 9.84% in the emerging economies.[13] The summary statistics indicate the sizable number of firms use zero-debt in their capital structure.

Table 7 reports the correlation coefficients between the explanatory variables. Table 7 shows that cash flow volatility measure is negatively correlated with *Asset Maturity*, *Firm Size*, *Tangibility* and *Profitability* but positively correlated with *Market To Book* and *Abnormal Earnings*. The correlation coefficients between *CFV_KS_oi_5* and *Firm Size* and *Profitability* are -35.12% and -47.77% respectively. On the other hand, the correlation coefficient between *CFV_KS_oi_5* and *Market To Book* is 34.64%. Overall, highly cash flow volatile firms have shorter asset maturity, smaller size, less collateral, less profitability but higher growth and higher abnormal earnings.

4 Testing

4.1 Testing Hypothesis 1 – Cash flow volatility and Debt maturity

To explore the influence of cash flow volatility on debt maturity choice, we use the ordered logit model. We construct *DebtMaturity(1/3)* in Section 3.2. The ordering starts from firms that hold debt with more than 1 year of maturity to firms with no long and short-term debt. We estimate

$$Pr(DebtMaturity(1/3)_{i,t} = j) = Pr(\kappa_{j-1} < \beta_1 * CFV\_KS\_oi\_5_{i,t} + \beta_2 * X_{i,t} + u_{i,t} < \kappa_j), \quad (2)$$

where, residual $u_{i,t}$ is assumed to be logistically distributed, and κ is a set of cut-points, where j is the category number. The model has $\kappa = 2$ cut-points as there are $j = 3$ categories of *DebtMaturity(1/3)*.

[13] That is probably because the U.S/Can group has more high-tech firms. We check the R&D expenses to total assets ratios of Canada (0.04) and US (0.047), which total up the second highest (0.087) ratio, only lower than Israel's (0.1).

Table 8 shows the results of Eq. (2) for the full sample using cross-sectional estimation in Columns 1-4 and panel estimation in Columns 5-8. We control for industry and/or year and/or development status or country in each column. The coefficients associated with the *CFV_KS_oi_5* are statistically significant at less than the 1% level in all specifications. The positive coefficients on *CFV_KS_oi_5* suggest that when cash flow volatility increases, the probability of a firm using shorter maturity debt increases.

Table 9 shows results for three sub-samples using cross-sectional estimation in Columns 1-3 and panel estimation in Columns 4-6. We control for industry, year and country dummies in all columns. The coefficients associated with the *CFV_KS_oi_5* remain positive and statistically significant at less than the 1% level in all groups of countries. Columns 1-3 show that the influence of *CFV_KS_oi_5* in the emerging economies is lower than the advanced economies and the U.S and Canada. Overall, our results support Hypothesis 1 for the entire sample and three sub-samples.

Table 10 shows the difference in the influence of *CFV_KS_oi_5* between the emerging countries group from the remaining groups. In Columns 1-2 we test this difference in cross-sectional estimation, the coefficients associated with the interaction term between *EME(0/1)* and *CFV_KS_oi_5* are negative and significant at the 1% level. This implies that the influence of *CFV_KS_oi_5* is stronger in developed countries than in emerging countries, which is consistent with the results in Columns 1-3 Table 9. This sign and significance hold when we test using panel estimation in Column 3-4, however, it becomes less significant when we only control for industry dummy.

Table 10 also shows the difference in the influence of *CFV_KS_oi_5* in the U.S and Canada group from other advanced economies. The coefficients associated with the interaction term between *ADE(0/1)* and *CFV_KS_oi_5* are positive in Columns 1-2. This implies that the influence of *CFV_KS_oi_5* in the advanced group is stronger than in the U.S/Can group, which is consistent with the results in Columns 2-3 Table 9. Also, the coefficient associated with this interaction term becomes negatively in Column 5. This result is consistent with the results in Columns 5-6 Table 9 where the coefficient associated with *CFV_KS_oi_5* in the advanced group is less than in the U.S/Can group.

To show the economic importance of cash flow volatility on debt maturity, we calculate the change in the probability of using debt at different maturities when cash flow volatility increases by one standard deviation. We multiply the marginal effects of cash flow volatility on debt maturity in each category with its standard deviation in each sub sample and in the full sample. Table 11 reports the results. For the full sample, one standard deviation increase in *CFV_KS_oi_5* implies a 3.73% decrease in the probability of firms using long-term debt, but a 1.37% increase in the probability of firms using short-term debt. The probability of firms using zero-debt is 2.36%, which is much higher than the likelihood of firms using short-term debt. For the U.S and Canada group, one standard deviation increase in *CFV_KS_oi_5* implies an only 0.69% increase in the probability of firms using just short-term debt, but a 3.4% increase in the probability of firms using no debt. We see the similar results when calculating the marginal effects of *CFV_KS_oi_5* in the panel data.

To visualize how a change in the probability of firms holding debt of different maturities changes by volatility, we use following steps: (i) we assign by year each firm-year observation to one of twenty firm-year cash flow volatility quintiles; (ii) we calculate the mean of actual percentage of sample firms in each debt maturity category by volatility quintile; (iii) we predict the probability a firm is in one of the three debt maturity categories and take the mean by volatility quintile; (iv) we plot in Fig 1 the percentage of the sample firms existing in each debt maturity category relative to the predicted probability by volatility quintile from the ordered probit shown by model Eq. (2). Fig 1 shows that the predicted values closely match the actual values. As can be seen clearly, the probability of firms holding long-term debt gradually decreases with cash flow volatility in quintiles 1-15 and sharply drops (from around 80% to approximately 40%) in volatility quintiles 15-20. Meanwhile, the probability of firms holding short-term debt and zero-debt increases with cash flow volatility. To be more specific, cash flow volatility has a small effect on the increase of the probability of firms using zero-debt in quintiles 1-15 and a large effect in quintiles 15-20. Overall, the economic importance of cash flow volatility on debt maturity is the highest in the high cash flow volatility quintiles 15-20.

4.2 Testing Hypothesis 2 – Cash flow volatility and Zero-debt policy

We follow Strebulaev and Yang (2013), Bessler, Drobetz, Haller, and Meier (2013) construct dependent variable *Zero Debt*, which takes the value 1 if a firm follow a zero-debt policy or in other word, it does not have any short-term and long-term debt in a given year (and 0 otherwise). We employ logit regressions to test Hypothesis 2. We estimate

$$Pr(Zero\ Debt_{i,t} = 1) = F(\beta_0 + \beta_1 * CFV\_KS\_oi\_5_{i,t} + \beta_2 * X_{i,t} + \epsilon_{i,t}), \tag{3}$$

Table 12 reports the estimation results using Eq. (3) for the entire sample. Columns 1-4 report the results for cross-sectional data and Columns 5-8 report the results for panel data. We control for industry and/or year and/or development status and/or country dummies in each column. The negative intercepts imply that zero-leverage firms are less common than firms that use debt. The coefficients on cash flow volatility are positive and significant in all specifications at 1% level, implying that firms with higher volatile cash flow are more likely to pursue a zero-debt policy.

Table 13 reports the estimation results using Eq. (3) for three sub-samples. Columns 1-3 report the results for cross-sectional data and Columns 4-6 report the results for panel data. We control for industry, year and country dummies in all columns. Cash flow volatility is positive and statistically significant in all specifications at 1% level. Overall, our results support Hypothesis 2 at less than 1% level that the probability of firms follow a zero-leverage policy increases with cash flow volatility.

To show the economic importance of cash flow volatility on firm use of zero-debt, we calculate the change in the probability of firms following a zero-debt policy when cash flow volatility increases by one standard deviation. We multiply the marginal effects of cash flow volatility on the likelihood of firms using a zero-debt policy with the standard deviation of cash flow volatility in each sub-sample and the entire sample. Table 14 reports the results. One standard deviation increase in *CFV_KS_oi_5* implies a 1.13% increase in the probability of firms using zero-debt in the emerging group but a much higher increase in the probability of firms following a zero-leverage policy in the U.S/Canada group, with 3.59%. Relative to unconditional means of zero-debt policies, the 1.13% increase represents a 11.48% actual change in the probability of

firms using zero-debt in the emerging group and 22.45% in the U.S/Cananda group.[14] We see the similar results when calculating the marginal effects of *CFV_KS_oi_5* in the panel data.

