

Macroeconomic Uncertainty and Corporate Capital Structure: Evidence from the Asia Pacific Region

(Ketidaktentuan Makroekonomi dan Struktur Modal Korporat: Bukti dari Rantau Asia Pasifik)

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ABSTRACT

The purpose of this paper is to examine the impact of macroeconomic uncertainty on corporate capital structure. This paper considers a wide spectrum of proxies for macroeconomic uncertainty to identify which types of macroeconomic uncertainty are important to the capital structure decisions of a sample of listed firms from seven Asia Pacific countries for the period 2004-2014. The regression models are estimated using the robust two-step system generalised method of moments (GMM) estimator. The results generally provide robust evidence of the negative effect of macroeconomic uncertainty on Asia Pacific firms' capital structure using different proxies for macroeconomic uncertainty. When the aggregate data are split into developing and developed countries, this paper continues to find some evidence supporting the negative association between macroeconomic uncertainty and capital structure. The results also indicate that the three broad classifications of macroeconomic uncertainty, i.e., external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome, significantly affect corporate capital structure. Further analyses reveal that the capital structures of firms in the developing and developed countries are affected by different types of macroeconomic uncertainty. Hence, policy makers should strive to devise suitable course of actions to overcome the unfavourable outcomes stemming from the volatility in the macroeconomic environment, bearing in mind of the multidimensional aspects of macroeconomic uncertainty.

Keywords: Asia Pacific; capital structure; leverage; macroeconomic uncertainty; risks

ABSTRAK

Kajian ini menyelidik kesan ketidaktentuan makroekonomi terhadap struktur modal korporat. Kajian ini mengambil kira pelbagai proksi untuk ketidaktentuan makroekonomi bagi mengenalpasti jenis ketidaktentuan makroekonomi yang dapat mempengaruhi keputusan struktur modal berdasarkan sampel firma tersenarai dari tujuh negara di rantau Asia Pasifik bagi tempoh 2004-2014. Model regresi dianggar menggunakan kaedah momen teritlak sistem langkah dua (GMM). Secara keseluruhan, hasil kajian memberikan bukti kukuh bahawa ketidaktentuan makroekonomi mendatangkan kesan negatif terhadap struktur modal firma di rantau Asia Pasifik berdasarkan proksi untuk ketidaktentuan makroekonomi yang berbeza. Apabila data agregat dibahagikan kepada negara membangun dan negara maju, kajian ini juga membuktikan kesan negatif ketidaktentuan makroekonomi terhadap struktur modal. Hasil kajian turut menunjukkan bahawa ketiga-tiga kategori utama ketidaktentuan makroekonomi, iaitu sumber ketidaktentuan makroekonomi luar negara, sumber ketidaktentuan makroekonomi domestik, dan volatiliti sebagai hasil makroekonomi mempunyai kesan yang signifikan terhadap struktur modal korporat. Analisis lanjutan mendedahkan bahawa struktur modal firma di negara membangun dan negara maju dipengaruhi oleh jenis ketidaktentuan makroekonomi yang berlainan. Justeru itu, pembuat dasar harus merumuskan langkah yang bersesuaian bagi mengatasi kesan buruk ketidaktentuan makroekonomi dan mengambil kira aspek kepelbagaian dimensi ketidaktentuan makroekonomi dalam pembentukan dasar.

Kata kunci: Asia Pasifik; struktur modal; leveraj; ketidaktentuan makroekonomi; risiko



INTRODUCTION

Numerous research has been conducted to identify the determinants of capital structure since the groundbreaking paper by Modigliani and Miller (1958) on the irrelevance theorem. The focus of these studies are predominantly on the effects of firm-specific determinants such as asset tangibility, profitability, and firm size on capital structure (e.g., Ebrahim et al. 2014; Martín & Saona 2017; Vo 2017). Recent papers have also documented the important influence of macroeconomic factors such as fiscal policy, interest rate, and inflation rate on capital structure decisions (e.g., Memon et al. 2015; Mokhova & Zinecker 2014; Zeitun et al. 2017).

Additionally, a few theoretical papers have attempted to examine how firm leverage responds to unforeseeable variations in macroeconomic conditions (e.g., Bhamra et al. 2010; Chen 2010; Levy & Hennessy 2007).¹ These studies posit that firms adopt lower leverage during times of adverse macroeconomic conditions. Meanwhile, empirical support on the association between macroeconomic uncertainty and the financing policy of firms is rather scarce. In the corporate finance literature, there are only a handful of research that have empirically investigated this relationship such as Baum et al. (2009), Caglayan and Rashid (2014), and Rashid (2013). Predominantly, these papers arrived at the same conclusion that a negative relationship prevails between macroeconomic uncertainty and leverage. However, these are single country analyses conducted chiefly on developed countries such as the U.S. and U.K. As such, the issue of generalisability of these research findings and their applicability to firms in developing countries may arise. Hence, it is our aim to close this gap by investigating the effect of macroeconomic uncertainty on leverage in a multi-country setting, whereby a selected number of Asia Pacific countries including both developing and developed countries are covered.

The Asia Pacific region is a vast region, covering a land area of approximately 2.8 billion hectares, or 22% of the world's land area (Food and Agriculture Organisation 1997). Although the region continues to remain as the most dynamic part of the world's economy, it is not spared from various sources of macroeconomic uncertainty through the decades (International Monetary Fund 2016). Macroeconomic uncertainty not only may affect the firms' decisions on production and investment but concomitantly, the ability of the firms to make sound financing decisions may be impacted as well. Given the potential adverse effect of macroeconomic uncertainty on firms in the Asia Pacific region, the economic growth of this region may also be negatively affected. Due to the importance of the potential destabilising effects of macroeconomic uncertainty, this paper is motivated to investigate the effects of macroeconomic uncertainty on the capital structure of firms in the Asia Pacific region.

Furthermore, macroeconomic uncertainty is multidimensional where firms may be uncertain about different facets of a macroeconomic context, and may respond differently to different sources of macroeconomic uncertainty. Nevertheless, past studies on the relationship between macroeconomic uncertainty and capital structure have only examined particular aspects of macroeconomic uncertainty like volatility of interest rates (Caglayan & Rashid 2014; Chow et al. 2017b), volatility of real Gross Domestic Product (GDP) (Caglayan & Rashid 2014; Rashid 2013), and inflation volatility (Hatzinikolaou et al. 2002). Therefore, it is also our aim to address this research gap by analysing a wider spectrum of proxies for macroeconomic uncertainty which can be broadly categorised into external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome, and to identify which specific types of macroeconomic uncertainty are important to corporate capital structure. To achieve these goals, we adopt the robust two-step system GMM estimation on an annual panel dataset for 907 public listed firms from seven countries in the Asia Pacific region for the period 2004-2014. In particular, the countries chosen are Malaysia, Thailand, Indonesia, Philippines, Singapore, Japan, and Australia.

The results of this study generally provide robust evidence of the negative effect of macroeconomic uncertainty on Asia Pacific firms' capital structure using different proxies for macroeconomic uncertainty. When the aggregate data are split into developing and developed countries, this paper continues to find some evidence supporting the negative relationship between macroeconomic uncertainty and capital structure. The results also indicate that the three broad classifications of macroeconomic uncertainty, i.e., external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome, significantly affect corporate capital structure. Further analyses reveal that the capital structures of firms in the developing and developed countries are affected by different types of macroeconomic uncertainty.

The contributions of this paper are two-fold. First, we find that macroeconomic uncertainty adversely affects the leverage of firms in the Asia Pacific region. This contributes to the empirical literature on how macroeconomic uncertainty affects leverage which has so far being primarily confined to single country studies, in particular developed countries like the U.S. and U.K. This research, which is conducted in a multi-country setting, furnishes consistent results with previous findings. Furthermore, we report that the negative association between macroeconomic uncertainty and leverage continues to persist among these Asia Pacific firms when the sample firms are split into developing and developed countries. These findings may prompt the policy makers to proactively devise suitable course

of actions to overcome the unfavourable outcomes stemming from the volatility in the macroeconomic environment, as this paper has demonstrated that when firms encounter heightened uncertainty in the macroeconomic environment, they tend to use less leverage in their capital structures. This subsequently will curtail the firms' production and investment activities. Given the potential widespread effect of macroeconomic uncertainty across various firms in a particular country or region, the economic growth of the country or region may be adversely affected as well. In addition, the findings of this study may also prompt monetary authorities, financial policy makers, and financial institutions to introduce appropriate financial instruments to fulfil funding needs and to mitigate risk during times of volatile macroeconomic conditions. Uncertainty, for instance, due to macroeconomic volatility, affects the borrowers' collateralisable net worth and the ability of lenders to assess the firms' creditworthiness accurately due to information asymmetry problems. This, in turn, affects the risk premium for external funds and the overall cost of borrowing from potential lenders (Caglayan & Rashid 2014; Rashid 2013). Nonetheless, during such turbulent times, alternative sources of financing should be made available to firms such as transitory debt sources like commercial papers and lines of credit.

