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RESEARCH ARTICLE

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Empirical analysis of debt maturity, cash holdings and firm investment in developing economies

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Abstract

This study investigates the potential simultaneous relationships among leverage, debt maturity and cash holdings and how these jointly affect financial policy and firms' investment activities in developing countries of Thailand, Indonesia and Singapore during the period 2006–2015. Using the two-step system GMM estimator, our results show that high-growth firms not only shorten debt maturity to reduce the underinvestment incentive, but also decrease leverage to reduce liquidity risk. We find evidence that the level of cash holdings is a key determinant of leverage in all countries and that debt policy and growth opportunities affect the investment decision of firms in Thailand and Singapore whereas cash policy is more important in Indonesia. These findings have significant implications for investment decisions in these economies.

KEYWORDS

cash holding, debt maturity, developing economies, firm, investment, liquidity

1 | INTRODUCTION

Modern corporate finance recognizes that, in the presence of market imperfections, firm financial and investment policies are related and depend on the firm's growth prospect. For instance, in the presence of information asymmetry between shareholders and debtholders, Myers (1977) shows that managers of leveraged firms with growth opportunities may not undertake positive NPV if the payoff of such projects benefit only the debtholders, leading to an underinvestment problem. On the other hand, Jensen and Meckling (1973) argue that managers of firms with low growth opportunities and free cash flows are more prone to make their firms grow beyond an optimal size, leading to an overinvestment problem. Dang (2011) advocates the use of more leverage to act as a disciplining mechanism which in turn helps to reduce the overinvestment problem. Thus, in the presence of information asymmetry and agency conflicts, corporate financial policies, such as the level of the firm cash holdings, the level of debt as well as the maturity structure of debt, are jointly determined, and these financial policies are interrelated with the firm corporate investment policy.

As noted above, corporate financial policy has many key elements, including the level of debt, the maturity structure of debt, and the level of cash holdings. Early research on corporate financial policy has explained a single element of financial policy at a time and treated each financial policy choice as independent of the others.[1] However, in practice, financial policy choices are simultaneously determined. Other recent studies have mainly concentrated on the simultaneous determination of leverage and debt maturity, the twin dimensions of capital

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structure (Barclay, Marx, & Smith, 2003; Billett, King, & Mauer, 2007; Dang, 2011; Elyasiani, Guo, & Tang, 2002; Johnson, 2003), but less attention has been devoted to the interdependence of these financial policy choices and corporate cash holdings. Acharya, Almeida, and Campello (2007) state that ignoring simultaneity between cash and debt policies may lead to spurious inferences because while cash reserves of firms are determined by their debt (proceeds from debt issuances) and cash flow (saving cash out of cash flow), changes in their leverage also accounts for changes in their cash balances and cash flow. Similarly, Harford, Klasa, and Maxwell (2014) point out that when firms make decisions on debt maturity structure and cash holdings, these firms trade off the benefits of shorter debt maturity against increased refinancing risk and also simultaneously consider how larger cash reserves can help reduce the increased refinancing risk. Thus, cash holding represents an important channel in mitigating the negative effect of policy uncertainty on firm real economic activities. Duong, Nguyen, and Rhee (2020) find that increase in cash holdings is not attributed to a reduction in firm investments but is more pronounced for financially constrained firms or those with larger exposure to policy uncertainty. Thus, holding more cash in the presence of policy uncertainty reduces the side effect of such policy on capital investment and firm innovation outputs. As such, the purpose of this article is to investigate the simultaneous inter-relationship between leverage, debt maturity and cash holdings in the light of the set of growth opportunities that are available to a firm, and also how these financial policies affect firm investment decision.

To investigate the abovementioned interrelationship, we select firms from three growing Southeast Asian tiger economies (i.e., Singapore) and tiger cub economies (i.e., Indonesia and Thailand) to test our hypotheses which is a significant departure from the vast majority of previous studies that use the western economies for their empirical samples. The Asian tiger economies exceeded 7% growth per year during the latter part of the 20th century, and successfully transformed into highly advanced, high-income economies. The Tiger Cub Economies are low-to-middle-income with an abundant work force, high rates of investment and rapid economic growth, similar to early versions of the Four Asian Tigers.

Singapore, Indonesia and Thailand are some of the most optimistic countries in terms of consumer confidence and not surprisingly were able to attract the top three direct investment inflows in the region in 2014. Thailand, Indonesia and Singapore are the main economies in the ASEAN Economic Community (AEC). The AEC market is considered a high growth environment offering a huge potential market place for investors. Ten member nations of the AEC comprise a population of 625 million and have a combined GDP of $2.8 trillion, of which $1.5 trillion is contributed by Thailand, Indonesia and Singapore. Our study investigates the simultaneous inter-relationship between leverage, debt maturity and cash flow in high growth environments where firms are exposed to higher levels of information asymmetry and agency costs. Therefore, we depart from previous studies in this area which are based on firms in the United States and other developed countries by using Thailand, Indonesia and Singapore that offer a high growth environment compared to US and markets of other developed countries as the test bed of our hypothesis. This is important in at least two aspects. Firstly, from a practical standpoint the three chosen countries (i.e., Thailand, Indonesia and Singapore) are high impact economies and a study of dynamics that govern firms in these economies is of critical importance. Secondly, as previously explained, past studies differ in terms of market sentiment and other characteristics and have focused on more mature developed economies such as US and UK. Thus, from a theoretical stand point, and by focusing on Thailand, Indonesia and Singapore, we are effectively investigating the impact of Southeast Asian growth states on the dynamics of the simultaneous interrelationship between leverage, debt maturity and cash holdings in the light of the set of growth opportunities that are available to a firm.

The paper adds to the literature by investigating the interaction between three corporate financial policies and investment decisions in light of the firm's growth prospect. In so doing, we model the simultaneous behaviour of, debt maturity, and corporate cash holdings. This extended model allows further investigation of how firms simultaneously determine their leverage, debt maturity and cash holdings on one hand; and how this simultaneous choice can affect their investment on the other hand. As explained above, we choose a high growth environment to test our assumptions as firms in these environments have higher levels of information asymmetry and agency costs.

We make the following contributions to the literature based our empirical findings. First, the results highlight the importance of considering the simultaneity of leverage, debt maturity, and cash holdings, suggesting that future research should not ignore this endogeneity bias as it may lead to flawed conclusions. Second, we find support for both the underinvestment hypothesis and liquidity risk theory. Liquidity risk can be exasperated if the level of cash holding does not meet the current liabilities of the business. High-growth firms do not only shorten debt maturity to reduce the liquidity risk, but also decrease leverage to mitigate the underinvestment incentive. Third, we find that cash holdings significantly affect the decision on leverage in these countries which indicates that firms value financial flexibility in high growth

environments. However, we do not find evidence that cash holdings affect debt maturity.