4.3 Evidence from control variables

With a few exceptions, our results in testing both Hypothesis 1 and Hypothesis 2, which are shown in Tables 8-13, provide statistically significant and consistent signs of coefficients associated with all control variables in all estimations and all groups of countries. We find a couple of exceptions to consistent results. The coefficients associated with *Market To Book* are not significant in the emerging group in Table 9 and Table 18. Also, the coefficients associated with *Firm Size* and *Tangibility* are not significant in Column 5, Table 18.[15]

Some of these results support the previous literature. The negative coefficients associated with *Tangibility* imply that firms have more tangible assets use longer-term debt, which is consistent with Demirgüç-Kunt and Maksimovic (1999), Fan, Titman, and Twite (2012), and Kirch and Terra (2012). The positive coefficients associated with *Market To Book* suggest firms with high market to book ratio use shorter-term debt. This result is contrary to that of Fan, Titman, and Twite (2012) and Zheng, Ghoul, Guedhami, and Kwok (2012), however, it supports Myers's prediction that firms with greater growth opportunities prefer shorter-term debt, which is consistent with the evidence of Barclay and Smith (1995), and Guedes and Opler (1996).

The signaling theory suggests that higher-quality firms prefer shorter-term debt to signal their quality to creditors. However, our results do not support this theory. We find a negative sign on the coefficients associated with *Firm Size*, which suggests smaller firms or lower-quality firms use shorter-term debt and larger firms or higher-quality firms use longer-term debt. Nonetheless, these results are still in line with Guedes and Opler (1996) and Scherr and Hulburt (2001). Similarly, we report the negative coefficients associated with *Abnormal Earnings*, which suggests that firms with higher future abnormal earnings or higher-quality firms use longer-term debt. This claim is contrary to the previous literature (Barclay and Smith, 1995, Guedes and Opler, 1996, Zheng, Ghoul, Guedhami, and Kwok, 2012).

In addition, we find that an increase in *Asset Maturity* increases (decreases) the probability of firms using shorter (longer) maturity of debt whereas most of the previous literature finds

[14] $Percentagechangeintheemerginggroup = \frac{1.13\%}{9.84\%}$ and $PercentagechangeintheU.S/Cangroup = \frac{3.59\%}{15.99\%}$.

[15] This maybe due to not enough within firm variations in *Firm Size* and *Tangibility* for panel data.

that firms with higher asset maturity use longer-term debt (Stohs and Mauer, 1996, Scherr and Hulburt, 2001, Zheng, Ghoul, Guedhami, and Kwok, 2012).[16] We note that Kirch and Terra (2012) find a similar result to ours. Also, Guedes and Opler (1996) find the positive relationship between asset maturity and firm use of debt at maturity of 10-19 years and over 30 years but the negative relationship with firm use of debt at maturity of 20-29 years.

We further find that positive coefficients are associated with *Profitability*. Although, this finding is contrary to the evidence of Demirgüç-Kunt and Maksimovic (1999), Fan, Titman, and Twite (2012) and Kirch and Terra (2012), it is in line with the pecking-order theory suggesting that firms with more profitability are more likely to become debt-free as they rely solely on internal funds (Bessler, Drobetz, Haller, and Meier, 2013).

Overall, we find that the probability a firm uses shorter maturity debt or follows a zero-debt policy increases with *Market To Book* ratio, *Asset Maturity* and *Profitability* and decreases with *Firm Size*, *Abnormal Earnings* and *Tangibility*. In summary, firms using shorter maturity debt or zero-debt have higher growth, higher asset maturity, but lower abnormal earnings and less tangible assets; they also are more profitable and smaller. These characteristics of zero-debt firms are also consistent with previous studies (Bessler, Drobetz, Haller, and Meier, 2013, Strebulaev and Yang, 2013).

5 Robustness checks

5.1 Additional firm-level control variables

To reduce concerns that our main results are driven by potential correlated omitted variables, we repeat our main analysis using additional firm-level control variables. As we discussed earlier, the influence of taxes on debt maturity determinants is indecisive. In this paper, we follow Stohs and Mauer (1996) and Zheng, Ghoul, Guedhami, and Kwok (2012) to compute tax rate as the ratio of income tax expense to pretax income to re-examine its role in the international context.[17]

[16] Because *Asset Maturity* and *Tangibility* are highly correlated (See Table 7), we estimate our regressions without *Tangibility*, however, the sign of *Asset Maturity* remains unchanged. The results are not tabulated in this paper.

[17] We use this measure because of the available data from Compustat.

Table 15 reports the impact of taxes on debt maturity. We find that *TaxRate* is negatively associated with debt maturity in pooled regression. The coefficient associated with *TaxRate* is statistically significant when we control for industry, year and development status or country dummies at less than 1% level but it is insignificant when we only control for industry. In panel regression, *TaxRate* becomes less significant even changes the sign when we only control for industry dummy. In the meantime, *CFV_KS_oi_5* continues to load positive and significant at the 1% level in specifications (1)-(5), in both cross-sectional and panel data.

5.2 Alternative debt maturity measure

To address concerns that our main results may be driven by measurement errors, we re-estimate our results using alternative measure of both dependent variables and our main variable of interest cash flow volatility in two hypotheses in these sections following. In this section, we re-estimate the results for the first hypothesis using another measure of debt maturity.

Although the previous literature employs the ratio of long-term debt to total debt to measure debt maturity, this is not a clean measure, especially when considering the influence of cash flow volatility.[18] Then we modify this ratio which is the ratio of long-term debt to total assets for robustness test. This proportion variable is bounded between zero and one so we use GLM with a logit link function.

$$E(\textit{Long-term Debt To Assets}_{i,t}|X_{i,t}, \textit{CFV\_KS\_oi\_5}_{i,t}) = G(\alpha+\beta_1*\textit{CFV\_KS\_oi\_5}_{i,t}+\beta_2*X_{i,t}+\epsilon), \tag{4}$$

where

- G(.) is the logistic link funtion,
- $\textit{Long-term Debt To Assets}_{i,t}$ is the ratio of long-term debt to total assets
- $X_{i,t}$ is a matrix of firm control variables listed in Section 3.4, and
- $\textit{CFV\_KS\_oi\_5}_{i,t}$ is volatility measure

Table 16 shows the GLM estimation results of Eq. (4) using *CFV_KS_oi_5* as the variable of interest, with standard errors clustered by firm. The table reports that the coefficients

[18] See Section 2.

associated with *CFV_KS_oi_5* are statistically significant at less than 1% level in explaining the debt ratio. *CFV_KS_oi_5* is negatively associated with the ratio of long-term debt to total assets, implying that firms with high cash flow volatility use less long-term debt, reinforcing our previous evidence.

5.3 Additional cash flow volatility measures

In this section, we address the concern about measurement error by repeating the estimation for the first hypothesis using all measures of cash flow volatility. Table 17 reports the positive and statistically significant coefficients associated with several cash flow volatility measures with different rolling windows. We use the ordered logit model for the full sample. In our main results, we used an estimation window of five years. For the *KS* and *SM* measure, which uses a rolling method, we constructed the measures using a three and four year window. For the *DL* measure, we estimate the mean over two, three, four and five years. As can be seen in the table, the number of observation increases as the window size decreases. In addition, the magnitude of the coefficients increases with the window size. For any window size or measure, the coefficient is statistically significant at less than 1 % level.

5.4 Alternative zero-debt firms measure

In this section, we address the concern about measurement error by repeating the estimation for the second hypothesis using an alternative measure of the zero-debt policy. We follow Devos, Dhillon, Jagannathan, and Krishnamurthy (2012) to construct *Zero Debt Alternative*, which takes the value of 1 if a firm has zero debt in 3 consecutive years ending in that year (and 0 otherwise). We use logit regression for the full sample and three sub-samples. Table 18 and Table 19 show the similar results with our main regressions using *Zero Debt* variable. This implies the impact of *CFV_KS_oi_5* on the probability of firms follow a zero-leverage policy is persistent.

6 Conclusion

The international evidence on the relationship between cash flow volatility and debt maturity and the zero-debt policy of firms is disputed. We re-examine these relationships by developing a

set of cash flow volatility measures, conducting tests using methods that account for non-linear relationships and subjecting our analysis to alternative estimation methods and window sizes. Across all these approaches, we find cash flow volatility is an important determinant of both debt maturity and zero-debt policies of firms.

Our empirical results are both significant and economically important. In testing, we reject at less than the 1% level that cash flow volatility does not influence debt maturity and zero-debt policies.[19] For example, a one standard deviation increase in cash flow volatility implies a 3.76% decrease in the probability of firms using long-term debt, but a 1.38% and 2.38% increase in the probability of using short-term debt and zero-debt, respectively. We also find that firms which follow a zero-debt policy have higher volatile cash flow, higher growth opportunities, higher asset maturity and higher profitability but are smaller and have lower tangibility.