Second, we find that the three broad classifications of macroeconomic uncertainty, i.e., external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome, have significant impact on leverage. This serves as a new contribution to the capital structure literature since prior studies have not investigated the multidimensional aspects of macroeconomic uncertainty. In addition to volatility of inflation rates, real GDP, interest rates, and growth rate of imports and exports which were reported as significant determinants of capital structure in previous research, we also find that volatility of openness coefficient, monetary growth, and net foreign direct investment (FDI) inflows have adverse impact on capital structure. Moreover, although we find some evidence supporting the negative association between macroeconomic uncertainty and leverage when the aggregate data are divided into developing and developed countries, we discover that the capital structures of firms in the developing and developed countries are influenced by different types of macroeconomic uncertainty. The identification of which specific types of macroeconomic uncertainty are important to the firms' capital structure choices may be of interest to the policy makers as well. For instance, as suggested by Olaberria and Rigolini (2009), if it is found that firms are exposed to external sources of volatility, policy makers should counterbalance this by improving domestic conditions which are within their control. Such measures may include more accountable institutions, more stable monetary and fiscal policies, and better

regulated financial markets. These findings may also provide valuable insights to managers of firms in their risk management practices since they often evaluate risk from various dimensions (Helliar et al. 2002; Morikawa 2016). Furthermore, it is imperative for managers to identify the source of uncertainty before evaluating its effects on corporate decisions, including capital structure choices (Huizinga 1993).

The rest of the paper is arranged as follows. The next section provides the review on related literature. This is followed by the description of data and methodology in the third section. The fourth section discusses the results and conducts further analyses and robustness tests. The last section concludes the study.

LITERATURE REVIEW

Extant macroeconomic literature has documented the critical influence of macroeconomic uncertainty on numerous economic variables such as stock returns, firm profitability, labour income, productivity, output growth, and financial or economic crises (Arellano et al. 2012; Bloom et al. 2013; Stock & Watson 2012). In addition, research has also been conducted on how uncertainties in the macroeconomic environment can affect the behaviour of firms including the demand for liquidity (Beaudry et al. 2001) and expenditures on capital investments (Baum et al. 2006; Sterken et al. 2001).

There is another related strand of literature which has produced theoretical arguments on how macroeconomic uncertainty affects corporate capital structure. For instance, Korajczyk and Levy (2003) study how macroeconomic conditions influence the capital structure of firms which are financially constrained and those which are not. They find that macroeconomic conditions have a greater effect on unconstrained firms as compared to constrained firms. Likewise, Hackbarth et al. (2006) develop a contingent claims model where the cash flows of the firm are conditional on macroeconomic conditions and idiosyncratic risks. The authors assert that leverage is countercyclical, and the pace and size of changes in firms' capital structures are dependent on macroeconomic conditions. In the same vein, Levy and Hennessy (2007) adopt a general equilibrium framework to examine the choices in firms' financing over the business cycle, and report that firms having more acute financing constraints are more likely to abstain from using more debts during times of adverse macroeconomic conditions. Other theoretical papers which have studied the influence of variations in macroeconomic conditions on leverage are Bhamra et al. (2010) and Chen (2010). Taken together, the theoretical relationship between macroeconomic uncertainty and the capital structure decisions of firms has been rather well-established, where past literature has shown that firms tend to use lower leverage during times of heightened macroeconomic

volatility. Notwithstanding, these studies predominantly do not take into account the potential sources of macroeconomic uncertainty.

Turning to the empirical studies on the association between macroeconomic uncertainty and firms' capital structure decisions, a survey of the empirical literature highlights the paucity of research that has been done on this area. For instance, Hatzinikolaou et al. (2002) investigate the effect of inflation uncertainty on the leverage of Dow Jones industrial firms. They find that during periods of heightened inflation uncertainty, firms encounter greater cash flow uncertainty and high business risk. Consequently, firms resort to issuing new equity capital as a way to raise funds for capital investments. At the same time, inflation uncertainty has a strong adverse impact on the firms' debt ratio. In a similar scope, Baum et al. (2009) examine the association between macroeconomic uncertainty and the leverage of U.S. non-financial firms, and report an inverse relation between both variables. The findings suggest that when the macroeconomic environment becomes increasingly unpredictable, firms tend to exercise extra caution by taking on less debts in anticipation of shrinking income and cash flows. Similar evidence is provided by Rashid (2013) who analyses the impact of macroeconomic uncertainty on the capital structure choices of U.K. energy firms. The author also pinpoints that macroeconomic uncertainty results in lower leverage. Besides, Caglayan and Rashid (2014) conduct their research on a sample of U.K. manufacturing firms and report on the adverse impact of macroeconomic uncertainty on leverage. The authors attributed the lower leverage to the financial distress risk faced by firms during times of high macroeconomic uncertainty. Turning to the Asia Pacific region, Chow et al. (2017a) examine how export volatility affects corporate financing decisions in Australia, and find that export volatility has a significant negative effect on long-term debt but no significant results are observed for short-term debt. Subsequently, in another paper, Chow et al. (2017b) conduct a study on the influence of macroeconomic uncertainty on the financing decisions of Philippine firms. The authors report that macroeconomic uncertainty has adverse effects on both short-term and long-term debt.

Collectively, these studies predominantly conclude that macroeconomic uncertainty is negatively related to leverage. Nonetheless, these studies are conducted on a single country only and are chiefly restricted to the U.S. and U.K. firms.² Less known, however, is whether these findings are applicable and generalisable to firms in other developed countries as well as to firms in developing countries. Furthermore, these studies have adopted different proxies for macroeconomic uncertainty, where some of these studies have demonstrated that the choice of proxy for macroeconomic uncertainty matters. Notwithstanding, these studies have focused on limited aspects of macroeconomic uncertainty such as inflation

volatility (Hatzinikolaou et al. 2002), volatility of real GDP (Caglayan & Rashid 2014; Rashid 2013), volatility of interest rates (Caglayan & Rashid 2014; Chow et al. 2017b), volatility of exports (Chow et al. 2017a; 2018), and volatility of imports (Chow et al. 2018).

Hence, the present study aims to rectify these literature gaps by exploring a wider spectrum of proxies for macroeconomic uncertainty which can be broadly categorised into external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome, and to identify which specific types of macroeconomic uncertainty are important to the firms' capital structure. This study is conducted in a multi-country setting based on selected firms from developing and developed Asia Pacific countries. We hypothesize that there is a negative association between the various proxies for macroeconomic uncertainty and leverage of these firms.

DATA AND METHODOLOGY

DATA

This research covers seven selected countries in the Asia Pacific region, i.e., Malaysia, Thailand, Philippines, Indonesia, Australia, Singapore, and Japan. The sample of Asia Pacific countries chosen possess varying institutional set-ups such as degree of economic development and financial markets. With regards to degree of economic development, Malaysia, Philippines, Indonesia, and Thailand are classified as developing countries, whilst Australia, Japan, and Singapore are developed countries. In a similar manner, although the stock markets in Malaysia, Philippines, Indonesia, and Thailand are regarded as emerging exchanges, the markets in Australia, Japan, and Singapore are better developed (La Porta et al. 1998; Öztekin & Flannery 2012). The diverse background of these countries presents us the chance to evaluate whether past results obtained from single-country analyses, especially in the U.K. and U.S., are applicable to other countries or regions, in particular the Asia Pacific region.

Our primary focus is to sample at least 10% of the public listed firms from each country. Out of the whole initial sample, we randomly select firms from every major sector. However, we do not include the financial sector because of differences in reporting requirements. This study covers the years 2004-2014, and only firms with five or more continuous annual data are chosen. Data for this study are gathered from various sources. We obtain macroeconomic data from various reliable sources, i.e., Federal Reserve Economic Data (FRED) by the Federal Reserve Bank of St. Louis, World Development Indicators (WDI) by the World Bank, International Financial Statistics (IFS) by the International Monetary Fund (IMF), Organisation for Economic Co-operation

and Development, Economic and Social Commission for Asia and the Pacific Statistical Database by the United Nations, Statistics Departments, and central banks of each country. Firm-specific data are obtained from Datastream. Whenever necessary, we resort to alternative sources such as company annual reports to collect any missing data. All data related to firm-specific and macroeconomic variables are winsorized at the lower and upper one-percentile to mitigate outlier problems. Our final sample consists of 907 listed non-financial firms, forming an unbalanced panel of 9,607 firm-year observations. 100 firms are sampled from Malaysia, Singapore, Thailand, Indonesia, and Philippines, respectively. Meanwhile, we also sample 186 Japanese firms and 221 Australian firms.³

METHODOLOGY

The capital structure regression model of this study is as follows:

$$\begin{aligned} LEV_{it} = & \beta_0 + \beta_1 LEV_{it-1} + \beta_2 MU_t + \beta_3 SALES_{it} + \\ & \beta_4 TANGI_{it} + \beta_5 FIRM_SIZE_{it} + \\ & \beta_6 INFLATION_t + \beta_7 EXG_RATE_t + \\ & \beta_8 CRISISDUM_t + \mu_t + \varepsilon_{it} \end{aligned} \quad (1)$$

where subscripts i and t represent the firm and year. LEV is leverage, MU is macroeconomic uncertainty, $SALES$ represents sales, $TANGI$ is asset tangibility, $FIRM_SIZE$ is firm size, $INFLATION$ is inflation rate, EXG_RATE is exchange rate, $CRISISDUM$ is crisis dummy, μ is country-specific effects, and ε denotes the disturbance term.

The dependent variable is leverage. This study adopts two measures of leverage. The first measure is a broader definition of book leverage, i.e., the book value of total debt ratio ($BVTDR$). Drobetz et al. (2007) pinpoint that a potential shortcoming of the total debt ratio is it also encompasses current liabilities, which are meant more for transaction purposes than for financing.⁴ Consequently, this measure of leverage may overstate the amount of leverage. Due to this reason and as a robustness check, we also adopt a second measure, which is a narrower definition of book leverage, i.e., the book value of long-term debt ratio ($BVLTDR$).