Our findings have implications to capital market participants and regulatory policy makers. As our results show that high growth firms in Singapore, Indonesia and Thailand have a tendency to reduce liquidity risk by shortening the debt maturity structure and to reduce bankruptcy risk by decreasing leverage, these actions would have a bearing on the overall risk profile of an individual firm and hence on the its expected return. Thus, from an investor standpoint in the fund allocation decision our results aid towards the formulation of effective benchmarks that can assist in identifying abnormal return opportunities. Furthermore, from a regulatory standpoint, as our work sheds insight on the dynamics of how leverage, debt maturity, and cash holdings simultaneously effect each other and the firm's investment policy our findings can assist towards the better understanding of the economy wide systematic risks at a macro level and hence shape regulatory policy aimed at reducing the macroeconomic risks in these high growth environments.

The remainder of this article is organized as follows: Section 2 provides the literature review and the development of the hypotheses, Section 3 is the data description and empirical models; Sections 4 is results and discussion of findings. Section 5 is the conclusion.

2 | REVIEW OF LITERATURE AND HYPOTHESES DEVELOPMENT

In the presence of market imperfections such as information asymmetries and agency conflicts, prior studies have showed that financial as well as investment decisions depend largely on the firm's growth prospect. For instance, Myers (1977) argues that when a firm has risky debt, managers may forgo positive-NPV projects as the payoffs of the projects partially accrue to debtholders, resulting in an underinvestment problem. Myers reveals that firms with growth opportunities are more prone to the underinvestment problem. As such, rational lenders anticipate conflicts and hence charge a higher interest rate to fund these investments. Myers proposed two possible strategies to eliminate the underinvestment problem: (a) lowering the level of leverage or (b) increasing the level of short term debt. The motivation behind the use of short term debt is to allow firms to undertake all positive NPV projects as the short term debt would mature before the completion of the project.

The above two strategies, advocated by Myers, suggest that short-term debt and leverage act as strategic substitutes to mitigate the underinvestment problem. The substitution effect suggests that firms using short term debt to resolve agency conflict of underinvestment problem have less incentive to reduce leverage. In a similar vein, firms that lower their leverage level to control for the underinvestment problem and bankruptcy will be less inclined towards using short term debt. Lambrecht and Pawlina (2013) argue that tangibility and leverage are negatively related when debt is over collateralized. This allows firms with higher tangibility to issue more debt without increasing expected bankruptcy costs. They developed a theory that where firms adopt a net debt target which acts as a balancing factor between shareholders and managers. Joshi (2019) asserts that the level of cash holding by firms is influenced by the level of their growth. For example, high-growth firms hold more cash to facilitate growth opportunities, capital expenditure planning and cost of debt financing. However, low-growth firms tend to hold more net debt rather than high cash. Accordingly, based on the underinvestment hypothesis we offer the following hypotheses:

Hypothesis 1a. *There is a negative relationship between growth opportunities and leverage.*

Hypothesis 1b. *There is a positive relationship between growth opportunities and short term debt.*

One possible drawback with the use of short term debt to resolve the underinvestment problem is that it exposes firms to additional costs stemming from refinancing risk. According to Froot, Scharfstein, and Stein (1993), changes in market conditions or capital market imperfections can lead to higher borrowing costs. Firms with short term debt may find it difficult to roll over the outstanding debt if the lenders refuse refinancing (Diamond, 1991, 1993), leading to liquidation or sale of important firm assets (Harford et al., 2014; Lambrecht & Pawlina, 2013). The refinancing risk argument suggests that debt maturity and leverage act as a complement to each other. As such it could be argued that the use of short term debt can affect the firm in two ways. First, it can mitigate the underinvestment problem. Second, it can increase the refinancing risk. In sum, the underinvestment argument predicts a negative relationship between debt maturity structure and leverage. However, the refinancing risk hypothesis predicts a positive relationship. This suggests that firm's debt policy depends upon the tradeoff between underinvestment cost and refinancing risk argument. As such we offer the following hypothesis:

Hypothesis 2. *There is a significant relationship between short term debt and leverage.*

According to Harford et al. (2014), firms that hold cash reserves are able to mitigate the refinancing risk.

The cash reserves allow firms to take up their growth opportunities, prevent firms from selling key assets and reduce the probability of firm bankruptcy. Indeed, Sun (2014) finds that firms that expect difficulties in obtaining future financing for future investments hold cash to hedge uncertain future financing conditions, implying a positive relationship between cash holdings and short debt maturity. Using the resource dependence theory, Li, Fung, Fung, and Qiao (2020) show that cash holding is negatively related to network centrality and structural holes of directorate interlocks. They argue that the directorate interlocks facilitate firms to have bank loans that substitute for cash holdings. Their result underscores the importance of the resource-based perspective on cash holding, and supports the argument that firms that have difficulty raising external funding have to hold more cash for precautionary motives. This, holding less cash can also be a business strategy for some firms. Yang and Cao (2019) highlight that corporate decisions such as payouts, cash holdings, investment, external financing, and even risk management strategies are highly dependent on the manager's 'time-inconsistent preferences'. They argue that a time-inconsistent manager tends to pay out cash to shareholders earlier by lowering the dividend payment (see also Nnadi, Sailesh Tanna, & Kabel, 2013), which causes the firm to hold less cash reserves and raise less equity. On the other hand, Harford et al. (2014) argue that large cash reserves may allow firms to rely on shorter debt maturity, implying a negative relationship between debt maturity and cash holdings. Thus, our third hypothesis is:

Hypothesis 3. *There is a significant relationship between short term debt and cash holdings.*

The relationship between growth opportunities and cash holdings has also attracted a number of researchers. For instance, Myers and Majluf (1984) find that information asymmetry between corporate insiders and outside investors is more severe for firms with growth opportunities. This greater asymmetric information leads to a higher cost of financing particularly for firms. Potì, Pattitoni, and Petracci (2020) explore the role precautionary motives in cash holding in private firms. They find evidence that the cash holdings to total assets is negatively related to the skewness of the distribution of the firm returns, as well as to the correlation between cash flows and investment in private firms. This implies that insiders will reduce the riskiness of their business if unable to attain the desired level of cash holdings, and in economies affected by cash shortages, entrepreneurs will be more cautious (Mortal, Nanda, & Reisel, 2020). In addition, firms with growth opportunities face higher financial distress costs and therefore high propensity to hold more cash (Joshi, 2019). Myers (1984) states that financial distress costs depend not only on the probability of default, but also on the value lost in bankruptcy. Growth opportunities, which are intangible in nature and part of the firms' value, are more likely to lose their value in financial distress. The study by Toledo and Marco (2010) on the level of cash holding in Europe shows that the most relevant factors in determining risk includes the level of cash holding, and the number of shareholders in relation to the size of the fund. This implies that the level of cash holding even in developed economies is a significant factor in assessing the degree of risk of a business. Marwick, Hasan, and Luo (2020) reveal that organization's capital is related to the level of its cash holding, and firms with high level of organisation capital hold relatively more cash. The study indicates that the effect of organisation capital on corporate cash holdings is stronger for firms experiencing high level of financing constraint and cash flow risk. As a result, firms with growth opportunities are more likely to accumulate cash to avoid costly external financing and financial distress costs. Therefore, a positive relationship between growth opportunities and cash holdings is expected as expressed in our fourth hypothesis.