Based on the classification into the different development status of the IMF's World Economic Outlook and the CIA World Factbook, we record the differences in firm's characteristics, firm use of zero-debt and the economic importance of cash flow volatility among groups of countries. In particular, we find that firms in the U.S and Canada have the highest growth opportunities and cash flow volatility but they have the shortest asset maturity, the lowest tangible asset and negative abnormal earnings. The number of firms follow a zero-debt policy is the highest in the U.S/Canada group (16%). By contrast, firms in the non-U.S./Canada developed economies have the lowest growth opportunities and profitability but have largest size. Additionally, firms in the emerging markets and developing economies have the smallest size and the lowest cash flow volatility but they have the longest asset maturity, the highest tangible assets and profitability and the lowest in the emerging group (9.84%). We also find that the influence of cash flow volatility on debt maturity and zero-debt policies is lower in emerging economies than in other countries. For example, in the emerging group, one standard deviation increase in cash flow volatility implies a 11.48% increase in the probability of firms using zero-debt. In comparison, in the U.S/Can group, a one standard deviation increase in cash flow volatility implies a 22.45% increase in the probability of firms following a zero-leverage policy.

[19]Only test without significance is the robustness test using alternative measure of zero-debt in panel data for emerging countries.

A question for future research is why our results for the U.S./Canada are stronger than our results for other developed and emerging economies. A plausible reason is that Venture Capital intensity has a persistent effect on firm experimentation, which naturally leads to low or even zero debt levels. As a preliminary investigation into this question, we compare our results with Israel, a country with a vibrate venture capital fueled economy. Mayer, Schoors, and Yafeh (2005) report that 93% of Israeli VC funds invest in early or start-up companies. Our very preliminary results are consistent with the reason of venture capital having a persistent effect on firm experimentation. The mean of firm cash flow volatility in Israel is 11.24%, which is almost identical to the mean of cash flow volatility in the U.S./Canada group. Also, 19.75% of Israeli firms follow a zero debt policy, which is higher than even in U.S./Canadian firms. Lastly, in estimation results using Israeli data, we find that cash flow volatility is even more economically important in explaining the zero-debt phenomenon than for U.S./Canadian firms. We leave detailed research on this question for follow-up research.

References

Antoniou, Antonios, Yilmaz Guney, and Krishna Paudyal, 2006, The determinants of debt maturity structure: Evidence from france, germany and the uk, *European Financial Management* 12, 161–194.

Barclay, Michael J., and Clifford W. Smith, 1995, The maturity structure of corporate debt, *The Journal of Finance* 50, 609–631.

Bessler, Wolfgang, Wolfgang Drobetz, Rebekka Haller, and Iwan Meier, 2013, The international zero-leverage phenomenon, *Journal of Corporate Finance* 23, 196–221.

Brick, Ivan E., and S. A. Ravid, 1985, On the relevance of debt maturity structure, *The Journal of Finance* 40, 1423–1437.

Dang, Viet Anh, 2013, An empirical analysis of zero-leverage firms: New evidence from the uk, *International Review of Financial Analysis* 30, 189–202.

de Jong, Abe, Rezaul Kabir, and Thuy Thu Nguyen, 2008, Capital structure around the world: The roles of firm- and country-specific determinants, *Journal of Banking & Finance* 32, 1954–1969.

De Veirman, Emmanuel, and Andrew Levin, 2011, Cyclical changes in firm volatility., *Reserve Bank of New Zealand Discussion Paper Series* 06.

Deesomsak, Rataporn, Krishna Paudyal, and Gioia Pescetto, 2009, Debt maturity structure and the 1997 asian financial crisis, *Journal of Multinational Financial Management* 19, 26–42.

Demirgüç-Kunt, Asli, and Vojislav Maksimovic, 1999, Institutions, financial markets, and firm debt maturity, *Journal of Financial Economics* 54, 295–336.

Devos, Erik, Upinder Dhillon, Murali Jagannathan, and Srinivasan Krishnamurthy, 2012, Why are firms unlevered?, *Journal of Corporate Finance* 18, 664–682.

Diamond, Douglas W., 1991, Debt maturity structure and liquidity risk, *The Quarterly Journal of Economics* 106, 709–737.

Döring, Simon, Wolfgang Drobetz, Malte Janzen, and Iwan Meier, 2017, Global cash flow sensitivities, *Finance Research Letters*.

Fan, J., S. Titman, and G. Twite, 2012, An international comparison of capital structure and debt maturity choices, *Journal of Financial and Quantitative Analysis* 47, 23–56.

Flannery, Mark J., 1986, Asymmetric information and risky debt maturity choice, *The Journal of Finance* 41, 19–37.

Ghoul, Sadok El, Omrane Guedhami, Chuck Kwok, and Xiaolan Zheng, 2017, Zero-leverage puzzle: An international comparison, *Review of Finance* 22, 1063–1120.

González, Víctor M., 2015, The financial crisis and corporate debt maturity: The role of banking structure, *Journal of Corporate Finance* 35, 310–328.

——— , 2017, Firm and country determinants of debt maturity: New international evidence, *International Finance* 20, 256–270.

Guedes, Jose, and Tim Opler, 1996, The determinants of the maturity of corporate debt issues, *The Journal of Finance* 51, 1809–1833.

Johnson, Shane A., 2003, Debt maturity and the effects of growth opportunities and liquidity risk on leverage, *The Review of Financial Studies* 16, 209–236.

Kale, Jayant R., Thomas H. Noe, and Gabriel G. Ram, 1991, The effect of business risk on corporate capital structure: Theory and evidence, *The Journal of Finance* 46, 1693–1715.

Kale, Jayant R., and Husayn Shahrur, 2007, Corporate capital structure and the characteristics of suppliers and customers, *Journal of Financial Economics* 83, 321–365.

Kane, A., A. J. Marcus, and R. L. McDonald, 1985, Debt policy and the rate of return premium to leverage, *The Journal of Financial and Quantitative Analysis* 20, 479–499.

Keefe, Michael O'Connor, and Mona Yaghoubi, 2016, The influence of cash flow volatility on capital structure and the use of debt of different maturities, *Journal of Corporate Finance* 38, 18–36.

Kim, Wi Saeng, and Eric H. Sorensen, 1986, Evidence on the impact of the agency costs of debt on corporate debt policy, *The Journal of Financial and Quantitative Analysis* 21, 131–144.

Kirch, Guilherme, and Paulo Renato Soares Terra, 2012, Determinants of corporate debt maturity in south america: Do institutional quality and financial development matter?, *Journal of Corporate Finance* 18, 980–993.

Kraus, Alan, and Robert H. Litzenberger, 1973, A state-preference model of optimal financial leverage, *The Journal of Finance* 28, 911–922.

Lewis, Craig M., 1990, A multiperiod theory of corporate financial policy under taxation, *The Journal of Financial and Quantitative Analysis* 25, 25–43.

Mayer, Colin, Koen Schoors, and Yishay Yafeh, 2005, Sources of funds and investment activities of venture capital funds: evidence from germany, israel, japan and the united kingdom, *Journal of Corporate Finance* 11, 586–608.

Miltersen, Kristian, and Walter Torous, 2008, Risky corporate debt with finite maturity, *SSRN Electronic Journal*.

Minton, Bernadette A., and Catherine Schrand, 1999, The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing, *Journal of Financial Economics* 54, 423–460.

Myers, Stewart C., 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

——— , and Nicholas S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Orman, Cüneyt, and Bülent Köksal, 2017, Debt maturity across firm types: Evidence from a major developing economy, *Emerging Markets Review* 30, 169–199.

Scherr, Frederick C., and Heather M. Hulburt, 2001, The debt maturity structure of small firms, *Financial Management* 30, 85–111.

Smith, Clifford W., and Ross L. Watts, 1992, The investment opportunity set and corporate financing, dividend, and compensation policies, *Journal of Financial Economics* 32, 263–292.

Stiglitz, Joseph E., and Andrew Weiss, 1981, Credit rationing in markets with imperfect information, *The American Economic Review* 71, 393–410.

Stohs, Mark Hoven, and David C. Mauer, 1996, The determinants of corporate debt maturity structure, *The Journal of Business* 69, 279–312.

Strebulaev, Ilya A., and Baozhong Yang, 2013, The mystery of zero-leverage firms, *Journal of Financial Economics* 109, 1–23.

Valev, Neven T., 2007, Uncertainty and international debt maturity, *Journal of International Financial Markets, Institutions and Money* 17, 372–386.

Wald, John K., 1999, How firm characteristics affect capital structure: an international comparison, *Journal of Financial Research* 22, 161.