The independent variable is macroeconomic uncertainty. The proxies for macroeconomic uncertainty adopted are based on several empirical literatures. Firstly, we use indicators which account for macroeconomic volatility, i.e., volatility as a macroeconomic outcome (Arza 2009; Caglayan & Rashid 2014; Chow et al. 2018; Rashid 2013). Additionally, macroeconomic uncertainty can result from either unstable or inconsistent domestic macroeconomic policies, or from volatility which has been imported from abroad. Hence, we also consider the possible sources of such volatile outcomes, particularly domestic sources of macroeconomic uncertainty which are under the countries' control (Arize et al. 2008; Arza 2009; Caglayan & Rashid 2014) as well as external

sources of macroeconomic uncertainty (Broner et al. 2013; Lee et al. 2013; Li & Rajan 2015).

Six indicators are used as proxies for macroeconomic outcomes, i.e., growth in prices, relative prices, growth in real GDP, growth in imports, and growth in exports. Specifically, the indicators of macroeconomic outcomes are as follows: growth rate of Producer Price Index (PPI), growth rate of Consumer Price Index (CPI), relative prices, growth rate of real GDP, growth rate of imports, and growth rate of exports. Seven indicators are used as proxies for four different domestic macroeconomic policies, i.e., fiscal result (fiscal policy), nominal and real interest rates, and monetary growth (monetary policy), openness coefficient (trade policy), and real exchange rate (exchange rate policy). Precisely, the indicators of domestic sources of uncertainty are as follows: fiscal result as a proportion of GDP, growth rate of nominal lending rates, growth rate of nominal deposit rates, real interest rate, monetary growth, openness coefficient, and growth rate of real broad effective exchange rates. Two indicators are used as proxies for an external source of macroeconomic uncertainty, i.e., capital mobility. Particularly, the indicators of external sources of uncertainty are as follows: net portfolio equity inflows as a proportion of GDP and net FDI inflows as a proportion of GDP.

We use the moving-average standard deviations of the residuals from a first-order autoregressive process of the macroeconomic series to estimate time-varying macroeconomic volatilities.^{5,6} The rationale for estimating the autoregressive processes is to control for inertia or past behaviour of the relevant macroeconomic variable. Hence, the residuals of these processes are made up of that part of the manifestation of the variable that cannot be 'expected' based on past performance. Consequently, the analyses of the residuals' variability would be largely due to unexpected volatility, which serves as a better proxy for uncertainty. Among studies using such volatility models are Aizenman and Marion (1999), Arza (2013), and Li and Rajan (2015).

In addition, this paper incorporates some control variables based on previous capital structure studies. We analyse firm-specific determinants, i.e., firm size, sales, and asset tangibility, and macroeconomic variables, i.e., exchange rate and inflation rate. In order to account for the global financial crisis (GFC), we have also included a crisis dummy. Lastly, we added country dummies to capture other unobservable country-specific effects. An overview of these variables, and their symbol and definitions is given in the appendix.

This study adopts a dynamic panel estimation procedure, i.e., the system GMM estimation for panel data (Blundell & Bond 1998). We adjusted all coefficients for heteroscedasticity. The GMM estimation procedure has the advantage of being able to deal with any potential endogeneity problems, eliminate unobserved firm fixed effects, and control for heterogeneity across firms.

Besides, we adopt the two-step estimator since it is more efficient than the one-step estimator. In order to examine whether the instrumental variables used in the estimations are robust or not, we apply two specification tests, i.e., the Hansen (1982) *J*-statistic and Arellano and Bond (1991) AR(2) test. The *J*-statistic is a test of over-identifying restrictions with the null hypothesis of the instruments being valid. Meanwhile, the null hypothesis of the AR(2) test is there is no second-order serial correlation in the model's residuals. To ascertain which types of macroeconomic uncertainty drive the results, this study estimates the regression model on the 15 proxies for macroeconomic uncertainty separately.⁷

RESULTS AND DISCUSSION

DESCRIPTIVE STATISTICS

Tables 1 and 2 provide the descriptive statistics for the full sample, and for the developing and developed countries, respectively. Table 2 also reports the two-sample-*t*-tests which indicate whether the differences observed between the developing and developed countries for various variables are statistically significant or not. A critical inspection of the descriptive statistics reveals some important information. For the full sample, firms have, on average, a total debt ratio of 21.8% (standard

deviation 22.7%). Meanwhile, firms have, on average, a long-term debt ratio of 12.6% (standard deviation 17.9%). A comparison between these two debt ratios indicates that firms utilise both long-term and short-term debts in their capital structure. Meanwhile, firms in the developing countries have, on average, marginally higher total debt ratio of 21.8%, as compared to 21.7% for firms in the developed countries. Nevertheless, the difference is not statistically significant. Conversely, firms in the developed countries have, on average, higher long-term debt ratio of 13.6%, as compared to 11.3% for firms in the developing countries, and the difference is statistically significant. The statistics imply that although firms in both the developed and developing countries utilise almost similar levels of total debts, firms in the developed countries depend more on long-term debts than firms in the developing countries.

Furthermore, a wide disparity is observed among the different proxies for macroeconomic uncertainty between the developing and developed countries and in most instances, the differences are statistically significant. Overall, it is observed that the developing countries are exposed to higher volatility in the macroeconomic environment than the developed countries. Developing countries have aggressively expanded their trading activities in recent years as part of their trade liberalisation initiatives. Although these initiatives have spurred the countries' economic growth, they have also become

TABLE 1. Descriptive statistics for full sample

Variable	Obs.	Mean	Std. Dev.	Min	Max
<i>Dependent variable</i>					
BVTDR	9,607	0.218	0.227	0.000	6.260
BVLTDR	9,607	0.126	0.179	0.000	5.698
<i>Independent variables</i>					
GDP_RISK	9,607	0.095	0.268	0.002	1.658
CPI_RISK	9,607	0.006	0.006	0.002	0.044
PPI_RISK	9,607	0.020	0.017	0.003	0.122
RP_RISK	9,607	0.015	0.013	0.002	0.093
EX_RISK	9,607	0.076	0.045	0.016	0.206
IM_RISK	9,607	0.075	0.046	0.016	0.250
M2_RISK	9,607	0.037	0.025	0.006	0.110
DEP_RISK	9,607	0.122	0.109	0.000	0.497
LEND_RISK	9,607	0.024	0.026	0.000	0.115
RINT_RISK	9,607	0.002	0.002	0.000	0.011
FIS_RISK	9,607	0.015	0.010	0.002	0.044
REER_RISK	9,607	0.016	0.007	0.005	0.036
OP_RISK	9,607	0.042	0.048	0.001	0.333
FDI_RISK	9,607	0.017	0.023	0.000	0.102
PEQ_RISK	9,607	0.018	0.015	0.000	0.071
<i>Control variables</i>					
SALES	9,607	0.884	0.681	0.000	5.675
TANGI	9,607	0.313	0.227	0.000	0.989
FIRM_SIZE	9,607	22.681	4.046	10.617	33.083
INFLATION	9,607	0.028	0.024	-0.014	0.131
EXG_RATE	9,607	95.596	8.269	75.040	112.400
CRISISDUM	9,607	0.188	0.391	0.000	1.000

Note: Refer to the appendix for symbol and definitions of variables.

TABLE 2. Descriptive statistics for developing and developed countries

Variable	Developing countries		Developed countries		Difference in means
	Mean	Std. Dev.	Mean	Std. Dev.	
<i>Dependent variable</i>					
BVTDR	0.218	0.197	0.217	0.248	0.001
BVLTDR	0.113	0.141	0.136	0.203	-0.023***
<i>Independent variables</i>					
GDP_RISK	0.194	0.384	0.020	0.028	0.174***
CPI_RISK	0.009	0.008	0.005	0.002	0.004***
PPI_RISK	0.022	0.017	0.018	0.018	0.004***
RP_RISK	0.017	0.011	0.013	0.014	0.004***
EX_RISK	0.077	0.045	0.075	0.045	0.002
IM_RISK	0.082	0.052	0.069	0.041	0.013***
M2_RISK	0.040	0.022	0.035	0.027	0.005***
DEP_RISK	0.105	0.077	0.136	0.127	-0.031***
LEND_RISK	0.028	0.020	0.020	0.030	0.008***
RINT_RISK	0.003	0.002	0.002	0.002	0.001***
FIS_RISK	0.010	0.008	0.018	0.010	-0.008***
REER_RISK	0.013	0.006	0.018	0.007	-0.005***
OP_RISK	0.051	0.032	0.035	0.057	0.016***
FDI_RISK	0.010	0.005	0.023	0.028	-0.013***
PEQ_RISK	0.015	0.015	0.020	0.015	-0.005***
<i>Control variables</i>					
SALES	0.802	0.666	0.946	0.685	-0.144***
TANGI	0.360	0.237	0.278	0.211	0.082***
FIRM_SIZE	23.374	3.660	22.153	4.242	1.221***
INFLATION	0.043	0.025	0.018	0.017	0.025***
EXG_RATE	95.867	6.933	95.391	9.151	0.476***
CRISISDUM	0.191	0.393	0.186	0.389	0.005
Observations	4,151		5,456		

Notes: Refer to the appendix for symbol and definitions of variables. *** Statistical significance at 1 percent level.

more susceptible to external shocks (Olaberria & Rigolini 2009).