Hypothesis 4. *There is a positive relationship between growth opportunities and cash holdings.*

According to the refinancing risk argument discussed above, high level of leverage can lead to financial distress. Therefore, it can be argued that firms with leverage hold cash reserves to decrease their financial distress risk, suggesting that a positive relationship may exist between leverage and cash holding. Indeed, Ozkan and Ozkan (2004) find that firms with leverage have high probability of financial distress. However, an inverse relationship between cash holdings and leverage can also be observed. For instance, according to the free cash flow hypothesis developed by Jensen (1986), large level of cash holdings may lead managers to undertake unprofitable or overly risky projects to realize their own interests rather than shareholders' interests, leading to an overinvestment problem. In such a setting, Jensen and Stulz contend that leverage could act as a monitoring mechanism, suggesting that firms can mitigate the overinvestment problem by increasing leverage to prevent managers from hoarding cash. Bhuiyan and Hooks (2019) identify poor corporate governance as one determinant of cash holdings. They find evidence that firms with higher cash holdings engage in overinvestment and such behaviour is more pronounced when problem directors are on the

board. In light of the conflicting effect of leverage on cash holdings, we offer the following hypothesis:

Hypothesis 5. *There is a significant relationship between leverage and cash holdings.*

The underinvestment and overinvestment arguments mentioned above provide interesting empirical implications for the interrelationship between corporate financial policies (leverage, debt maturity and cash holdings) and firm investment. According to the underinvestment argument, lowering the level of leverage and/or increasing the level of short term debt allow firms to exercise their growth opportunities. Joshi (2019) observes that debt appears to be most important for low-growth firms, followed by high-growth firms and financially-constrained firms. This suggests that this debt strategy allows for more investments. As pointed out by Dang (2011), lowering the level of leverage and/or increasing the level of short term debt are more likely to magnify the positive effect of growth opportunities on investment. As such we propose the following hypothesis.

Hypothesis 6. *There is a positive relationship between growth opportunities and firm investment.*

Jensen (1986) and Stulz (1990) find that issuing debt is used as a protection mechanism against overinvestment. Debt disciplines firms and force them to pay out cash as interest and principal, suggesting that debt servicing reduces the potential of investing in poor investment projects (Aivazian et al., 2005b). Hence, the overinvestment hypothesis suggests a negative relationship between debt and firm investment. Hence, our seventh hypothesis states:

Hypothesis 7. *Leverage and debt maturity have significant negative impact on firm investment.*

Empirical research finds that firms with growth opportunities can reduce the underinvestment problem by holdings cash as these firms tend to face information asymmetry problems, which can lead to the high cost of external financing (Kim et al., 1998; Opler et al., 1999). Harford et al. (2014) also find that firms with refinancing risk can mitigate the underinvestment problem by holdings cash reserves. This implies that cash reserves can reduce refinancing risk, preventing the firms to forgo valuable growth opportunities. As a result, cash holdings are expected to positively affect firm investment, and therefore our eighth hypothesis is:

Hypothesis 8. *Cash holdings have a positive impact on firm investment.*

3 | DATA DESCRIPTION AND EMPIRICAL MODELS

The sample for this study is an unbalanced panel of publicly traded firms in Thailand, Indonesia and Singapore that are available from the *Datastream*[2] database over the period of 2006 to 2015. The study period starts from the year 2006 due to the availability of the historical yield data of government bonds and treasury bills of the studied countries. The accounting data of these firms are obtained from the *Worldscope* database.[2] See Table A1 for the empirical definition of the variables in this study. To calculate total assets in constant prices, we also collected the historical data of Consumer Price Index (CPI). The initial sample excludes firms in the financial and utility sectors as those firms have different regulatory accounting standards and unique capital structure characteristics. Consequently, the final samples include 251 Thai, 206 Indonesian and 320 Singaporean firms. To reduce the impact of outliers, we winsorise all firm-level variables at 1st and 99th percentiles.

To examine the inter-relationship between leverage, debt maturity and cash holdings in the light of the set of growth opportunities that are available to a firm, and also how these financial policies affect firm investment decision, we augment Dang' (2011) partial adjustment framework[3] by introducing a cash holding equation. In particular, we consider the following dynamic equations.

$$LEV_{i,t} = \alpha_0 + \delta_{LEV} LEV_{i,t-1} + \alpha_1 MAT_{i,t} + \alpha_2 CASH_{i,t} + \alpha_3 GTH_{i,t} + \alpha_4 GTH \times MAT_{i,t} + \sum \alpha_j^{LEV} X_{i,t}^{LEV} + \nu_i + \mu_{i,t} \quad (1)$$

$$MAT_{i,t} = \alpha_0 + \delta_{MAT} MAT_{i,t-1} + \alpha_1 LEV_{i,t} + \alpha_2 CASH_{i,t} + \alpha_3 GTH_{i,t} + \alpha_4 GTH \times LEV_{i,t} + \sum \alpha_j^{MAT} X_{i,t}^{MAT} + \nu_i + \mu_{i,t} \quad (2)$$

$$CASH_{i,t} = \alpha_0 + \delta_{CASH} CASH_{i,t-1} + \alpha_1 LEV_{i,t} + \alpha_2 MAT_{i,t} + \alpha_3 GTH_{i,t} + \sum \alpha_j^{CASH} X_{i,t}^{CASH} + \nu_i + \mu_{i,t} \quad (3)$$

Where $LEV_{i,t}$ is market leverage of a firm i in the end of period t, measured by total debt divided by the market

value of equity plus total liabilities. $MAT_{i,t}$ is debt maturity, measured by the ratio of long-term debt that matures after 1 year to total debt. $CASH_{i,t}$ is corporate cash holdings, defined as the ratio of cash and short-term investments to total assets. $GTH_{i,t}$ is growth opportunities, defined by the market value of equity plus book value of total liabilities, all divided by total assets. $X_{i,t}^{LEV}$ are set of control variables (see Appendix A1). ν_i represents the time-invariant unobservable individual effects. $\mu_{i,t}$ is the error term.

The growth interaction terms are included in the equations. For instance, in Equation (1) the interaction term $GTHxMAT_{i,t}$, is included to test whether short debt maturity influences the hypothesized negative relationship between leverage and growth opportunities. As the net impact of growth opportunities on leverage is estimated by $\partial LEV/\partial GTH = \alpha_3 + \alpha_4 MAT$, a shorter debt maturity will decrease the negative impact of growth opportunities on leverage if the coefficient of this interaction term, α_4, is negative (Dang, 2011).