Zheng, Xiaolan, Sadok El Ghoul, Omrane Guedhami, and Chuck C. Y. Kwok, 2012, National culture and corporate debt maturity, *Journal of Banking & Finance* 36, 468–488.

Zulfiqar, Ali Memon, Chen Yan, Zubair Tauni Muhammad, and Ali Hashmat, 2018, The impact of cash flow volatility on firm leverage and debt maturity structure: evidence from china, *China Finance Review Intl* 8, 69–91.

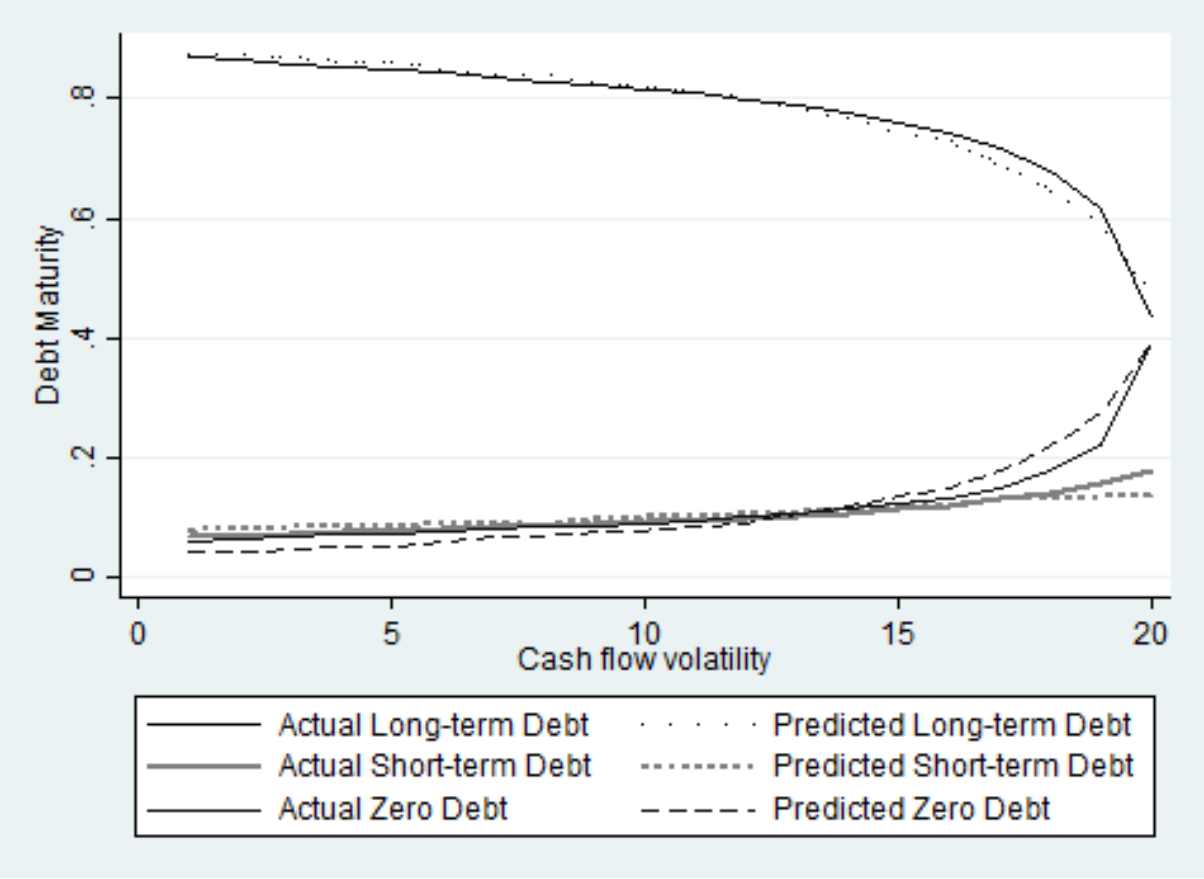

Figure 1: The change in probability of firms using *DebtMaturity(1/3)* by volatility quintiles

The horizontal axis shows the 20-quintiles of *CFV_KS_oi_5*. The figure plots by quintiles the predicted probability and actual percentage for each maturity category. Predicted probabilities are obtained from the ordered logit model shown in Eq. (2). From the top, first, second and third sets of lines depict the first, third and second categories of *DebtMaturity(1/3)*, respectively.

Table 1: Sample

This table provides the number of observations for the final sample, each sub-sample and each country. The final sample includes 248,470 firm-year observations from 72 countries over the 1993-2015 period. EME denotes the emerging markets and developing countries group, ADE denotes the non-US and Canada advanced economies group and US/Can denotes the U.S and Canada group. ALL denotes the full sample.

Country	Obs	Percent	Country	Obs	Percent
Argentina	400	0.16	Australia	8,648	3.48
Bahrain	100	0.04	Austria	578	0.23
Bangladesh	412	0.17	Belgium	776	0.31
Botswana	46	0.02	Cyprus	330	0.13
Brazil	1,922	0.77	Czech Republic	42	0.02
Chile	1,123	0.45	Denmark	1,286	0.52
China	20,112	8.09	Estonia	141	0.06
Colombia	191	0.08	Finland	1,103	0.44
Croatia	369	0.15	France	5,004	2.01
Egypt	425	0.17	Germany	5,214	2.10
Ghana	34	0.01	Greece	1,841	0.74
Hungary	136	0.05	Hong Kong SAR	1,132	0.46
India	13,435	5.41	Iceland	66	0.03
Indonesia	3,334	1.34	Ireland	678	0.27
Jordan	285	0.11	Israel	1,799	0.72
Kenya	160	0.06	Italy	1,351	0.54
Kuwait	430	0.17	Japan	40,773	16.41
Malaysia	8,063	3.25	Korea	7,665	3.08
Mexico	1,057	0.43	Latvia	200	0.08
Morocco	185	0.07	Lithuania	219	0.09
Nigeria	393	0.16	Luxembourg	211	0.08
Pakistan	1,975	0.79	Malta	50	0.02
Papua New Guinea	24	0.01	Netherlands	1,401	0.56
Peru	652	0.26	New Zealand	645	0.26
Philippines	959	0.39	Norway	1,015	0.41
Poland	2,703	1.09	Portugal	348	0.14
Qatar	88	0.04	Singapore	5,126	2.06
Romania	326	0.13	Slovak Republic	43	0.02
Russia	703	0.28	Spain	857	0.34
Saudi Arabia	528	0.21	Sweden	3,484	1.40
South Africa	2,022	0.81	Switzerland	1,979	0.80
Sri Lanka	1,169	0.47	United Kingdom	15,063	6.06
Thailand	5,137	2.07	**ADE**	**109,068**	**43.90**
Turkey	1,870	0.75			
United Arab Emirates	275	0.11	Canada	2,138	0.86
Venezuela	73	0.03	United States	66,045	26.58
Zambia	61	0.02	**U.S and Canada**	**68,183**	**27.44**
Zimbabwe	42	0.02			
EME	**71,219**	28.66	**Total**	**248,470**	**100.00**

Table 2: Dependent Variables - Debt maturity

This table shows the dependent variables construction. Panel A shows the construction of the categorical dependent variable *DebtMaturity(1/3)*. The first column shows the number the variable is set to. The other columns depict the rules by which the variable is set, where "yes" denotes a firm hold that type of debt, "no" denotes a firm does not hold that type of debt, and "N.A"(not applicable) implies a firm may or may not hold that type of debt. We use Compustat items *dltt, dlc* and *lt* . Panel B shows the construction of the continuous dependent variable. The first column is the name of variable, the second column provides definitions, the third column illustrates formulas and the last column is the data sources.

Panel A: Categorical Debt Maturity Variable

DebtMaturity(1/3)	Total liabilities	Long-term debt	Short-term debt
1	Yes	Yes	N/A
2	Yes	No	Yes
3	Yes	No	No

Panel B : Continuous Debt Maturity Variables

Variable	Definition	Construction	Data sources
Long-term Debt To Assets	The ratio of long term debt to total assets	$\frac{dltt}{at}$	Compustat

Table 3: Volatility measures correlations

This table shows the pairwise correlations between volatility measures. See Section 3.3 for the discussion on the volatility measures. Reference numbers in columns and rows refer to the variables associated with the pairwise correlation.