Table 3 presents the correlations between the variables. We observe that majority of the explanatory variables are weakly correlated with one another since the correlation coefficients are generally low, i.e., below 0.8 (Gujarati & Porter 2009). However, what is of primary concern are the statistically significant and high correlations observed among several proxies for macroeconomic uncertainty. In particular, high correlations are observed between volatility of growth rate of PPI and volatility of relative prices (correlation of 0.94), and between volatility of growth rate of nominal lending rates and real interest rate volatility (correlation of 0.83). In order to deal with multicollinearity problem arising from high correlations between these variables, each regression model is analyzed separately for each proxy for macroeconomic uncertainty.⁸

MAIN REGRESSION RESULTS

Tables 4 and 5 present the estimates for book value of total debt ratio and long-term debt ratio for the full sample, respectively. The results for 15 regressions are reported, one for each proxy for macroeconomic uncertainty. Asymptotic standard errors are robust to

heteroscedasticity. The instruments are valid as indicated by the Hansen *J*-statistics, and the models' residuals are not subject to second-order correlations according to the AR(2) test statistics.

The results in Table 4 show that nine proxies for macroeconomic uncertainty have a statistically significant negative relationship with total debt ratio, i.e., volatility of growth rate of CPI, growth rate of PPI, relative prices, growth rate of imports, growth rate of exports, growth rate of nominal lending rates, real interest rate, openness coefficient, and net FDI inflows. Nonetheless, the coefficients of six other proxies are not statistically significant.

Meanwhile, the findings in Table 5 reveal that five proxies for macroeconomic uncertainty have a statistically significant negative relationship with long-term debt ratio, i.e., volatility of growth rate of real GDP, growth rate of PPI, relative prices, monetary growth, and openness coefficient. The results for volatility of growth rate of PPI, relative prices, and openness coefficient are qualitatively similar to those reported in Table 4 using total debt ratio as the proxy for leverage, hence confirming that our main empirical findings are generally robust to different definitions of leverage. Interestingly, volatility of growth rate of nominal deposit rates has a significant positive relationship with long-term debt ratio. This

TABLE 4. Regression results for all countries (Dependent variable: Book value of total debt ratio)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GDP_RISK	0.001 (0.10)														
CPI_RISK		-1.020*** (-4.16)													
PPI_RISK			-0.400*** (-3.52)												
RP_RISK				-0.407** (-2.56)											
EX_RISK					-0.081*** (-2.69)										
IM_RISK						-0.123*** (-4.06)									
M2_RISK							-0.062 (-1.25)								
DEP_RISK								0.015 (0.81)							
LEND_RISK									-0.173*** (-2.77)						
RINT_RISK										-1.712*** (-2.66)					
FIS_RISK											-0.212 (-1.41)				
REER_RISK												0.154 (0.80)			
OP_RISK													-0.195*** (-4.53)		
FDI_RISK														-0.167* (-1.74)	
PEQ_RISK															-0.003 (-0.03)
LAGGED BVTDR	0.678*** (17.40)	0.680*** (18.08)	0.684*** (18.57)	0.682*** (18.07)	0.681*** (17.34)	0.681*** (16.94)	0.680*** (16.99)	0.678*** (17.36)	0.682*** (17.31)	0.680*** (17.33)	0.678*** (17.39)	0.677*** (17.43)	0.682*** (17.94)	0.679*** (17.32)	0.678*** (17.27)
SALES	-0.011*** (-3.78)	-0.011*** (-3.68)	-0.011*** (-3.82)	-0.011*** (-3.83)	-0.011*** (-3.84)	-0.011*** (-3.82)	-0.011*** (-3.79)	-0.011*** (-3.82)	-0.011*** (-3.82)	-0.011*** (-3.76)	-0.011*** (-3.82)	-0.011*** (-3.78)	-0.012*** (-3.88)	-0.011*** (-3.83)	-0.011*** (-3.78)
TANGI	0.042*** (3.77)	0.046*** (4.15)	0.045*** (4.01)	0.043*** (3.86)	0.042*** (3.79)	0.043*** (3.78)	0.042*** (3.72)	0.042*** (3.74)	0.042*** (3.75)	0.043*** (3.79)	0.043*** (3.82)	0.043*** (3.81)	0.043*** (3.85)	0.043*** (3.80)	0.042*** (3.76)
FIRM_SIZE	0.009*** (5.68)	0.008*** (5.48)	0.008*** (5.40)	0.008*** (5.43)	0.009*** (5.58)	0.009*** (5.76)	0.009*** (5.61)	0.009*** (5.70)	0.009*** (5.64)	0.009*** (5.70)	0.009*** (5.68)	0.009*** (5.68)	0.008*** (5.42)	0.009*** (5.61)	0.009*** (5.70)

TABLE 4. Regression results for all countries (Dependent variable: Book value of total debt ratio) (continued)

Variable	BVTDR (1)	BVTDR (2)	BVTDR (3)	BVTDR (4)	BVTDR (5)	BVTDR (6)	BVTDR (7)	BVTDR (8)	BVTDR (9)	BVTDR (10)	BVTDR (11)	BVTDR (12)	BVTDR (13)	BVTDR (14)	BVTDR (15)
INFLATION	0.284*** (3.78)	0.311*** (4.07)	0.192*** (2.77)	0.216*** (3.06)	0.168** (2.23)	0.112 (1.41)	0.280*** (3.74)	0.301*** (4.09)	0.237*** (3.08)	0.243*** (3.14)	0.273*** (3.69)	0.285*** (3.84)	0.116 (1.59)	0.289*** (3.85)	0.284*** (3.76)
EXG_RATE	0.001*** (4.51)	0.001*** (4.46)	0.000*** (4.01)	0.001*** (4.31)	0.001*** (5.05)	0.000*** (4.08)	0.001*** (4.70)	0.001*** (3.87)	0.000*** (3.83)	0.000*** (3.54)	0.001*** (4.59)	0.001*** (4.36)	0.000*** (3.19)	0.000*** (4.29)	0.001*** (4.56)
CRISISDUM	0.013*** (6.15)	0.019*** (7.78)	0.023*** (6.73)	0.020*** (6.09)	0.019*** (6.63)	0.022*** (7.10)	0.013*** (6.21)	0.012*** (4.45)	0.016*** (6.64)	0.016*** (6.48)	0.013*** (6.18)	0.013*** (5.20)	0.021*** (7.94)	0.014*** (6.52)	0.013*** (6.07)
Constant	-0.179*** (-6.17)	-0.169*** (-5.83)	-0.156*** (-5.18)	-0.164*** (-5.42)	-0.176*** (-6.13)	-0.163*** (-5.47)	-0.179*** (-6.24)	-0.176*** (-6.16)	-0.165*** (-5.84)	-0.164*** (-5.85)	-0.182*** (-6.37)	-0.183*** (-6.31)	-0.144*** (-4.70)	-0.169*** (-5.93)	-0.179*** (-6.21)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700
No. of firms	907	907	907	907	907	907	907	907	907	907	907	907	907	907	907
No. of instruments	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
AR(1): <i>p</i> -value	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
AR(2): <i>p</i> -value	0.834	0.840	0.837	0.836	0.835	0.840	0.836	0.832	0.848	0.848	0.835	0.834	0.839	0.834	0.834
<i>J</i> -statistic: <i>p</i> -value	0.562	0.628	0.748	0.689	0.711	0.658	0.580	0.531	0.710	0.664	0.612	0.592	0.696	0.605	0.559

Notes: Figures in parentheses are *t*-statistics. Asymptotic standard errors are heteroscedasticity robust. Refer to the appendix for symbol and definitions of variables. ***, **, and * Statistical significance at 1, 5, and 10 percent levels, respectively.

TABLE 5. Regression results for all countries (Dependent variable: Book value of long-term debt ratio)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GDP_RISK	-0.007* (-1.91)														
CPI_RISK		-0.147 (-0.76)													
PPI_RISK			-0.202** (-2.25)												
RP_RISK				-0.300** (-2.46)											
EX_RISK					0.006 (0.24)										
IM_RISK						-0.026 (-0.97)									
M2_RISK							-0.074* (-1.88)								
DEP_RISK								0.043*** (2.95)							
LEND_RISK									-0.007 (-0.13)						
RINT_RISK										0.225 (0.40)					
FIS_RISK											-0.085 (-0.61)				
REER_RISK												0.081 (0.48)			
OP_RISK													-0.132*** (-4.14)		
FDI_RISK														-0.001 (-0.02)	
PEQ_RISK															0.002 (0.02)
LAGGED BVLTR	0.596*** (24.55)	0.596*** (24.54)	0.599*** (25.39)	0.599*** (25.10)	0.596*** (24.55)	0.595*** (24.89)	0.596*** (24.39)	0.595*** (24.31)	0.595*** (24.15)	0.594*** (24.14)	0.596*** (24.83)	0.596*** (24.38)	0.595*** (24.81)	0.595*** (24.45)	0.596*** (24.40)
SALES	-0.013*** (-5.68)	-0.013*** (-5.69)	-0.013*** (-5.68)	-0.013*** (-5.68)	-0.013*** (-5.70)	-0.013*** (-5.69)	-0.013*** (-5.71)	-0.013*** (-5.75)	-0.013*** (-5.70)	-0.013*** (-5.67)	-0.013*** (-5.70)	-0.013*** (-5.70)	-0.013*** (-5.75)	-0.013*** (-5.72)	-0.013*** (-5.70)
TANGI	0.047*** (5.23)	0.047*** (5.26)	0.047*** (5.32)	0.047*** (5.26)	0.046*** (5.21)	0.047*** (5.26)	0.046*** (5.19)	0.045*** (5.11)	0.047*** (5.22)	0.047*** (5.25)	0.047*** (5.25)	0.046*** (5.16)	0.047*** (5.29)	0.046*** (5.18)	0.046*** (5.18)
FIRM_SIZE	0.010*** (8.65)	0.010*** (8.64)	0.010*** (8.51)	0.010*** (8.46)	0.010*** (8.61)	0.010*** (8.67)	0.010*** (8.57)	0.010*** (8.81)	0.010*** (8.93)	0.010*** (8.85)	0.010*** (8.69)	0.010*** (8.74)	0.010*** (8.52)	0.010*** (8.86)	0.010*** (8.76)