To assess the effect of financial policies on firm investment, we have also considered the below investment equation.

$$\begin{aligned} INV_{i,t} = {} & \alpha_0 + \delta_{INV} INV_{i,t-1} + \alpha_1 LEV_{i,t-1} + \alpha_2 MAT_{i,t-1} \\ & + \alpha_3 CASH_{i,t-1} + \alpha_4 GTH_{i,t-1} + \alpha_5 GTH \times LEV_{i,t-1} \\ & + \alpha_6 GTH \times MAT_{i,t-1} + \alpha_7 CF_{i,t-1} + \nu_i + \mu_{i,t} \end{aligned} \quad (4)$$

Where $INV_{i,t}$ is firm investment, measured by capital expenditures less depreciation, all divided by lagged net property, plant and equipment. $CF_{i,t}$ is cash flow, measured by EBITDA plus depreciation, all divided by total assets.

It is generally argued that endogeneity can lead to bias and inconsistent results. There are two possible causes of endogeneity with our empirical design: reverse causality (simultaneity) and the dynamic setting of the equations (i.e., including lagged dependent variables). For the simultaneity (among leverage, debt maturity and cash holdings) issue, it could be argued the decision to hold cash depends on the borrowing capacity of the firm, and similarly the decision to borrow depends on the level of cash held by the firm. Similarly, allowing the lagged dependent variables used in the above equations to be correlated with unobserved heterogeneity create an endogeneity bias. To address this problem, the difference GMM estimator developed by Arellano and Bond (1991) is used. The difference GMM estimation involves first-differencing the dynamic equations to remove the individual effects and utilizing the lagged values in levels of the dependent variables and of endogenous variables as instruments for the first-differenced lagged dependent variables and the first- differenced endogenous variables. The two-step system GMM estimator with robust standard errors is the most suitable estimator for the model in this study. However, to facilitate comparison with previous studies done on the single-equation we also employ the pooled OLS estimator and the FE (within) estimator to estimate the models without addressing endogeneity. This exercise will also highlight the issues of ignoring the endogeneity problem in our context. Moreover, the two-equation system that simultaneously considers only leverage and debt maturity is also estimated in order to compare the results with the three-equation system that accounts for the endogeneity among leverage, debt maturity and cash holdings.

TABLE 1 Structure of unbalanced panel data. The table displays the number of firm-year observations for each country for a particular year

Year	Thailand	Indonesia	Singapore
2006	215	150	234
2007	225	159	263
2008	235	174	279
2009	244	186	290
2010	249	194	299
2011	251	206	320
2012	251	206	320
2013	251	206	319
2014	251	205	316
2015	251	200	306
Total	2,423	1,886	2,946

4 | RESULTS AND DISCUSSION OF FINDINGS

4.1 | Summary statistics

Table 1 provides the summary of the unbalanced panel data for each country. Table 2 provides the summary of descriptive statistics and the correlation matrix of the variables for each country are reported in Tables 3–5 respectively.

Table 2 shows that on average, firms in Thailand and Indonesia are more levered than those in Singapore. The mean (median) leverage of Thai and Indonesian firm is 0.283 (0.261) and 0.290 (0.254) respectively, while that of Singaporean firms is 0.243 (0.212). These statistics are higher than those documented in Johnson (2003) for the U.S. firms and Dang (2011) for the UK firms.[4] As for debt

TABLE 2 Summary statistics of variables

Variable	Mean	*SD*	Minimum	Median	Maximum
Panel A: Thailand					
Leverage	0.283	0.191	0.001	0.261	0.735
Debt maturity	0.404	0.314	0.000	0.389	0.994
Cash holdings	0.073	0.083	0.001	0.044	0.413
Firm investment	0.082	0.253	−0.305	0.014	1.601
Growth opportunities	1.284	0.726	0.480	1.072	4.705
Tangibility	0.383	0.238	0.008	0.380	0.916
Profitability	0.046	0.084	−0.280	0.048	0.272
Non-debt tax shields	0.040	0.029	0.001	0.035	0.160
Size	15.343	1.441	12.788	15.118	19.370
Asset maturity structure	14.976	16.055	1.650	10.347	105.948
Earnings volatility	0.048	0.048	0.004	0.034	0.297
Firm quality	0.022	0.215	−0.613	0.003	1.179
Term structure (%)	1.438	0.685	0.550	1.220	2.670
Effective tax rate	0.170	0.158	−0.024	0.176	0.840
Net working capital	0.063	0.225	−0.528	0.035	0.740
CAPEX	0.053	0.055	0.000	0.036	0.255
Dividend dummy	0.746	0.436	0.000	1.000	1.000
Net debt issuance	0.001	0.065	−0.217	−0.002	0.217
Cash flow	0.112	0.095	−0.230	0.107	0.405
Panel B: Indonesia					
Leverage	0.290	0.209	0.002	0.254	0.869
Debt maturity	0.500	0.350	0.000	0.528	1.000
Cash holdings	0.101	0.095	0.002	0.069	0.398
Firm investment	0.111	0.263	−0.263	0.033	1.511
Growth opportunities	1.351	0.825	0.375	1.048	4.892
Tangibility	0.410	0.232	0.013	0.390	0.917
Profitability	0.068	0.081	−0.185	0.063	0.338
Non-debt tax shields	0.038	0.030	0.001	0.033	0.162
Size	21.001	1.605	17.555	20.995	24.545
Asset maturity structure	23.737	47.944	1.904	11.508	351.544
Earnings volatility	0.053	0.059	0.002	0.036	0.393
Firm quality	0.026	0.344	−1.492	0.005	1.988
Term structure	2.061	1.453	−1.313	2.041	4.535
Effective tax rate	0.201	0.504	−2.774	0.253	1.996
Net working capital	0.024	0.241	−1.255	0.029	0.539
CAPEX	0.058	0.062	0.000	0.037	0.309
Dividend dummy	0.492	0.500	0.000	0.000	1.000
Net debt issuance	0.007	0.078	−0.284	0.000	0.296
Cash flow	0.114	0.095	−0.173	0.106	0.448
Panel C: Singapore					
Leverage	0.243	0.176	0.001	0.212	0.697
Debt maturity	0.390	0.319	0.000	0.359	1.000

(Continues)

TABLE 2 (Continued)

Variable	Mean	*SD*	Minimum	Median	Maximum
Cash holdings	0.166	0.120	0.008	0.137	0.589
Firm investment	0.123	0.408	−0.291	0.011	2.781
Growth opportunities	1.178	0.751	0.447	0.949	5.305
Tangibility	0.270	0.204	0.003	0.231	0.819
Profitability	0.025	0.102	−0.532	0.035	0.230
Non-debt tax shields	0.030	0.026	0.000	0.023	0.126
Size	12.283	1.658	9.154	12.013	16.940
Asset maturity structure	20.810	53.929	1.367	8.950	441.702
Earnings volatility	0.064	0.082	0.003	0.037	0.526
Firm quality	0.033	0.329	−1.064	0.002	1.714
Term structure	1.339	0.735	0.010	1.310	2.290
Effective tax rate	0.139	0.315	−1.373	0.153	1.533
Net working capital	0.051	0.192	−0.671	0.049	0.530
CAPEX	0.046	0.058	0.000	0.024	0.311
Dividend dummy	0.665	0.472	0.000	1.000	1.000
Net debt issuance	0.008	0.080	−0.258	−0.001	0.289
Cash flow	0.070	0.124	−0.632	0.081	0.370