Volatility measures	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) *CFV_KS_oi_3*	1										
(2) *CFV_KS_oi_4*	0.7658	1									
(3) *CFV_KS_oi_5*	0.8808	0.8234	1								
(4) *CFV_SM_oi_3*	0.8524	0.7648	0.8235	1							
(5) *CFV_SM_oi_4*	0.7139	0.8659	0.7469	0.748	1						
(6) *CFV_SM_oi_5*	0.8203	0.8252	0.881	0.8574	0.8062	1					
(7) *CFV_DL_oi_1*	0.7753	0.7371	0.6999	0.7082	0.6917	0.677	1				
(8) *CFV_DL_oi_2*	0.7543	0.8388	0.7764	0.7716	0.7834	0.7552	0.8754	1			
(9) *CFV_DL_oi_3*	0.8484	0.8373	0.8366	0.8286	0.776	0.8111	0.8451	0.9464	1		
(10) *CFV_DL_oi_4*	0.7059	0.8539	0.7541	0.7043	0.8312	0.7555	0.7653	0.894	0.8752	1	
(11) *CFV_DL_oi_5*	0.8193	0.855	0.8574	0.7884	0.7944	0.8488	0.7869	0.8939	0.9487	0.917	1

Table 4: Explanatory Variables

This table provides the explanatory variable definitions and constructions. Column (1) provides the variable name. Column (2) defines the variable. Column (3) shows the variable constructions using system variable names. Column (4) provides the data sources.

Variable	Definition	Construction	Data sources
CFV_KS_oi_5	Cash flow volatility	Section 3.3	Compustat
Market To Book	The ratio of market value of equity and total liabilities to total assets	$\frac{lt+mve}{at}$	Compustat
Asset Maturity	The weighted average of the maturities of current assets and long-term assets, where the maturity of currents assets is measured as current assets divided by the cost of goods sold and the maturity of long-term assets is estimated as the ratio of gross property, plant and equipment to depreciation and amortization	$\frac{act}{at} * \frac{act}{cogs} + \frac{ppegt}{at} * \frac{ppegt}{dp}$	Compustat
Abnormal Earnings	Abnormal future earnings estimated as the change in operating income from year t to year t-1 divided by market value of equity	$\frac{oibdp_{t+1}-oibdp_t}{mve}$	Compustat
Firm Size	The natural logarithm of total assets in U.S dollars	$ln(at)$	Compustat
Tangibility	The ratio of gross property, plant and equipment to total assets	$\frac{ppegt}{at}$	Compustat
Profitability	The ratio of revenue to total assets	$\frac{ebit}{at}$	Compustat

Table 5: Summary statistics

This table shows the summary statistics of all variables used in the main regressions for the full sample of 248,470 observations from 72 countries over the 1993-2015 period and three sub-samples. All variables are winsorized at the 1% level in both tails of distribution before the summary statistics are calculated. Definitions and data sources for all variables are outlined in Table 2 and Table 4

	Full sample			Emerging countries			Advanced economies			U.S/Canada		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Market To Book	1.722	1.194	1.742	1.821	1.180	2.077	1.462	1.060	1.453	2.036	1.489	1.719
Asset Maturity	14.316	8.957	20.142	17.094	11.631	21.562	15.551	9.443	22.230	9.440	5.905	12.962
Abnormal Earnings	0.006	0.009	0.314	0.013	0.007	0.349	0.007	0.009	0.340	-0.002	0.010	0.217
Firm Size	5.320	5.267	1.972	4.953	4.952	1.793	5.513	5.458	1.983	5.396	5.322	2.080
Tangibility	0.558	0.497	0.382	0.596	0.555	0.366	0.553	0.497	0.390	0.526	0.434	0.381
Profitability	0.036	0.054	0.157	0.058	0.056	0.102	0.026	0.046	0.156	0.028	0.071	0.197
CFV_KS_oi_5	8.168	4.450	11.988	6.271	4.281	7.192	7.412	3.673	12.016	11.359	6.208	14.962

Table 6: Summary of *DebtMaturity(1/3)*

The table reports the number of observations, the frequency and the percentage of the *DebtMaturity(1/3)* for the full sample of 248,470 observations from 72 countries over the 1993-2015 period and three sub-samples.

	Full sample		Emerging countries		Advanced economies		U.S/Canada	
DebtMaturity(1/3)	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
1- Long-term debt	193,705	77.96	51,972	72.97	88,089	80.77	53,644	78.68
2- Short-term debt	25,479	10.25	12,242	17.19	9,602	8.8	3,635	5.33
3- Zero debt	29,286	11.79	7,005	9.84	11,377	10.43	10,904	15.99
	248,470	100	71,219	100	109,068	100	68,183	100

Table 7: Correlation matrix

This table shows the pairwise correlation coefficients between explanatory variables. Reference numbers in columns and rows refer to the variables associated with the pairwise correlation coefficients.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *Market To Book*	1						
(2) *Asset Maturity*	-0.0403	1					
(3) *Abnormal Earnings*	-0.0022	-0.0065	1				
(4) *Firm Size*	-0.1577	-0.0529	0.008	1			
(5) *Tangibility*	-0.1032	0.5165	-0.001	0.0861	1		
(6) *Profitability*	-0.112	-0.0801	0.15	0.3156	0.0169	1	
(7) *CFV_KS_oi_5*	0.3464	-0.0061	0.0083	-0.3512	-0.1385	-0.4777	1

Table 8: Testing Hypothesis 1 - Cash flow volatility and Debt maturity

This table shows the estimation results of Eq. (2) using an ordered logit model for the full sample of 248,470 firm-year observations from 72 countries over the 1993-2015 period. The dependent variable is the categorical variable *DebtMaturity(1/3)*, which is constructed in Panel A Table 2. The regressions include industry, year and development status or country dummies. Columns 1-4 report the estimation results using the cross-sectional data and Columns 5-8 report the estimation results using panel data. Definition and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

Variables	Cross-sectional				Panel			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFV_KS_oi_5	0.0200***	0.0222***	0.0218***	0.0236***	0.0138***	0.0160***	0.0157***	0.0154***
	(0.000908)	(0.000929)	(0.000928)	(0.000950)	(0.00145)	(0.00149)	(0.00150)	(0.00149)
Market To Book	0.0816***	0.0832***	0.0740***	0.0562***	0.0718***	0.0651***	0.0623***	0.0439***
	(0.00592)	(0.00617)	(0.00608)	(0.00622)	(0.00812)	(0.00881)	(0.00879)	(0.00896)
Asset Maturity	0.0117***	0.0104***	0.0109***	0.0108***	0.0117***	0.00926***	0.00953***	0.00938***
	(0.000482)	(0.000483)	(0.000483)	(0.000501)	(0.000731)	(0.000743)	(0.000746)	(0.000744)
Abnormal Earnings	-0.168***	-0.182***	-0.177***	-0.228***	-0.155***	-0.187***	-0.187***	-0.216***
	(0.0147)	(0.0149)	(0.0150)	(0.0170)	(0.0245)	(0.0259)	(0.0259)	(0.0268)
Firm Size	-0.286***	-0.300***	-0.299***	-0.388***	-0.527***	-0.752***	-0.758***	-0.871***
	(0.00692)	(0.00708)	(0.00731)	(0.00869)	(0.0159)	(0.0190)	(0.0196)	(0.0219)
Tangibility	-1.356***	-1.270***	-1.287***	-1.267***	-1.753***	-1.825***	-1.839***	-1.827***
	(0.0452)	(0.0450)	(0.0450)	(0.0464)	(0.0711)	(0.0717)	(0.0717)	(0.0723)
Profitability	1.067***	1.198***	1.114***	1.552***	0.763***	1.059***	1.053***	1.282***
	(0.0657)	(0.0672)	(0.0674)	(0.0704)	(0.0910)	(0.0946)	(0.0950)	(0.0960)
Firm	No	No	No	No	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Development status	No	No	Yes	No	No	No	Yes	No
Country	No	No	No	Yes	No	No	No	Yes
Observations	248,470	248,470	248,470	248,470	248,470	239,684	239,684	239,684
χ^2	6338	6705	6600		4608	4621	4791	8449
Pseudo R-Square	0.103	0.111	0.115	0.143				
Number of firms	29,683	29,683	29,683	29,683	29,683	29,204	29,204	29,204