TABLE 5. Regression results for all countries (Dependent variable: Book value of long-term debt ratio) (continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
INFLATION	0.043 (0.74)	0.040 (0.68)	-0.017 (-0.29)	-0.022 (-0.36)	0.046 (0.72)	0.003 (0.05)	0.033 (0.56)	0.075 (1.28)	0.035 (0.57)	0.042 (0.70)	0.034 (0.58)	0.036 (0.61)	-0.081 (-1.31)	0.037 (0.64)	0.035 (0.60)
EXG_RATE	0.000 (1.57)	0.000* (1.94)	0.000 (1.52)	0.000 (1.63)	0.000* (1.88)	0.000* (1.80)	0.000** (2.22)	0.000 (0.98)	0.000* (1.84)	0.000** (1.97)	0.000** (1.99)	0.000* (1.94)	0.000 (0.87)	0.000* (1.91)	0.000* (1.92)
CRISISDUM	0.005*** (2.77)	0.006*** (2.85)	0.010*** (3.55)	0.010*** (3.81)	0.005* (1.93)	0.007** (2.49)	0.006*** (2.93)	0.002 (0.70)	0.006*** (2.56)	0.005** (2.42)	0.006*** (2.92)	0.005** (2.43)	0.011*** (4.85)	0.005*** (2.84)	0.005*** (2.80)
Constant	-0.186*** (-7.85)	-0.191*** (-7.98)	-0.180*** (-7.25)	-0.180*** (-7.22)	-0.192*** (-7.98)	-0.187*** (-7.67)	-0.191*** (-8.03)	-0.186*** (-7.79)	-0.191*** (-8.23)	-0.193*** (-8.28)	-0.193*** (-8.15)	-0.194*** (-8.14)	-0.169*** (-6.73)	-0.193*** (-8.20)	-0.192*** (-8.06)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700
No. of firms	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
No. of instruments	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
AR(1): <i>p</i> -value	0.657	0.658	0.660	0.660	0.656	0.657	0.658	0.650	0.656	0.654	0.657	0.656	0.658	0.655	0.656
AR(2): <i>p</i> -value	0.283	0.284	0.284	0.285	0.291	0.317	0.287	0.320	0.281	0.278	0.314	0.276	0.312	0.283	0.292

Notes: Figures in parentheses are *t*-statistics. Asymptotic standard errors are heteroscedasticity robust. Refer to the appendix for symbol and definitions of variables. ***, **, *, and * Statistical significance at 1, 5, and 10 percent levels, respectively.

finding contradicts with our hypothesis that a negative association prevails between macroeconomic uncertainty and leverage as well as prior findings by Caglayan and Rashid (2014). Nevertheless, this may be explained by Muthama et al. (2013) that interest rates have a positive relationship with leverage. Similarly, Mokhova and Zinecker (2014) also find that long-term and short-term interest rates positively influence leverage. At the same time, past literature finds that interest rates positively affect interest rate volatility (Chan et al. 1992; Longstaff & Schwartz 1992). Meanwhile, the coefficients of the remaining nine proxies are not statistically significant.

Collectively, the results offer strong supporting evidence that higher macroeconomic volatility leads to less leverage. This is in agreement with previous empirical findings from the U.S. and U.K. (Baum et al. 2009; Caglayan & Rashid 2014; Rashid 2013) as well as selected countries in the Asia Pacific region (Chow et al. 2017a; 2017b; 2018). The results may be explained by several factors. For example, firms may reduce their borrowings during periods of escalating macroeconomic uncertainty because cash flows and revenues are expected to deteriorate (Baum et al. 2009). Additionally, firms may use lower debt during such times as a precautionary measure to conserve their financial flexibility (Bhamra et al. 2010). Moreover, leverage may become a less attractive financing alternative due to expectations of less tax benefits of debts (Chen 2010).

Turning to the control variables, sales has a statistically significant negative association with total debt and long-term debt ratios in each regression model. The findings agree with Baum et al. (2009) and Caglayan and Rashid (2014), indicating that firms are able to borrow less when sales improve. Meanwhile, asset tangibility has a statistically significant positive relationship with total debt and long-term debt ratios in each regression model. This is in accord with the trade-off theory which predicts that firms possessing more tangible assets have a greater amount of assets to offer as collateral for loans, and lenders face lower risk when lending to such firms. This also complements the results by Frank and Goyal (2009) and Vo (2017). Likewise, firm size has a statistically significant positive association with total debt and long-term debt ratios in each regression model. This corroborates the trade-off theory which postulates that larger firms are better diversified and have lower chances of bankruptcy. Similar evidence is reported by Chakraborty (2013) and Vo (2017).

Overall, inflation rate has a statistically significant positive association with total debt ratio, which is in line with the predictions of the trade-off theory. Firms may be encouraged to issue more debts when expected inflation increases since they can receive greater tax benefits from the interest payments. The results are in agreement with Memon et al. (2015) and Zeitun et al. (2017).⁹ Nonetheless, the coefficient of inflation rate is generally positive but not statistically significant when

leverage is proxied by the long-term debt ratio. Exchange rate generally has a statistically significant positive association with total debt and long-term debt ratios. Past literature has demonstrated that exchange rate may affect capital structure via various channels such as share prices and value of the firm (Akay & Cifter 2014; Tehrani & Najafzadehkhoee 2015). Consequently, firm may rely more on debt financing given the adverse conditions in the stock markets.¹⁰

As a whole, the crisis dummy coefficient is positive and statistically significant. This reflects that the GFC has a powerful influence on the leverage of firms. This also agrees with Campello et al. (2010) and Iqbal and Kume (2014). Finally, the coefficients of both the lagged total debt ratio and lagged long-term debt ratio are significantly positive in each regression model. This reflects that leverage has persistence effects, where firms which adopt more debts in the previous period will persist to do so in the following periods. The results are also consistent with Caglayan and Rashid (2014).

Taken together, the results generally provide robust evidence of the adverse effect of macroeconomic uncertainty on the leverage of firms in the Asia Pacific region using different proxies for firm leverage and measures of macroeconomic uncertainty. This contributes to the empirical literature on how macroeconomic uncertainty affects leverage which has so far being primarily confined to single country studies, in particular developed countries like the U.S. and U.K. This study, which is done in a multi-country setting, provides consistent results with the earlier findings. Moreover, the results also indicate that the three broad classifications of macroeconomic uncertainty, i.e., external sources of macroeconomic uncertainty (volatility of net FDI inflows), domestic sources of macroeconomic uncertainty (volatility of growth rate of nominal lending rates, growth rate of nominal deposit rates, real interest rate, monetary growth, and openness coefficient), and volatility as a macroeconomic outcome (volatility of growth rate of PPI, growth rate of CPI, relative prices, growth rate of real GDP, growth rate of imports, and growth rate of exports) have significant effects on leverage. This is a new contribution to the capital structure literature since past studies have not analysed the multidimensional aspects of macroeconomic uncertainty. However, we find no support for the influence of volatility of fiscal policies, exchange rate growth, and net portfolio equity inflows.

FURTHER ANALYSES: DEVELOPING VERSUS DEVELOPED COUNTRIES

We further segregate the sample by developing and developed countries to investigate whether the impact of macroeconomic uncertainty on leverage differs by level of economic development or is common across

various countries. The results are shown in Table 6 for the developing countries and Table 7 for the developed countries.

The results show that the capital structures of firms (as proxied by the long-term debt ratio) for the developing and developed countries are affected by different types of macroeconomic uncertainty. Precisely, volatility of growth rate of CPI, growth rate of real GDP, growth rate of nominal lending rates, and real interest rate have a statistically significant negative association with the leverage of firms in the developing countries. Meanwhile, volatility of relative prices, growth rate of PPI, monetary growth, and openness coefficient have a statistically significant negative association with the leverage of firms in the developed countries. Overall, the results provide some robust supporting evidence of our hypothesis that higher macroeconomic uncertainty leads to lower leverage among firms in both the developing and developed countries. The statistically significant negative results obtained for volatility of real interest rate for the developing countries in the Asia Pacific region corroborates the findings by Chow et al. (2017b) who conduct their research among Philippine firms. Notwithstanding, we did not find any statistically significant results for the association between volatility of growth rate of exports and leverage of firms in the developed countries in the Asia Pacific region, which contradicts with Chow et al. (2017a) who report a statistically significant negative relationship between export volatility and leverage among Australian firms.