Note: The variable definitions and measurements are in the Appendix. CAPEX is measured by capital expenditures divided by total assets. Dividend dummy is 1 if a firm paid a common dividend in a given year, 0 otherwise. *Net debt issuance* is measured by long-term borrowings minus long-term debt reduction, all divided by total assets. *Cash flow* is measured by EBITDA divided by total assets. To mitigate the impact of outliers, all firm-level variables are winsorised at 1st and 99th percentiles. As for Singapore, term structure is the difference between the yields of 10-year government bonds and those of 1-year treasury bills since their final 3-month and 6-month treasury bills had been discontinued since 2013, and the yields of 1-year treasury bills are almost identical to those of 3-month treasury bills, as shown in Table A2.

maturity (the proportion of long-term debt), the average ratio in Thailand (0.404) is similar to that in Singapore (0.390), while it is highest in Indonesia (0.500), suggesting that Indonesian firms use less short-term debt than Thai and Singaporean firms. However, these statistics are still lower than that in the UK (0.538) reported by Dang (2011). The mean for cash holdings is highest in Singapore (0.166), while it is lowest in Thailand (0.073).

Similar to Bates, Kahle, and Stulz (2009) and Brick and Liao (2016) for the U.S. firms, Indonesian firms have the average cash holdings ratio of 0.101. The average firm investment in Thailand is 0.082, which is equal to that in Dang (2011) for the UK firms. However, the average ratio in Indonesia and Singapore is higher at 0.111 and 0.123 respectively. As for growth opportunities, the results show that all three countries have high growth opportunities. The mean for growth opportunities is highest in Indonesia (1.351), followed by Thailand (1.284) and then Singapore (1.178). Nevertheless, the results for growth opportunities do not appear to be consistent with those for firm investment. According to Jensen (1986), firms with high growth opportunities are usually active in investment. However, in this study, Singapore firms that have the lowest growth opportunities have the highest ratio of firm investment. This suggests that there are other factors that affect firm investment. The differences in other variables also imply variations in the corporate financial practices in these countries.

Correlation matrices in Table 3 show that consistent with liquidity risk theory, leverage is weakly positively correlated to debt maturity in all countries (0.040–0.095). There is a moderate negative correlation between cash holdings and leverage in all countries (−0.367 to −0.429). While cash holdings are weakly positively correlated to debt maturity in Thailand and Indonesia (0.080–0.101), cash holdings and debt maturity are weakly negatively correlated in Singapore (−0.026). A negative correlation between growth opportunities and leverage in all countries (−0.321 to −0.470) is supported by the underinvestment and overinvestment hypotheses that high-growth firms decrease leverage to reduce the underinvestment incentive, whereas low-growth firms increase leverage to control the overinvestment incentive. However, a positive correlation between growth opportunities and debt maturity in all countries (0.045–0.117) contradicts the underinvestment and overinvestment hypotheses. Consistent

TABLE 3 Correlation matrix. The table presents the correlation matrix for the data of firms in each country in the period of 2005–2014

	LEV	MAT	CASH	INV	GTH	TANG	PROF	NDTS	SIZE	AMAT	VOL	QUA	TERM	TAX	NWC	CAPX	DIV	ISSUE	CF
Panel A: Thailand																			
LEV	1.000																		
MAT	0.057	1.000																	
CASH	−0.429	0.080	1.000																
INV	−0.050	0.064	0.016	1.000															
GTH	−0.470	0.081	0.266	0.080	1.000														
TANG	0.080	0.279	−0.185	−0.048	0.022	1.000													
PROF	−0.308	0.105	0.182	0.079	0.328	0.033	1.000												
NDTS	−0.125	0.064	0.053	−0.183	0.194	0.391	0.069	1.000											
SIZE	0.075	0.351	0.059	0.069	0.102	0.088	0.164	−0.017	1.000										
AMAT	0.129	0.155	−0.118	0.176	−0.077	0.250	−0.041	−0.358	0.107	1.000									
VOL	−0.165	−0.045	0.160	0.043	0.171	−0.030	−0.125	0.086	−0.169	0.006	1.000								
QUA	0.110	−0.058	−0.051	−0.047	−0.030	0.024	−0.263	0.050	−0.047	−0.023	−0.004	1.000							
TERM	0.050	0.018	0.002	−0.051	−0.099	0.043	0.000	0.034	−0.023	−0.008	0.037	0.027	1.000						
TAX	−0.099	0.072	0.043	0.084	0.072	−0.042	0.322	−0.037	0.088	0.034	−0.154	−0.145	−0.042	1.000					
NWC	−0.061	0.076	−0.064	0.048	−0.159	−0.535	0.142	−0.420	−0.126	0.009	−0.076	−0.128	0.005	0.109	1.000				
CAPX	−0.111	0.176	−0.004	0.533	0.202	0.435	0.179	0.280	0.087	0.066	0.063	−0.037	−0.014	0.078	−0.284	1.000			
DIV	−0.218	0.010	0.061	0.103	0.137	−0.027	0.410	0.014	0.204	−0.076	−0.249	−0.121	−0.055	0.310	0.123	0.176	1.000		
ISSUE	0.071	0.190	−0.038	0.315	0.034	−0.012	0.031	−0.167	0.186	0.098	−0.038	−0.007	0.027	0.082	0.079	0.298	0.165	1.000	
CF	−0.359	0.138	0.210	0.015	0.396	0.124	0.787	0.355	0.140	−0.146	−0.036	−0.363	−0.012	0.262	−0.029	0.240	0.363	−0.046	1.000
Panel B: Indonesia																			
LEV	1.000																		
MAT	0.040	1.000																	
CASH	−0.367	0.101	1.000																
INV	−0.125	0.061	0.114	1.000															
GTH	−0.354	0.045	0.199	0.120	1.000														
TANG	0.233	0.300	−0.321	−0.092	−0.014	1.000													
PROF	−0.375	0.013	0.335	0.134	0.394	−0.135	1.000												
NDTS	0.208	−0.006	−0.110	−0.158	0.082	0.443	−0.063	1.000											
SIZE	−0.012	0.378	0.222	0.079	0.160	0.075	0.177	−0.047	1.000										
AMAT	0.000	0.243	−0.050	0.045	−0.028	0.121	−0.102	−0.257	0.037	1.000									

(Continues)

TABLE 3 (Continued)