Table 9: Testing Hypothesis 1 - Sub-sample analysis

This table shows the estimation results of Eq. (2) using an ordered logit model for three sub-samples. The dependent variable is the categorical variable *DebtMaturity(1/3)*, which is constructed in Panel A Table 2. The regressions include industry, year and country dummies. Columns 1-3 report the estimation results using the cross-sectional data and Columns 4-6 report the estimation results using panel data. Definition and data sources for all explanatory variables are outlined in Table 4. EME denotes the emerging markets and developing countries group, ADE denotes the advanced economies group and U.S/Can denotes the U.S and Canada group. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional			Panel		
Variables	EME(1)	ADE (2)	U.S/Can (3)	EME (4)	ADE (5)	U.S/Can (6)
CFV_KS_oi_5	0.0218***	0.0223***	0.0209***	0.0155***	0.0115***	0.0153***
	(0.00236)	(0.00140)	(0.00154)	(0.00340)	(0.00215)	(0.00230)
Market To Book	0.0333***	0.0460***	0.0990***	0.0160	0.0346**	0.0766***
	(0.0108)	(0.00975)	(0.0117)	(0.0157)	(0.0156)	(0.0151)
Asset Maturity	0.00956***	0.0104***	0.0126***	0.00496***	0.0113***	0.0122***
	(0.000973)	(0.000684)	(0.00184)	(0.00129)	(0.00108)	(0.00243)
Abnormal Earnings	-0.276***	-0.181***	-0.464***	-0.237***	-0.162***	-0.443***
	(0.0321)	(0.0237)	(0.0469)	(0.0524)	(0.0358)	(0.0710)
Firm Size	-0.431***	-0.380***	-0.424***	-0.942***	-0.927***	-0.825***
	(0.0165)	(0.0143)	(0.0165)	(0.0474)	(0.0313)	(0.0368)
Tangibility	-1.095***	-1.342***	-1.302***	-1.245***	-2.172***	-1.909***
	(0.0814)	(0.0755)	(0.101)	(0.124)	(0.120)	(0.149)
Profitability	2.942***	1.196***	1.720***	1.912***	0.972***	1.390***
	(0.211)	(0.101)	(0.114)	(0.247)	(0.140)	(0.152)
Firm	No	No	No	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Observations	71,215	108,316	60,153	71,215	108,316	60,153
χ^2	2387	5061	5733	2049	5427	6110
Pseudo R-Square	0.128	0.163	0.156			
Number of firms	9,861	12,536	6,807	9,861	12,536	6,807

Table 10: Testing Hypothesis 1 - Differences by sub-sample

This table shows the estimation results of Eq. (2) using an ordered logit model for the full sample of 248,470 firm-year observations from 72 countries over the 1993-2015 period, with the dummies for countries group. The dependent variable is the categorical variable *DebtMaturity(1/3)*, which is constructed in Panel A Table 2. Columns 1-2 report the estimation results using the cross-sectional data and Columns 3-4 report the estimation results using panel data. The regressions include industry and year dummies. Definition and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional		Panel	
Variables	(1)	(2)	(3)	(4)
CFV_KS_oi_5	0.0237***	0.0240***	0.0156***	0.0192***
	(0.00135)	(0.00135)	(0.00251)	(0.00259)
Market To Book	0.0743***	0.0755***	0.0707***	0.0630***
	(0.00587)	(0.00609)	(0.00808)	(0.00878)
Asset Maturity	0.0113***	0.0108***	0.0115***	0.00950***
	(0.000481)	(0.000481)	(0.000729)	(0.000745)
Abnormal Earnings	-0.175***	-0.186***	-0.153***	-0.189***
	(0.0148)	(0.0151)	(0.0244)	(0.0260)
Firm Size	-0.270***	-0.299***	-0.512***	-0.758***
	(0.00702)	(0.00733)	(0.0161)	(0.0197)
Tangibility	-1.337***	-1.271***	-1.738***	-1.829***
	(0.0455)	(0.0451)	(0.0712)	(0.0719)
Profitability	1.048***	1.195***	0.729***	1.077***
	(0.0673)	(0.0681)	(0.0916)	(0.0955)
EME(0/1)	0.507***	0.0737	0.870***	-0.264***
	(0.0431)	(0.0478)	(0.0709)	(0.0846)
ADE(0/1)	-0.0440	-0.383***	-0.00601	-0.856***
	(0.0418)	(0.0452)	(0.0688)	(0.0784)
*EME(0/1) * CFV_KS_oi_5*	-0.0155***	-0.0157***	-0.00697*	-0.0115***
	(0.00239)	(0.00243)	(0.00362)	(0.00375)
*ADE(0/1) * CFV_KS_oi_5*	0.00123	0.000323	0.00136	-0.00322
	(0.00166)	(0.00166)	(0.00312)	(0.00320)
Firm	No	No	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Year	No	Yes	No	Yes
Observations	248,470	248,470	248,470	239,684
χ^2	6322	6645	4927	4814
Pseudo R-Square	0.108	0.115		
Number of firms	29,683	29,683	29,683	29,204

Table 11: Economic importance of cash flow volatility on debt maturity

This table reports the economic importance of cash flow volatility on debt maturity for the full sample and three sub-samples. Panel A shows cross-sectional estimation results. Panel B shows panel estimation results. *dy/dx* represents marginal effect. *dy* presents the change in the dependent variable for a one standard deviation change in *CFV_KS_oi_5*. We calculate *dy* by multiplying the marginal effects of *CFV_KS_oi_5* in the full sample and three sub-sample with the standard deviation of *CFV_KS_oi_5* in each sample, respectively

	ALL		EME		ADE		U.S/Can	
	dy/dx	dy	dy/dx	dy	dy/dx	dy	dy/dx	dy
Panel A: Cross-sectional								
1-Long-term debt	-0.0031	-0.03731	-0.00268	-0.01921	-0.00259	-0.03121	-0.00273	-0.04091
2-Short-term debt	0.001137	0.013685	0.001431	0.010247	0.000983	0.011843	0.000463	0.006946
3-Zero-debt	0.001963	0.023625	0.001251	0.008959	0.001606	0.019362	0.002263	0.033959
Panel B: Panel								
1-Long-term debt	-0.00097	-0.01173	-0.00092	-0.00662	-0.0006	-0.00728	-0.00103	-0.01549
2-Short-term debt	0.000309	0.003724	0.000407	0.002916	0.000195	0.002346	0.000162	0.002424
3-Zero-debt	0.000666	0.008009	0.000517	0.003706	0.00041	0.004938	0.000871	0.013065

Table 12: Testing Hypothesis 2 - Cash flow volatility and Zero-debt policy

This table shows the estimation results of Eq. (3) using a logit model for the full sample of 248,470 firm-year observations from 72 countries over the 1993-2015 period. The dependent variable is the dummy variable *Zero Debt*, which takes the value of 1 if a firm has zero debt in a given year (and 0 otherwise). Columns 1-4 report the estimation results using the cross-sectional data, Columns 5-8 report the estimation results using panel data. The regressions include industry, year and development status or country dummies. Definitions and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional				Panel			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFV_KS_oi_5	0.0250***	0.0265***	0.0234***	0.0227***	0.0159***	0.0183***	0.0167***	0.0156***
	(0.000980)	(0.00100)	(0.000998)	(0.00102)	(0.00163)	(0.00164)	(0.00163)	(0.00163)
Market To Book	0.0732***	0.0739***	0.0698***	0.0752***	0.0868***	0.0859***	0.0827***	0.0726***
	(0.00609)	(0.00628)	(0.00632)	(0.00676)	(0.00967)	(0.0101)	(0.0101)	(0.0103)
Asset Maturity	0.0117***	0.0109***	0.0120***	0.0119***	0.0154***	0.0135***	0.0143***	0.0141***
	(0.000536)	(0.000541)	(0.000543)	(0.000573)	(0.000899)	(0.000917)	(0.000928)	(0.000940)
Abnormal Earnings	-0.195***	-0.207***	-0.207***	-0.255***	-0.151***	-0.192***	-0.203***	-0.236***
	(0.0186)	(0.0188)	(0.0199)	(0.0225)	(0.0369)	(0.0396)	(0.0403)	(0.0421)
Firm Size	-0.258***	-0.267***	-0.310***	-0.358***	-0.458***	-0.684***	-0.745***	-0.833***
	(0.00869)	(0.00882)	(0.00926)	(0.0105)	(0.0187)	(0.0206)	(0.0214)	(0.0244)
Tangibility	-1.397***	-1.324***	-1.346***	-1.370***	-2.199***	-2.292***	-2.350***	-2.360***
	(0.0604)	(0.0601)	(0.0596)	(0.0613)	(0.0963)	(0.0967)	(0.0970)	(0.0985)
Profitability	1.443***	1.525***	1.609***	1.849***	1.003***	1.307***	1.431***	1.629***
	(0.0787)	(0.0807)	(0.0799)	(0.0816)	(0.111)	(0.114)	(0.115)	(0.118)
Firm	No	No	No	No	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Development status	No	No	Yes	No	No	No	Yes	No
Country	No	No	No	Yes	No	No	No	Yes
Constant	-1.359***	-2.125***	-2.598***	-1.827***	-3.230***	-4.913***	-5.001***	-2.794***
	(0.391)	(0.404)	(0.413)	(0.549)	(0.652)	(0.718)	(0.724)	(0.937)
Observations	248,470	248,470	248,470	248,404	248,470	248,470	248,470	248,404
χ^2	5069	5253	5338	6229	4117	4234	4310	4876
Pseudo R-Square	0.148	0.154	0.167	0.189				
Number of firms	29,683	29,683	29,683	29,672	29,683	29,683	29,683	29,672