In contrast to the findings for the developing countries, the results show that volatility of growth rate of CPI has a statistically significant positive association with the leverage of firms in the developed countries. This finding contradicts with our hypothesis and prior results by Hatzinikolaou et al. (2002) and Tehrani and Najafzadehkhoe (2015). Notwithstanding, this may be explained by the findings of Memon et al. (2015) and Tomak (2013) that inflation rate is positively related to leverage. At the same time, past literature reveals that inflation level is positively linked to inflation uncertainty (Ball 1992; Cukierman & Meltzer 1986; Friedman 1977). Similar to the results in Table 5, Table 7 also reports that the coefficient of volatility of growth rate of nominal deposit rates is significantly positive for the developed countries.

In summary, when the aggregate data are split into developing and developed countries, we continue to find some evidence supporting the negative association between macroeconomic uncertainty and leverage. Nonetheless, the leverage of firms in the developing and developed countries are affected by different types of macroeconomic uncertainty. This corroborates prior literature which has demonstrated that corporate financing practices differ between these countries due to variations in institutional and environmental settings (Colombage 2007; Öztekin & Flannery 2012). For instance, firms in

these countries are exposed to different degrees of trade liberalisation, financial market development, and country governance, which in turn make them susceptible to different types of macroeconomic uncertainty.

ROBUSTNESS CHECKS

As robustness checks, this study tests several alternative proxies for macroeconomic uncertainty, and the results are presented in Table 8. The estimates for book value of total debt ratio for the full sample are shown in Models 1, 5, 9, and 13, while the estimates for book value of long-term debt ratio for all firms are reported in Models 2, 6, 10, and 14. The sample firms are further separated into developing countries (Models 3, 7, 11, and 15) and developed countries (Models 4, 8, 12, and 16).

First, this paper considers alternative proxies for external sources of macroeconomic uncertainty. In particular, we adopt two proxies which are exogenous to the economic system of the sample countries, i.e., the Chicago Board Options Exchange Market Volatility Index (*VIX*) and the U.S. Economic Policy Uncertainty index (*EPU*). Both data are sourced from the FRED by the Federal Reserve Bank of St. Louis. The *VIX*, which was introduced by Whaley (1993), measures expected short-term market volatility, while the *EPU* was first proposed by Baker et al. (2015) to gauge the economic policy uncertainty in the U.S. Both indices are reported as critical factors in explaining volatility (Liu et al. 2017; Mei et al. 2018; Wang 2019). Since the U.S. is the largest economy in the world, any uncertainty arising from its economy may also affect other countries including those in the Asia Pacific region. The results for *VIX* are not statistically significant (Models 1 to 4). Meanwhile, only one out of four of the estimations for *EPU* is negative and statistically significant (Model 6) while the remaining three models show insignificant results (Models 5, 7, and 8). To sum, the results still provide some evidence supporting the adverse impact of external sources of macroeconomic uncertainty on the leverage of Asia Pacific firms, hence confirming the robustness of our earlier findings.

Second, this research uses an alternative proxy for trade policy uncertainty, i.e., tariff overhang (*TARIFF*) which is measured as the difference between the most favoured nation bound and applied tariffs (Osnago et al. 2015). Data on bound and applied tariff rates are extracted from the World Trade Organisation's Tariff Download Facility and the World Bank's WDI, respectively. We find that only one out of four estimations for *TARIFF* is negative and statistically significant (Model 12) while the remaining three models show insignificant results (Models 9 to 11). Hence, this study concludes that the additional tests still furnish some supporting evidence of the negative effect of trade policy uncertainty on leverage, hence reaffirming the robustness of the main results.

TABLE 6. Regression results for developing countries (Dependent variable: Book value of long-term debt ratio)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GDP_RISK	-0.010*** (-2.08)														
CPI_RISK		-0.456** (-2.20)													
PPI_RISK			-0.144 (-1.21)												
RP_RISK				0.043 (0.29)											
EX_RISK					-0.016 (-0.45)										
IM_RISK						-0.043 (-1.22)									
M2_RISK							0.020 (0.27)								
DEP_RISK								-0.018 (-0.83)							
LEND_RISK									-0.166* (-1.93)						
RINT_RISK										-1.764** (-2.35)					
FIS_RISK											-0.075 (-0.39)				
REER_RISK												-0.023 (-0.11)			
OP_RISK													-0.059 (-0.79)		
FDI_RISK														-0.048 (-0.16)	
PEQ_RISK															-0.004 (-0.03)
LAGGED BVLTR	0.698*** (16.07)	0.708*** (15.74)	0.705*** (15.84)	0.695*** (15.90)	0.697*** (15.80)	0.701*** (15.64)	0.696*** (15.82)	0.697*** (15.74)	0.714*** (16.13)	0.716*** (15.54)	0.697*** (15.92)	0.697*** (15.89)	0.701*** (15.91)	0.697*** (15.87)	0.697*** (15.95)
SALES	-0.015*** (-4.53)	-0.015*** (-4.46)	-0.015*** (-4.47)	-0.015*** (-4.62)	-0.015*** (-4.55)	-0.015*** (-4.51)	-0.015*** (-4.55)	-0.015*** (-4.55)	-0.015*** (-4.37)	-0.015*** (-4.33)	-0.015*** (-4.56)	-0.015*** (-4.55)	-0.015*** (-4.53)	-0.015*** (-4.55)	-0.015*** (-4.56)
TANGI	0.042*** (4.58)	0.041*** (4.43)	0.041*** (4.47)	0.042*** (4.55)	0.042*** (4.51)	0.041*** (4.46)	0.042*** (4.53)	0.042*** (4.51)	0.040*** (4.40)	0.040*** (4.33)	0.042*** (4.53)	0.042*** (4.52)	0.042*** (4.50)	0.042*** (4.53)	0.042*** (4.50)
FIRM_SIZE	0.011*** (6.33)	0.011*** (5.89)	0.011*** (5.96)	0.012*** (6.18)	0.011*** (6.22)	0.011*** (6.01)	0.012*** (6.27)	0.011*** (6.21)	0.011*** (5.88)	0.011*** (5.62)	0.012*** (6.30)	0.011*** (6.29)	0.011*** (6.13)	0.011*** (6.26)	0.011*** (6.28)

TABLE 6. Regression results for developing countries (Dependent variable: Book value of long-term debt ratio) (continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
INFLATION	0.032 (0.45)	0.041 (0.57)	-0.009 (-0.12)	0.022 (0.29)	-0.006 (-0.07)	-0.042 (-0.48)	0.014 (0.20)	0.007 (0.10)	-0.003 (-0.04)	-0.002 (-0.02)	0.015 (0.21)	0.017 (0.24)	-0.023 (-0.25)	0.016 (0.23)	0.017 (0.24)
EXG_RATE	-0.000 (-0.57)	0.000 (0.36)	-0.000 (-0.05)	0.000 (0.16)	0.000 (0.07)	-0.000 (-0.15)	0.000 (0.10)	0.000 (0.21)	0.000 (0.46)	0.000 (0.48)	0.000 (0.04)	0.000 (0.11)	-0.000 (-0.06)	0.000 (0.15)	0.000 (0.15)
CRISISDUM	0.005** (1.96)	0.011*** (3.47)	0.010*** (2.49)	0.005 (1.53)	0.007* (1.93)	0.010** (2.48)	0.006** (2.34)	0.007** (2.53)	0.009*** (3.27)	0.010*** (3.40)	0.006** (2.29)	0.006** (2.30)	0.009** (2.27)	0.006** (2.31)	0.006** (2.27)
Constant	-0.189*** (-5.05)	-0.209*** (-5.80)	-0.200*** (-5.12)	-0.216*** (-5.74)	-0.210*** (-5.59)	-0.197*** (-4.73)	-0.214*** (-6.08)	-0.214*** (-6.01)	-0.205*** (-5.66)	-0.202*** (-5.49)	-0.210*** (-5.79)	-0.212*** (-5.76)	-0.201*** (-4.97)	-0.213*** (-5.99)	-0.213*** (-6.04)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751	3,751
No. of firms	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
No. of instruments	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
AR(1): <i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2): <i>p</i> -value	0.601	0.570	0.596	0.615	0.614	0.605	0.618	0.619	0.596	0.591	0.616	0.614	0.599	0.614	0.614
<i>J</i> -statistic: <i>p</i> -value	0.474	0.295	0.375	0.423	0.389	0.341	0.426	0.375	0.279	0.248	0.422	0.416	0.401	0.423	0.422

Notes: Figures in parentheses are *t*-statistics. Asymptotic standard errors are heteroscedasticity robust. Refer to the appendix for symbol and definitions of variables. ***, **, *, and * Statistical significance at 1, 5, and 10 percent levels, respectively.