	LEV	MAT	CASH	INV	GTH	TANG	PROF	NDTS	SIZE	AMAT	VOL	QUA	TERM	TAX	NWC	CAPX	DIV	ISSUE	CF
VOL	0.034	0.032	−0.006	0.046	0.189	0.093	0.036	0.160	−0.040	−0.060	1.000								
QUA	0.066	−0.028	−0.035	−0.049	−0.006	0.000	−0.110	0.023	−0.033	−0.015	−0.001	1.000							
TERM	0.054	0.001	0.004	0.044	−0.049	−0.013	0.009	−0.034	0.035	−0.016	−0.009	0.047	1.000						
TAX	−0.109	−0.031	0.086	0.037	−0.014	−0.074	0.136	−0.004	0.023	−0.051	−0.100	−0.060	0.015	1.000					
NWC	−0.342	0.079	0.072	0.066	−0.136	−0.383	0.266	−0.426	−0.062	0.069	−0.202	−0.097	−0.003	0.089	1.000				
CAPX	−0.019	0.158	0.005	0.625	0.145	0.318	0.177	0.267	0.132	−0.046	0.089	−0.062	0.012	0.021	−0.099	1.000			
DIV	−0.290	0.044	0.376	0.167	0.189	−0.191	0.447	−0.079	0.383	−0.103	−0.092	−0.040	0.014	0.093	0.158	0.169	1.000		
ISSUE	0.048	0.146	0.013	0.305	−0.031	−0.033	−0.028	−0.157	0.139	0.061	−0.031	−0.032	−0.019	0.011	0.053	0.304	0.105	1.000	
CF	−0.346	0.011	0.319	0.078	0.397	−0.035	0.818	0.192	0.141	−0.158	0.081	−0.289	−0.061	0.126	0.135	0.207	0.378	−0.097	1.000
Panel C: Singapore																			
LEV	1.000																		
MAT	0.095	1.000																	
CASH	−0.442	−0.026	1.000																
INV	0.033	0.084	−0.002	1.000															
GTH	−0.321	0.117	0.183	0.089	1.000														
TANG	0.131	0.200	−0.304	0.027	−0.040	1.000													
PROF	−0.074	0.164	−0.015	0.096	−0.024	0.024	1.000												
NDTS	−0.117	−0.044	−0.039	−0.151	0.116	0.467	−0.107	1.000											
SIZE	0.209	0.402	−0.190	0.030	−0.067	0.166	0.308	−0.197	1.000										
AMAT	0.146	0.182	−0.133	0.065	−0.068	0.254	0.027	−0.246	0.257	1.000									
VOL	−0.155	−0.039	0.160	0.074	0.314	−0.089	−0.257	0.034	−0.328	−0.029	1.000								
QUA	0.082	−0.026	−0.038	−0.064	0.042	0.019	−0.316	0.085	−0.090	−0.001	0.060	1.000							
TERM	0.024	−0.015	0.087	−0.029	−0.085	−0.078	−0.055	−0.008	0.020	−0.053	−0.003	−0.039	1.000						
TAX	0.015	−0.023	−0.033	0.006	−0.049	−0.009	0.151	−0.045	0.082	0.001	−0.072	−0.076	−0.027	1.000					
NWC	−0.056	0.033	−0.073	−0.003	−0.261	−0.393	0.237	−0.345	−0.057	0.023	−0.140	−0.148	−0.008	0.057	1.000				
CAPX	−0.004	0.117	−0.084	0.561	0.080	0.450	0.108	0.324	0.034	−0.035	0.004	−0.043	−0.068	−0.027	−0.229	1.000			
DIV	−0.028	0.162	−0.034	0.030	−0.057	−0.015	0.396	−0.118	0.363	0.037	−0.324	−0.118	−0.051	0.098	0.164	0.033	1.000		
ISSUE	0.202	0.176	−0.078	0.282	0.007	−0.001	0.124	−0.168	0.183	0.086	−0.024	−0.054	−0.046	0.009	0.028	0.237	0.121	1.000	
CF	−0.104	0.145	0.027	0.081	0.019	0.103	0.813	0.058	0.240	−0.002	−0.175	−0.466	−0.067	0.123	0.154	0.166	0.333	0.064	1.000

TABLE 4 Determinants of leverage

Independent variable	Predicted sign	Thailand		Indonesia		Singapore	
		Pooled OLS	Fixed-effect (within)	Pooled OLS	Fixed-effect (within)	Pooled OLS	Fixed-effect (within)
Debt maturity$_t$	+	0.0829***	0.0615*	0.0162	0.0534	0.0893***	0.0585***
(Prop. long)		(3.89)	(1.79)	(0.66)	(1.58)	(5.37)	(2.45)
Cash holdings$_t$	−	−0.7299***	−0.3287***	−0.5508***	−0.2521***	−0.5474***	−0.3232***
		(−21.56)	(−5.62)	(−11.48)	(−3.75)	(−24.00)	(−7.60)
Growth opportunities$_t$	−	−0.0797***	−0.0944***	−0.0671***	−0.0610***	−0.0432***	−0.0397***
		(−13.21)	(−7.99)	(−7.06)	(−6.43)	(−7.44)	(−4.08)
Growth opportunities$_t$ x debt maturity$_t$	−	−0.0257**	−0.0118	0.0010	−0.0225	−0.0338***	−0.0203
		(−2.12)	(−0.59)	(0.06)	(−1.49)	(−3.47)	(−1.61)
Tangibility$_t$	+	0.0139	0.0447	0.0214	−0.0085	0.0190	0.0838***
		(0.88)	(1.16)	(0.90)	(−0.16)	(1.00)	(2.58)
Profitability$_t$	−	−0.3702***	−0.4137***	−0.4965***	−0.3693***	−0.2359***	−0.2511***
		(−8.93)	(−7.61)	(−7.40)	(−4.49)	(−7.36)	(−5.81)
Non-debt tax shields$_t$	−	−0.2407**	0.3020	1.2723***	1.2185***	−0.6652***	0.2724
		(−2.17)	(1.64)	(7.76)	(4.09)	(−5.26)	(0.98)
Size$_t$	+	0.0169***	0.0735***	0.0151***	0.0414**	0.0112***	0.0644***
		(7.53)	(6.33)	(4.85)	(2.96)	(5.77)	(7.04)
Constant		0.1809***	−0.7286***	0.0875	−0.5016*	0.2498***	−0.4849***
		(5.21)	(−3.92)	(1.32)	(−1.69)	(10.01)	(−4.14)
Observations		2,423	2,423	1,886	1,886	2,946	2,946
R^2		0.3695	0.3508	0.3012	0.2368	0.3023	0.2707

Note: The dependent variable is *leverage*, measured by total debt divided by the market value of equity plus total liabilities. *Debt maturity* is measured by long-term debt that matures after 1 year divided by total debt. *Cash holdings* are the ratio of cash and short-term investments to total assets. *Growth opportunities* are measured by market value of equity plus book value of total liabilities, all divided by total assets. *Tangibility* is the ratio of net property, plant and equipment to total assets. *Profitability* is the ratio of operating income to total assets. *Non-debt tax shield* is the ratio of depreciation and amortisation to total assets. *Size* is the natural logarithm of total assets in 2006 price. *t*-Statistics based on robust standard errors are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively.

with trade-off theory, growth opportunities and cash holdings are positively correlated in all countries (0.183–0.266). In line with the financial flexibility theory firms with higher growth tend to accumulate more cash to avoid forgoing valuable investments or expensive external financing. In Thailand and Indonesia, firm investment is negatively correlated with leverage but positively correlated with debt maturity, cash holdings and growth opportunities. However, firm investment is positively correlated with leverage, debt maturity and growth opportunities but negatively correlated with cash holdings in Singapore.