Table 13: Testing Hypothesis 2 - Sub-sample analysis

This table shows the estimation results of Eq. (3) using a logit model for the three sub-samples. The dependent variable is the dummy variable *Zero Debt*, which takes the value of 1 if a firm has zero debt in a given year (and 0 otherwise). The regressions include industry, year and country dummies. Definitions and data sources for all explanatory variables are outlined in Table 4. EME denotes the emerging markets and developing countries group, ADE denotes the advanced economies group and U.S/Can denotes the U.S and Canada group. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional			Panel		
Variables	EME (1)	ADE (2)	U.S/Can (3)	EME (4)	ADE (5)	U.S/Can(6)
CFV_KS_oi_5	0.0202***	0.0214***	0.0215***	0.0199***	0.0123***	0.0152***
	(0.00289)	(0.00152)	(0.00162)	(0.00439)	(0.00249)	(0.00245)
Market To Book	0.0456***	0.0604***	0.103***	0.0452**	0.0505***	0.0868***
	(0.0126)	(0.0107)	(0.0121)	(0.0212)	(0.0184)	(0.0161)
Asset Maturity	0.0122***	0.0109***	0.0139***	0.0113***	0.0142***	0.0166***
	(0.00113)	(0.000736)	(0.00189)	(0.00189)	(0.00127)	(0.00250)
Abnormal Earnings	-0.390***	-0.177***	-0.465***	-0.343***	-0.146**	-0.446***
	(0.0476)	(0.0320)	(0.0500)	(0.0930)	(0.0580)	(0.0899)
Firm Size	-0.371***	-0.358***	-0.383***	-0.870***	-0.932***	-0.745***
	(0.0213)	(0.0186)	(0.0169)	(0.0580)	(0.0374)	(0.0385)
Tangibility	-1.370***	-1.341***	-1.369***	-1.948***	-2.546***	-2.294***
	(0.117)	(0.100)	(0.112)	(0.187)	(0.167)	(0.170)
Profitability	4.679***	1.384***	1.936***	3.591***	1.349***	1.598***
	(0.340)	(0.118)	(0.124)	(0.440)	(0.183)	(0.170)
Firm	No	No	No	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.153	-0.327	-1.402**	0.400	-0.115	-2.478***
	(0.615)	(0.646)	(0.568)	(1.108)	(1.162)	(0.957)
Observations	71,179	108,959	67,916	71,179	108,959	67,916
χ^2	1485	3215	2045	1064	2724	1381
Pseudo R-Square	0.148	0.230	0.177			
Number of firms	9,856	12,525	7,263	9,856	12,525	7,263

Table 14: Economic importance of cash flow volatility on zero-debt policy

This table reports the economic importance of cash flow volatility on zero-debt policy for the full sample and three sub-samples. Panel A shows cross-sectional estimation results. Panel B shows panel estimation results. *dy/dx* represents marginal effect. *dy* presents the change in the dependent variable for a one standard deviation change in *CFV_KS_oi_5*. We calculate *dy* by multiplying the marginal effects of *CFV_KS_oi_5* in the full sample and three sub-sample with the standard deviation of *CFV_KS_oi_5* in each sample, respectively

ALL		EME		ADE		US/Can	
dy/dx	dy	dy/dx	dy	dy/dx	dy	dy/dx	dy
Panel A: Cross-sectional							
0.001964	0.023637	0.001575	0.011283	0.001582	0.019071	0.002392	0.035905
Panel B: Panel							
0.0006355	0.007648	0.000736	0.00527	0.000415	0.005001	0.000854	0.012815

Table 15: Robustness check: Additional firm-level control variables

This table presents robustness tests of Hypothesis 1 using additional control variables. The full sample comprises 248,441 firm-year observations from 72 countries over 1993-2015 period. The dependent variable is *DebtMaturity(1/3)*, which is constructed in Panel A Table 2. We use ordered logit regressions, which include industry, year and development status or country dummies. Columns 1-5 report the estimation results using the cross-sectional data and Columns 6-10 report the estimation results using panel data. Definitions and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional				Panel			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFV_KS_oi_5	0.0200***	0.0222***	0.0219***	0.0236***	0.0138***	0.0160***	0.0157***	0.0154***
	(0.000908)	(0.000929)	(0.000928)	(0.000950)	(0.00145)	(0.00149)	(0.00150)	(0.00149)
Market To Book	0.0816***	0.0833***	0.0740***	0.0560***	0.0720***	0.0651***	0.0622***	0.0438***
	(0.00592)	(0.00618)	(0.00609)	(0.00623)	(0.00812)	(0.00881)	(0.00879)	(0.00896)
Asset Maturity	0.0117***	0.0104***	0.0109***	0.0108***	0.0117***	0.00929***	0.00956***	0.00942***
	(0.000482)	(0.000483)	(0.000483)	(0.000502)	(0.000731)	(0.000744)	(0.000747)	(0.000745)
Abnormal Earnings	-0.168***	-0.182***	-0.177***	-0.228***	-0.154***	-0.186***	-0.186***	-0.215***
	(0.0147)	(0.0149)	(0.0151)	(0.0170)	(0.0245)	(0.0259)	(0.0260)	(0.0268)
Firm Size	-0.286***	-0.301***	-0.300***	-0.390***	-0.527***	-0.753***	-0.759***	-0.873***
	(0.00693)	(0.00710)	(0.00733)	(0.00872)	(0.0159)	(0.0190)	(0.0197)	(0.0219)
Tangibility	-1.357***	-1.271***	-1.289***	-1.268***	-1.754***	-1.825***	-1.839***	-1.827***
	(0.0452)	(0.0450)	(0.0450)	(0.0465)	(0.0710)	(0.0717)	(0.0717)	(0.0723)
Profitability	1.063***	1.177***	1.084***	1.514***	0.773***	1.050***	1.043***	1.270***
	(0.0656)	(0.0670)	(0.0670)	(0.0700)	(0.0911)	(0.0947)	(0.0951)	(0.0961)
TaxRate	0.0149	0.0720***	0.0992***	0.128***	-0.0445*	0.0457*	0.0515**	0.0708***
	(0.0188)	(0.0187)	(0.0188)	(0.0189)	(0.0247)	(0.0253)	(0.0254)	(0.0255)
Firm	No	No	No	No	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Development status	No	No	Yes	No	No	No	Yes	No
Country	No	No	No	Yes	No	No	No	Yes
Observations	248,441	248,441	248,441	248,441	248,441	239,658	239,658	239,658
χ^2	6351	6752	6670	9294	4620	4621	4792	8454
Pseudo R-Square	0.103	0.112	0.115	0.143				
Number of firms	29,682	29,682	29,682	29,682	29,682	29,203	29,203	29,203

Table 16: Robustness check : Alternative debt maturity ratio

This table presents additional robustness tests of Hypothesis 1 using alternative dependent variable. The full sample comprises 248,428 firm-year observations from 72 countries over 1993-2015 period. The dependent variable is *Long-term Debt To Assets*, which is defined as the ratio of long term debt to total assets. We use general linear model (GLM) with a logit link function. The regressions include industry, year and development status or country dummies. Definitions and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

Variables	(1)	(2)	(3)	(4)
CFV_KS_oi_5	-0.00886***	-0.0103***	-0.0139***	-0.0169***
	(0.000863)	(0.000895)	(0.000922)	(0.000976)
Market To Book	0.00365	0.00296	-0.00423	-0.00341
	(0.00491)	(0.00508)	(0.00552)	(0.00510)
Asset Maturity	-0.00466***	-0.00312***	-0.00191***	-0.00131***
	(0.000542)	(0.000499)	(0.000475)	(0.000416)
Abnormal Earnings	0.0794***	0.0852***	0.109***	0.113***
	(0.0100)	(0.0102)	(0.0107)	(0.00956)
Firm Size	0.158***	0.165***	0.145***	0.179***
	(0.00385)	(0.00388)	(0.00381)	(0.00400)
Tangibility	0.594***	0.525***	0.522***	0.534***
	(0.0241)	(0.0238)	(0.0229)	(0.0224)
Profitability	-0.933***	-1.020***	-1.041***	-1.323***
	(0.0479)	(0.0479)	(0.0481)	(0.0474)
Industry	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	Yes
Development status	No	No	Yes	No
Country	No	No	No	Yes
Constant	-3.184***	-2.493***	-3.109***	-3.309***
	(0.131)	(0.133)	(0.131)	(0.255)
Observations	248,428	248,428	248,428	248,428