TABLE 7. Regression results for developed countries (Dependent variable: Book value of long-term debt ratio)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GDP_RISK	0.036 (0.29)														
CPI_RISK		1.163* (1.89)													
PPI_RISK			-0.284** (-2.38)												
RP_RISK				-0.494*** (-3.05)											
EX_RISK					0.011 (0.30)										
IM_RISK						-0.052 (-1.22)									
M2_RISK							-0.100** (-2.28)								
DEP_RISK								0.088*** (4.15)							
LEND_RISK									0.036 (0.54)						
RINT_RISK										1.085 (1.43)					
FIS_RISK											-0.137 (-0.67)				
REER_RISK												0.208 (0.78)			
OP_RISK													-0.150*** (-4.44)		
FDI_RISK														0.015 (0.17)	
PEQ_RISK															0.041 (0.41)
LAGGED BVLTR	0.577*** (22.22)	0.579*** (22.04)	0.578*** (22.58)	0.576*** (22.32)	0.576*** (21.83)	0.575*** (22.60)	0.578*** (22.21)	0.578*** (21.75)	0.575*** (21.63)	0.573*** (21.72)	0.578*** (21.89)	0.577*** (22.09)	0.574*** (22.26)	0.575*** (22.04)	0.577*** (21.97)
SALES	-0.008*** (-2.77)	-0.008*** (-2.74)	-0.008*** (-2.75)	-0.008*** (-2.72)	-0.008*** (-2.86)	-0.008*** (-2.79)	-0.008*** (-2.80)	-0.009*** (-3.06)	-0.008*** (-2.82)	-0.008*** (-2.77)	-0.008*** (-2.84)	-0.008*** (-2.76)	-0.008*** (-2.84)	-0.008*** (-2.80)	-0.008*** (-2.76)
TANGI	0.045*** (3.31)	0.045*** (3.28)	0.046*** (3.39)	0.046*** (3.41)	0.045*** (3.32)	0.046*** (3.40)	0.045*** (3.27)	0.044*** (3.23)	0.046*** (3.27)	0.048*** (3.39)	0.046*** (3.41)	0.046*** (3.31)	0.046*** (3.36)	0.045*** (3.28)	0.045*** (3.24)
FIRM_SIZE	0.009*** (6.35)	0.008*** (6.21)	0.008*** (6.20)	0.008*** (6.16)	0.009*** (6.25)	0.009*** (6.42)	0.008*** (6.17)	0.009*** (6.59)	0.009*** (6.55)	0.008*** (6.24)	0.009*** (6.33)	0.009*** (6.34)	0.008*** (6.29)	0.009*** (6.48)	0.009*** (6.44)

TABLE 7. Regression results for developed countries (Dependent variable: Book value of long-term debt ratio) (continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
INFLATION	0.070 (0.68)	0.116 (1.13)	-0.034 (-0.33)	-0.090 (-0.87)	0.098 (0.91)	0.015 (0.14)	0.049 (0.48)	0.195* (1.86)	0.085 (0.81)	0.111 (1.05)	0.064 (0.62)	0.072 (0.69)	-0.116 (-1.12)	0.071 (0.68)	0.057 (0.56)
EXG_RATE	0.000** (2.33)	0.000*** (2.90)	0.000** (2.09)	0.000** (1.97)	0.000** (2.20)	0.000*** (2.57)	0.000*** (2.79)	0.000 (0.48)	0.000*** (2.67)	0.000*** (3.01)	0.000** (2.35)	0.000** (2.45)	0.000 (1.36)	0.000*** (2.56)	0.000** (2.45)
CRISISDUM	0.004 (1.25)	0.002 (0.62)	0.010*** (2.80)	0.013*** (3.36)	0.004 (1.06)	0.008* (1.89)	0.005* (1.92)	-0.005 (-1.24)	0.004 (1.35)	0.004 (1.28)	0.005* (1.85)	0.003 (1.04)	0.011*** (3.61)	0.004 (1.62)	0.004 (1.60)
Constant	-0.164*** (-5.74)	-0.173*** (-6.26)	-0.141*** (-4.59)	-0.134*** (-4.30)	-0.161*** (-5.65)	-0.160*** (-5.63)	-0.158*** (-5.54)	-0.152*** (-5.21)	-0.169*** (-6.22)	-0.170*** (-6.26)	-0.164*** (-5.76)	-0.166*** (-5.76)	-0.125*** (-4.07)	-0.167*** (-5.75)	-0.165*** (-5.71)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949	4,949
No. of firms	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507
No. of instruments	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
AR(1): <i>p</i> -value	0.068	0.068	0.068	0.069	0.069	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.069	0.068	0.068
AR(2): <i>p</i> -value	0.630	0.631	0.633	0.631	0.630	0.632	0.632	0.621	0.627	0.623	0.633	0.632	0.628	0.628	0.631
<i>J</i> -statistic: <i>p</i> -value	0.178	0.225	0.216	0.212	0.143	0.206	0.215	0.196	0.148	0.142	0.193	0.169	0.231	0.159	0.154

Notes: Figures in parentheses are *t*-statistics. Asymptotic standard errors are heteroscedasticity robust. Refer to the appendix for symbol and definitions of variables. ***, **, and * Statistical significance at 1, 5, and 10 percent levels, respectively.

TABLE 8. Robustness checks using alternative proxies for macroeconomic uncertainty

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
VIX	0.002 (0.09)	0.008 (0.49)	0.005 (0.25)	0.012 (0.49)												
EPU					-0.001 (-0.59)	-0.005** (-2.14)	-0.003 (-1.22)	-0.003 (-0.81)								
TARIFF									0.278 (1.59)	-0.197 (-1.61)	0.124 (0.72)	-0.325** (-2.07)				
EMP													0.022*** (4.24)	0.013*** (2.81)	0.020*** (3.34)	0.009 (1.60)
LAGGED LEV	0.678*** (17.35)	0.595*** (24.69)	0.697*** (15.82)	0.577*** (22.22)	0.678*** (17.33)	0.597*** (24.28)	0.699*** (16.14)	0.579*** (21.77)	0.680*** (17.37)	0.595*** (24.41)	0.698*** (15.89)	0.577*** (21.84)	0.022*** (4.24)	0.013*** (2.81)	0.020*** (3.34)	0.009 (1.60)
SALES	-0.011*** (-3.74)	-0.013*** (-5.70)	-0.015*** (-4.56)	-0.008*** (-2.80)	-0.011*** (-3.79)	-0.013*** (-5.58)	-0.015*** (-4.54)	-0.008*** (-2.65)	-0.011*** (-3.75)	-0.013*** (-5.70)	-0.015*** (-4.54)	-0.008*** (-2.80)	0.690*** (16.27)	0.601*** (24.07)	0.705*** (15.85)	0.580*** (22.12)
TANGI	0.042*** (3.67)	0.047*** (5.23)	0.042*** (4.52)	0.046*** (3.33)	0.042*** (3.76)	0.046*** (5.17)	0.042*** (4.56)	0.045*** (3.27)	0.042*** (3.76)	0.047*** (5.27)	0.042*** (4.47)	0.046*** (3.77)	0.040*** (3.56)	0.046*** (5.21)	0.040*** (4.39)	0.047*** (3.42)
FIRM_SIZE	0.009*** (5.57)	0.010*** (8.64)	0.011*** (6.25)	0.009*** (6.37)	0.009*** (5.73)	0.010*** (8.71)	0.011*** (6.33)	0.009*** (6.34)	0.009*** (5.52)	0.010*** (8.74)	0.011*** (6.26)	0.009*** (6.50)	0.009*** (5.43)	0.010*** (8.28)	0.011*** (5.99)	0.008*** (6.02)
INFLATION	0.279*** (3.17)	0.021 (0.33)	0.009 (0.11)	0.030 (0.25)	0.296*** (3.96)	0.074 (1.20)	0.035 (0.49)	0.096 (0.81)	0.290*** (3.86)	0.031 (0.53)	0.014 (0.20)	0.033 (0.31)	0.203*** (2.71)	-0.001 (-0.01)	-0.059 (-0.78)	0.076 (0.74)
EXG_RATE	0.001*** (4.33)	0.000* (1.78)	0.000 (0.08)	0.000** (2.31)	0.001*** (4.12)	0.000*** (2.98)	0.000 (0.44)	0.000* (2.56)	0.001*** (4.58)	0.000* (1.87)	0.000 (0.12)	0.000** (2.24)	0.001*** (4.40)	0.000* (1.67)	-0.000 (-0.25)	0.000*** (2.57)
CRISISDUM	0.013*** (3.75)	0.005* (1.75)	0.005 (1.35)	0.003 (0.93)	0.014*** (6.20)	0.007*** (3.41)	0.007*** (2.56)	0.005* (1.94)	0.014*** (6.59)	0.005*** (2.67)	0.006** (2.43)	0.004 (1.41)	0.014*** (6.50)	0.006*** (3.11)	0.005* (1.95)	0.006** (1.99)
Constant	-0.180*** (-6.11)	-0.191*** (-7.99)	-0.213*** (-5.70)	-0.162*** (-5.69)	-0.182*** (-6.36)	-0.201*** (-8.58)	-0.216*** (-6.09)	-0.171*** (-6.22)	-0.192*** (-6.56)	-0.183*** (-7.48)	-0.218*** (-6.10)	-0.149*** (-5.07)	-0.172*** (-5.96)	-0.183*** (-7.60)	-0.190*** (-5.21)	-0.159*** (-5.64)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,700	8,700	3,751	4,949	8,700	8,700	3,751	4,949	8,700	8,700	3,751	4,949	8,700	8,700	3,751	4,949
No. of firms	907	907	400	507	907	907	400	507	907	907	400	507	907	907	400	507
No. of instruments	24	24	21	20	24	24	21	20	24	24	21	20	24	24	21	20
AR(1):	0.022	0.034	0.000	0.068	0.022	0.034	0.000	0.068	0.022	0.034	0.000	0.068	0.022	0.034	0.000	0.068
p-value																
AR(2):	0.834	0.657	0.615	0.631	0.832	0.655	0.614	0.630	0.834	0.655	0.609	0.630	0.843	0.664	0.574	0.635
p-value																
J-statistic:	0.541	0.303	0.413	0.159	0.544	0.160	0.452	0.113	0.613	0.359	0.428	0.216	0.681	0.274	0.307	0.219
p-value																

Notes: Figures in parentheses are *t*-statistics. Asymptotic standard errors are heteroscedasticity robust. Refer to the appendix for symbol and definitions of variables. ***, **, and * Statistical significance at 1, 5, and 10 percent levels, respectively.