Furthermore, the overall results show that the correlations between variables in all countries are not strong (less than −0.70 or more than 0.70), except for a strong correlation between cash flow and profitability (0.787–0.818). Nonetheless, cash flow and profitability are not independent variables used in the same regression. Consequently, there is no multicollinearity[5] problem in this study.

4.2 | Empirical results

4.2.1 | Leverage equation

Table 4 is the result of the leverage model and shows that debt maturity (the proportion of long-term debt) has a significant and positive effect on leverage in all countries with the exception of Indonesia, which reports the

TABLE 5 Determinants of debt maturity

Independent variable	Predicted sign	Thailand		Indonesia		Singapore	
		Pooled OLS	Fixed- effect (within)	Pooled OLS	Fixed- effect (within)	Pooled OLS	Fixed- effect (within)
Leverage$_t$	+	0.1951**	0.1038	0.1303*	0.0822	0.1287**	0.0652
		(2.37)	(0.99)	(1.79)	(0.63)	(2.02)	(0.76)
Cash holdings$_t$	+/−	0.3518***	0.2158*	0.2081**	0.1515	0.1703***	0.1309*
		(3.98)	(1.91)	(2.36)	(1.20)	(3.13)	(1.73)
Growth opportunities$_t$	−	0.0376***	0.0242*	0.0004	−0.0085	0.0600***	0.0299***
		(2.96)	(1.69)	(0.03)	(−0.52)	(5.53)	(2.58)
Growth opportunities$_t$ x leverage$_t$	−	−0.0300	0.0756	−0.0238	−0.0325	0.0195	0.0670
		(−0.36)	(0.68)	(−0.43)	(−0.26)	(0.35)	(1.18))
Asset maturity structure$_t$	+	0.0024***	0.0007	0.0017***	0.0003	0.0005***	0.0002
		(5.69)	(1.23)	(10.97)	(1.57)	(4.57)	(1.25)
Earnings volatility$_t$	−	−0.0056	−0.0719	0.3506**	0.1318	0.1910**	0.1873*
		(−0.04)	(−0.46)	(2.42)	(0.70)	(2.38)	(1.78)
Firm quality$_t$	−	−0.0590**	−0.0670***	−0.0155	−0.0197	−0.0075	−0.0094
		(−2.09)	(−3.21)	(−0.72)	(−1.38)	(−0.45)	(−0.68)
Term structure$_t$	+	0.0143*	0.0116**	−0.0024	−0.0026	−0.0065	−0.0077
		(1.66)	(2.02)	(−0.48)	(−0.88)	(−0.89)	(−1.15)
Effective tax rate$_t$	+	0.0710*	−0.0103	−0.0148	−0.0042	−0.0458***	−0.0202
		(1.85)	(−0.27)	(−1.01)	(−0.37)	(−2.67)	(−1.40)
Size$_t$	+	0.0682***	0.0415*	0.0786***	0.0523*	0.0779***	0.0696***
		(16.07)	(1.79)	(16.98)	(1.91)	(23.31)	(4.14)
Constant		−0.8306***	−0.3530	−1.2532***	−0.6213	−0.7088***	−0.5562***
		(−12.46)	(−0.98)	(−13.41)	(−1.08)	(−15.6)	(−2.65)
Observations		2,423	2,423	1,886	1,886	2,946	2,946
R^2		0.1542	0.0272	0.2042	0.0176	0.2009	0.0300

Note: The dependent variable is *debt maturity*, measured by long-term debt that matures after 1 year divided by total debt. *Leverage* is measured by total debt divided by the market value of equity plus total liabilities. *Cash holdings* are the ratio of cash and short-term investments to total assets. *Growth opportunities* are measured by market value of equity plus book value of total liabilities, all divided by total assets. *Asset maturity structure* is measured by net property, plant and equipment divided by depreciation. *Earnings volatility* is the standard deviation of EBITD over the 3 years preceding the sample year, scaled by average total assets for that period. *Firm quality* is the difference between EPS in years $t + 1$ and t to share price in year t. *Term structure* is the difference between yields on 10Y government bonds and 3M treasury bills. *Effective tax rate* is measured by income taxes divided by pre-tax income. *Size* is the natural logarithm of total assets in 2005 price. t-Statistics based on robust standard errors are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively.

insignificant effect of debt maturity. The positively significant relationship between leverage and debt maturity is consistent with Elyasiani et al. (2002) for the U.S. firms and the prediction of liquidity risk theory. Using more short-term debt (a lower proportion of long-term debt) increases liquidity risk. Firms therefore simultaneously lower leverage to help reduce the increasing risk. In other words, leverage and debt maturity are strategic complements to reduce liquidity risk.

Consistent with Loncan and Caldeira (2014), the coefficient on the cash holdings variable for all countries is significant and negative at the 1% significance level, suggesting that leverage decreases with cash holdings. According to pecking order theory, firms prefer internal financing (retained earnings and cash holdings) to external financing (equity or debt). Under this theory, when investments exceed retained earnings, firms first use the accumulated cash reserves and then issue debt if the accumulated cash is not sufficient. In all countries, growth opportunities have a significant and negative impact on leverage at the 1% significance level. This provides a strong support for Myers' (1977) underinvestment hypothesis that firms with high growth opportunities control their underinvestment incentive by lowering leverage. This finding is in line with Rajan and Zingales (1995), Deesomsak, Paudyal, and Pescetto (2004) and Frank and Goyal (2009).