Table 17: Robustness check: Alternative measure of cash flow volatility

This table presents additional robustness tests of Hypothesis 1 using all measures of cash flow volatility. We use the ordered logit model for the full sample, which comprise 248,470 firm-year observations from 72 countries over 1993-2015 period. The dependent variable is *DebtMaturity(1/3)*, which is constructed in Panel A Table 2. The rolling years column shows the number of years in the window. Columns (1) (3) (5) show the coefficients associated with cash flow volatility. Columns (2) (4) (6) show the number of observations in the model using each cash flow volatility measure. Definitions and constructions for all other explanatory variables are shown in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Window	*KS_oi*	Obs	*SM_oi*	Obs	*DL_oi*	Obs
1	N.A	N.A	N.A	N.A	0.00948***	325,959
2	N.A	N.A	N.A	N.A	0.0141***	304,595
3	0.0198***	299,222	0.0120***	279,958	0.0195***	279,957
4	0.0226***	283,292	0.0136***	260,883	0.0188***	260,859
5	0.0236***	248,470	0.0158***	230,996	0.0252***	230,988

Table 18: Robustness check: Alternative zero-debt measure

This table presents robustness tests of Hypothesis 2 using alternative zero-debt measure for the full sample. The full sample comprises 219,301 firm-year observations for 72 countries over the 1993-2015 period. The dependent variable is *Zero Debt Alternative*, which takes the value of 1 if a firm has zero debt in 3 consecutive years ending in that year (and 0 otherwise). We use logit regressions, which include industry, year and development status or countries dummies. Columns 1-5 report the estimation results using the cross-sectional data, Column 6-10 report the estmation results using panel data. Definitions and data sources for all explanatory variables are outlined in Table 4. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional				Panel			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CFV_KS_oi_5	0.0270***	0.0290***	0.0252***	0.0241***	0.0160***	0.0197***	0.0173***	0.0157***
	(0.00120)	(0.00123)	(0.00123)	(0.00126)	(0.00276)	(0.00261)	(0.00261)	(0.00267)
Market To Book	0.0746***	0.0743***	0.0715***	0.0850***	0.101	0.103***	0.102***	0.0951***
	(0.00743)	(0.00765)	(0.00781)	(0.00857)	(0.0782)	(0.0157)	(0.0162)	(0.0170)
Asset Maturity	0.0140***	0.0131***	0.0144***	0.0144***	0.0239**	0.0215***	0.0230***	0.0227***
	(0.000648)	(0.000656)	(0.000664)	(0.000706)	(0.0122)	(0.00160)	(0.00167)	(0.00174)
Abnormal Earnings	-0.226***	-0.238***	-0.249***	-0.310***	-0.253***	-0.313***	-0.341***	-0.391***
	(0.0210)	(0.0212)	(0.0229)	(0.0263)	(0.0940)	(0.0579)	(0.0604)	(0.0640)
Firm Size	-0.255***	-0.263***	-0.323***	-0.366***	-0.376	-0.699***	-0.800***	-0.900***
	(0.0111)	(0.0112)	(0.0120)	(0.0134)	(0.574)	(0.0380)	(0.0405)	(0.0442)
Tangibility	-1.636***	-1.539***	-1.558***	-1.622***	-2.913	-3.082***	-3.204***	-3.292***
	(0.0802)	(0.0795)	(0.0784)	(0.0815)	(2.363)	(0.183)	(0.187)	(0.190)
Profitability	1.379***	1.468***	1.620***	1.856***	0.639	1.036***	1.235***	1.443***
	(0.101)	(0.103)	(0.103)	(0.105)	(0.449)	(0.190)	(0.194)	(0.201)
Firm	No	No	No	No	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Development status	No	No	Yes	No	No	No	Yes	No
Country	No	No	No	Yes	No	No	No	Yes
Constant	-1.660***	-2.506***	-3.138***	-2.675***	-6.076	-7.951***	-8.241***	-6.707***
	(0.464)	(0.479)	(0.491)	(0.739)	(10.97)	(0.912)	(0.958)	(1.341)
Observations	219,301	219,301	219,301	218,363	219,301	219,301	219,301	218,363
χ^2	3843	4041	4143	4885		2097		
Pseudo R-Square	0.170	0.177	0.195	0.221				
Number of firms	28,877	28,877	28,877	28,753	28,877	28,877	28,877	28,753

Table 19: Robustness check: Alternative zero-debt measure - sub-sample analysis

This table presents additional robustness tests of Hypothesis 2 using alternative zero-debt measure for three sub-samples. The dependent variable is *Zero Debt Alternative*, which takes the value of 1 if a firm has zero debt in 3 consecutive years ending in that year (and 0 otherwise). We use logit regressions, which include industry, year and country dummies. Columns 1-3 report the estimation results using cross-sectional data, Columns 4-6 report the estimation results using panel data. Definitions and data sources for all variables are outlined in Table 4. EME denotes the emerging markets and developing countries group, ADE denotes the advanced economies group and U.S/Can denotes the U.S and Canada group. Clustered standard errors by firm are shown in parentheses with 1%, 5% and 10% significance levels denoted by ***, ** and *, respectively.

	Cross-sectional			Panel		
Variables	EME (1)	ADE (2)	U.S/Can (3)	EME (4)	ADE (5)	U.S/Can (6)
CFV_KS_oi_5	0.0157***	0.0229***	0.0234***	0.0114	0.0138***	0.0152***
	(0.00376)	(0.00186)	(0.00203)	(0.00713)	(0.00399)	(0.00378)
Market To Book	0.0506***	0.0734***	0.113***	0.0962***	0.0678**	0.0937***
	(0.0163)	(0.0131)	(0.0153)	(0.0348)	(0.0291)	(0.0255)
Asset Maturity	0.0149***	0.0131***	0.0187***	0.0196***	0.0207***	0.0302***
	(0.00134)	(0.000932)	(0.00246)	(0.00322)	(0.00208)	(0.00501)
Abnormal Earnings	-0.438***	-0.246***	-0.550***	-0.484***	-0.338***	-0.623***
	(0.0567)	(0.0386)	(0.0535)	(0.133)	(0.0867)	(0.118)
Firm Size	-0.370***	-0.360***	-0.403***	-0.850***	-1.027***	-0.789***
	(0.0276)	(0.0236)	(0.0216)	(0.0974)	(0.0582)	(0.0611)
Tangibility	-1.735***	-1.561***	-1.616***	-3.099***	-3.206***	-3.094***
	(0.160)	(0.131)	(0.151)	(0.318)	(0.291)	(0.299)
Profitability	5.770***	1.310***	2.035***	4.589***	1.291***	1.396***
	(0.441)	(0.148)	(0.162)	(0.734)	(0.302)	(0.271)
Firm	No	No	No	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.792	-0.429	-1.655**	-2.522	-0.715	-4.395***
	(0.872)	(0.699)	(0.659)	(1.673)	(1.117)	(1.148)
Observations	61,571	97,032	59,171	61,571	97,032	59,171
χ^2	1168	2580	1555		1767	822.3
Pseudo R-Square	0.177	0.267	0.207			
Number of firms	9,616	12,066	7,004	9,616	12,066	7,004

Table 20: Literature review

This table summarizes the literature of the relationship between cash flow volatility and debt maturity and zero-debt policies

Study	Scope	Results
Panel A: Literature review of the relationship between cash flow volatility and debt maturity		
Guedes and Opler (1996)	the U.S	Negative
Stosh and Mauer(1996)		Negative
Johnson (2003)		Negative
Miltersen and Torous (2008)	the U.S	Negative
Keefe and Yaghoubi (2016)	the U.S	Negative
Antoniou, Guney and Paudyal (2006)	France, Germany and the UK	Positive (French firms) Negative (British firms)
Deesomsak, Paudyal and Pescetto (2009)	Singapore, Thailand, Malaysia and Australia	Negative (Singapore)
Orman and Kösal (2017)	Turkey	Insignificant
Kirch and Terra (2012)	South America	Positive
Zulfiquar et al. (2018)	China	Negative
Zheng et al. (2012)	40 countries	Negative
Gonzaléz (2017)	39 countries	Insignificant
Panel B: Literature review of the relationship between cash flow volatility and zero-debt policies		
Strebulaev and Yang (2013)	the U.S	Negative
Dang (2013)	the UK	Insignificant
Keefe and Yaghoubi (2016)	the U.S	Positive
Zheng et al. (2017)	73 countries	Negative