Lastly, this study adopts an alternative proxy for exchange rate policy uncertainty, i.e., exchange market pressure (*EMP*) which is calculated as the difference between the percentage change of exchange rate (measured in domestic currency units per U.S. dollar) and the percentage change of international reserves as a fraction of monetary base (Girton & Roper 1977). The *EMP* gauges the amount of central bank's intervention required to achieve any desired exchange rate target. All data required for the computation of the *EMP* are gathered from the IFS by the IMF. Interestingly, the results depict that three out of four estimations for *EMP* are positive and statistically significant (Models 13 to 15) while Model 16 reports insignificant results. The findings largely contradict with our prior results in Tables 4 to 6 where the coefficient of volatility of growth rate of real broad effective exchange rates is not statistically significant. Nonetheless, this may be explained by prior studies which contend that exchange rate may be positively associated with leverage since firms may turn to debt financing when it is not favourable to issue equities due to exchange rate conditions (Akay & Cifter 2014; Tehrani & Najafzadehkhoe 2015). Concomitantly, past literature has also demonstrated that there is a positive influence of exchange rate on exchange rate volatility (Mayowa 2015) and a more flexible exchange rate regime results in higher exchange rate volatility (Grossmann & Orlov 2014; Staněk 2007).

CONCLUSION

This research examines how the capital structure of firms in Asia Pacific countries reacts to macroeconomic uncertainty using the robust two-step system GMM estimation procedure. We consider a wide spectrum of proxies for macroeconomic uncertainty to identify which specific types of macroeconomic uncertainty are important to capital structure decisions. The results reveal that there are nine proxies for macroeconomic uncertainty with coefficient estimates which are significantly negative when leverage is proxied by the total debt ratio. Meanwhile, there are five proxies for macroeconomic uncertainty with coefficient estimates which are significantly negative when leverage is measured by the long-term debt ratio. Hence, the results generally provide robust evidence that macroeconomic uncertainty negatively impacts leverage using different proxies for leverage and macroeconomic uncertainty. This indicates that when Asia Pacific firms encounter heightened uncertainty in the macroeconomic environment, they adopt less debt in their capital structures. Moreover, the findings also indicate that the three broad classifications of macroeconomic uncertainty, i.e., external sources of macroeconomic uncertainty, domestic sources of macroeconomic uncertainty, and volatility as a macroeconomic outcome have significant effects on leverage.

Subsequently, when the aggregate data are divided into developing and developed countries, we continue to find some evidence supporting the adverse association between macroeconomic uncertainty and leverage. Hence, the results offer consistent and robust evidence on the effect of macroeconomic uncertainty on leverage in both the developing and developed countries in the Asia Pacific region, as well as with those documented in the U.K. and U.S. Nonetheless, our analyses further reveal that the capital structures of firms in the developing and developed countries are affected by different types of macroeconomic uncertainty. Taken collectively, in addition to volatility of inflation rates, real GDP, interest rates, and growth rate of imports and exports which were reported as significant determinants of capital structure in prior studies, this paper also finds that volatility of openness coefficient, monetary growth, and net FDI inflows have adverse impact on capital structure. Nevertheless, there is no empirical support for the influence of volatility of fiscal results, exchange rate growth, and net portfolio equity inflows.

With regards to policy implications, these findings provide new insights into corporate financing strategies during times of macroeconomic uncertainty. This may benefit the capital structure literature by furnishing further evidence on the effect of macroeconomic uncertainty on capital structure using a sample of Asia Pacific firms, including how the capital structures of firms in the developing and developed countries are influenced by different types of macroeconomic uncertainty. These findings are also of significance for policy makers to devise suitable course of actions to overcome the unfavourable outcomes stemming from the volatility in the macroeconomic environment. Besides, these results may also serve as a guide to monetary authorities, financial policy makers, and financial institutions to introduce suitable financial instruments to fulfil funding requirements and to alleviate risk during such times. Last but not least, these findings may also assist firms in formulating their risk management policies since managers often evaluate risk from multiple dimensions (Helliard et al. 2002; Morikawa 2016). Moreover, it is necessary for managers to identify the source of uncertainty before assessing its impact on corporate decisions, including capital structure choices (Huizinga 1993).

NOTE

- ¹ In this paper, the terms "capital structure" and "leverage" are applied interchangeably.
- ² One exception is Chow et al. (2018) who investigate the moderating role of corporate governance on the association between macroeconomic uncertainty and firm leverage among selected Asia Pacific countries. The authors find that the overall impact of macroeconomic uncertainty on leverage among firms with good corporate governance is significantly negative. However, this study only adopts two

proxies for macroeconomic uncertainty, i.e., volatility of imports and volatility of exports.

³ The number of firms sampled from each country represents 11% to 37% of the target population.

⁴ However, the authors also acknowledged that firms that carry out maturity management of debtors and creditors can be deemed as short-term financing.

⁵ We use a five-period moving-average standard deviation, where the period covered depends on the time interval of the macroeconomic series such as monthly, quarterly, or annually. In order to obtain the annual measure of volatility for monthly or quarterly data, we further compute the arithmetic mean of the relevant monthly or quarterly data, respectively.

⁶ Similar to Aizenman and Marion (1999), since this study has a relatively short sample period of 11 years, we did not attempt to test for more complicated autoregressive schemes.

⁷ We do not include all proxies for macroeconomic uncertainty in a single regression to avoid multicollinearity problems.

⁸ One issue that may arise from estimating each proxy for macroeconomic uncertainty separately is this may result in a biased estimate as the effects of other macroeconomic uncertainty forces could be at play in each regression model via the residuals. Hence, country dummies are incorporated in each estimation model to control for the potential remaining effects of other macroeconomic uncertainty forces.

⁹ However, it is noteworthy that while the association between inflation rate and total debt ratio is positive, volatility of growth rate of CPI is negatively linked to total debt ratio (refer to Model 2 in Table 4). The results indicate that although firms may be inclined to issue more debts when expected inflation is higher due to greater interest tax shields, higher inflation volatility may instead result in lower leverage due to anticipation of a deterioration in revenues and cash flows (Baum et al. 2009) and less tax benefits of debts (Chen 2010). The overall effect of inflation rate and inflation volatility on total debt ratio (as measured by the sum of coefficients on inflation rate and volatility of growth rate of CPI) is significantly negative (-0.709). The evidence suggests that heightened inflation volatility offsets the benefits of greater interest tax shields arising from higher expected inflation, hence resulting in firms to adopt less debt in their capital structures.

¹⁰ The concerns highlighted earlier about the conflicting findings between inflation rate and leverage, and inflation volatility and leverage do not apply to the association between exchange rate and leverage, and volatility of exchange rate growth and leverage. Only the coefficient of exchange rate is significantly positive while the coefficient of volatility of exchange rate growth is positive but not statistically significant (refer to Model 12 in Tables 4 and 5).

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APPENDIX. Variable definitions

Symbol	Variable	Definition
BVTDR	Book value of total debt ratio	Book value of total debt divided by book value of total assets
BVLTDR	Book value of long-term debt ratio	Book value of long-term debt divided by book value of total assets
SALES	Sales	Sales divided by total assets
TANGI	Tangibility	Net values of property, plant, and equipment divided by total assets
FIRM_SIZE	Firm size	Natural logarithm of total assets
INFLATION	Inflation rate	Percentage change in annual CPI
EXG_RATE	Exchange rate	Real broad effective exchange rate
GDP_RISK	Macroeconomic uncertainty	Volatility of growth rate of real GDP (based on quarterly data)
CPI_RISK		Volatility of growth rate of CPI (based on quarterly data)
PPI_RISK		Volatility of growth rate of PPI (based on quarterly data)
RP_RISK		Volatility of relative prices. Relative prices is computed as CPI divided by PPI (based on quarterly data)
EX_RISK		Volatility of growth rate of exports (based on quarterly data)
IM_RISK		Volatility of growth rate of imports (based on quarterly data)
M2_RISK		Volatility of monetary growth, where monetary growth is the growth rate of money and quasi money (based on annual data)
DEP_RISK		Volatility of growth rate of nominal deposit rates (based on quarterly data)
LEND_RISK		Volatility of growth rate of nominal lending rates (based on quarterly data)
RINT_RISK		Volatility of real interest rate, where real interest rate is computed as nominal lending rate adjusted for inflation (based on quarterly data)
FIS_RISK		Volatility of fiscal result as a proportion of GDP (based on annual data)
REER_RISK		Volatility of growth rate of real broad effective exchange rates (based on monthly data)
OP_RISK		Volatility of openness coefficient, where openness coefficient is computed as total imports and exports divided by GDP (based on quarterly data)
FDI_RISK		Volatility of net FDI inflows as a proportion of GDP (based on annual data)
PEQ_RISK		Volatility of net portfolio equity inflows as a proportion of GDP (based on annual data)
CRISISDUM	Crisis dummy	Dummy variable takes the value of one if the year is between 2008 and 2009, and zero otherwise