TABLE 6 Determinants of cash holdings

		Thailand		Indonesia		Singapore	
Independent variable	**Predicted sign**	**Pooled OLS**	**Fixed-effect (within)**	**Pooled OLS**	**Fixed-effect (within)**	**Pooled OLS**	**Fixed-effect (within)**
Leverage$_t$	+/−	−0.1864***	−0.1148***	−0.1378***	−0.0967***	−0.2969***	−0.2580***
		(−18.13)	(−6.37)	(−12.71)	(−5.40)	(−24.23)	(−9.37)
Debt maturity$_t$	+/−	0.0292***	0.0312***	0.0270***	0.0304***	0.0323***	0.0347***
(Prop. long)		(5.14)	(3.23)	(4.33)	(3.09)	(4.36)	(3.06)
Growth opportunities$_t$	+	0.0041	0.0145***	−0.0045	−0.0024	−0.0009	−0.0016
		(1.08)	(2.87)	(−1.57)	(−0.58)	(−0.21)	(−0.31)
Net working capital$_t$	−	−0.0490***	−0.0764***	−0.0534***	−0.0827***	−0.0960***	−0.0946***
		(−6.29)	(−3.08)	(−5.93)	(−5.40)	(−7.46)	(−3.87)
CAPEX$_t$	−	−0.1988***	−0.1367***	−0.1700***	−0.1170***	−0.2946***	−0.1749***
		(−6.03)	(−4.29)	(−5.18)	(−2.98)	(−8.01)	(−3.71)
Dividend dummy$_t$	−	−0.0082**	0.0026	0.0420***	0.0041	0.0024	0.0034
		(−2.22)	(0.63)	(9.03)	(0.74)	(0.49)	(0.60)
Net debt issuance$_t$	+	0.0227	0.0090	0.0298	0.0295	0.0863***	0.0246
		(0.93)	(0.44)	(1.19)	(1.42)	(3.29)	(0.88)
Profitability$_t$	−	0.0788***	0.0649**	0.2117***	0.2318***	0.0345	0.0113
		(2.90)	(2.22)	(6.78)	(5.86)	(1.24)	(0.36)
Size$_t$	−	0.0021*	0.0072	0.0044***	0.0019	−0.0116***	−0.0128*
		(1.67)	(0.91)	(2.96)	(0.33)	(−7.78)	(−1.76)
Constant		0.0928***	−0.0300	0.0180	0.0682	0.3843***	0.3835***
		(5.02)	(−0.24)	(0.59)	(0.56)	(19.87)	(4.43)
Observations		2,423	2,423	1,886	1,886	2,946	2,946
R^2		0.2253	0.1427	0.2628	0.1061	0.2380	0.1390

Note: The dependent variable is *cash holdings*, measured by the ratio of cash and short-term investments to total assets. *Leverage* is measured by total debt divided by the market value of equity plus total liabilities. *Debt maturity* is measured by long-term debt that matures after 1 year divided by total debt. *Growth opportunities* are measured by market value of equity plus book value of total liabilities, all divided by total assets. *Net working capital* is measured by net working capital net of cash holdings, all divided by total assets. *CAPEX* is measured by capital expenditures divided by total assets. *Dividend dummy* is 1 if a firm paid a common dividend in a given year, 0 otherwise. *Net debt issuance* is measured by long-term borrowings minus long-term debt reduction, all divided by total assets. *Profitability* is the ratio of operating income to total assets. *Size* is the natural logarithm of total assets in 2006 price. *t*-Statistics based on robust standard errors are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively.

The results for the interaction term between growth opportunities and debt maturity are mixed. The coefficient on the interaction term is negative and significant in the pooled OLS regressions of Thai and Singaporean firms. As discussed earlier, the significantly negative coefficient provides a support for the hypothesis that short debt maturity reduces the negative impact of growth opportunities on leverage (the substitution effect). For example, when considering the total impact of growth opportunities on leverage for firms in Thailand, firms that use more short-term debt have a smaller total negative impact of growth opportunities on leverage (∂LEV/∂GTH = −0.0797 to 0.0257MAT).

However, the result also suggests that even with 100% short-term debt (MAT = 0), growth opportunities still negatively affect leverage. This means that short debt maturity cannot completely substitute for low leverage in controlling the underinvestment problem and implies that using short debt maturity has costs, which also force firms to simultaneously reduce leverage. Under liquidity risk theory, these costs are liquidity risk costs.

Furthermore, when considering the total impact of debt maturity on leverage (∂LEV/∂MAT = 0.0829–0.0257GTH), the total positive impact of debt maturity on leverage becomes weaker when firms have higher growth opportunities. With the level of growth opportunities at

TABLE 7 Joint determination of leverage, debt maturity and cash holdings

	Two-equation system		Three-equation system		
Independent variable	**Leverage**	**Debt maturity**	**Leverage**	**Debt maturity**	**Cash holdings**
Panel A: Thailand					
$Leverage_{t-1}$	0.6002***		0.5903***		
	(10.34)		(11.75)		
$Debt\ maturity_{t-1}$		0.5263***		0.5136***	
(prop. Long)		(10.08)		(10.38)	
$Cash\ holdings_{t-1}$					0.5893***
					(11.77)
$Leverage_t$		0.0215		0.0406	−0.0455**
		(0.18)		(0.33)	(−2.32)
$Debt\ maturity_t$	−0.1397**		−0.1131**		0.0225
(Prop. long)	(−2.23)		(−1.98)		(1.36)
$Cash\ holdings_t$			−0.2844***	0.3756*	
			(−3.22)	(1.71)	
$Growth\ opportunities_t$	−0.0870***	0.0167	−0.0778***	0.0179	0.0021
	(−4.36)	(0.95)	(−4.57)	(1.03)	(0.47)
$Growth\ opportunities_t$ x $debt\ maturity_t$	0.0820***		0.0749***		
	(2.66)		(2.65)		
$Growth\ opportunities_t$ x $leverage_t$		0.1127		0.2008	
		(0.75)		(1.24)	
$Tangibility_t$	0.0552*		0.0150		
	(1.71)		(0.48)		
$Profitability_t$	−0.2523***		−0.2518***		0.0620***
	(−4.28)		(−4.56)		(2.68)
$Non\text{-}debt\ tax\ shields_t$	−0.4133**		−0.3510**		
	(−2.42)		(−2.14)		
$Size_t$	0.0158***	0.0341***	0.0154***	0.0306***	−0.0007
	(3.58)	(4.13)	(3.79)	(3.81)	(−0.33)
$Asset\ maturity\ structure_t$		0.0006		0.0008	
		(1.33)		(1.59)	
$Earnings\ volatility_t$		−0.0959		−0.0577	
		(−0.62)		(−0.37)	
$Firm\ quality_t$		−0.0282		−0.0335	
		(−1.19)		(−1.39)	
$Term\ structure_t$		0.0173***		0.0164**	
		(2.68)		(2.50)	
$Effective\ tax\ rate_t$		0.0324		0.0419	
		(0.88)		(1.19)	
$Net\ working\ capital_t$					−0.0425***
					(−3.34)
$CAPEX_t$					−0.1573***
					(−3.89)
$Dividend\ dummy_t$					0.0009
					(0.25)

TABLE 7 (Continued)

	Two-equation system		Three-equation system		
Independent variable	**Leverage**	**Debt maturity**	**Leverage**	**Debt maturity**	**Cash holdings**
Net debt issuance$_t$					0.0078
					(0.30)
Observations	2,172	2,172	2,172	2,172	2,172
AR(1) test	−8.00***	−7.72***	−8.47***	−7.68***	−5.87***
AR(2) test	−0.52	0.42	−0.42	0.37	0.30
Hansen test (*df*)	155.48(84)***	107.89(84)**	174.20(112)***	128.24(112)	96.35(84)
Panel B: Indonesia					
Leveraget-1	0.5451***		0.5256***		
	(8.37)		(7.93)		
Debt maturityt-1		0.7731***		0.7661***	
(Prop. long)		(11.25)		(11.19)	
Cash holdingst-1					0.5897***
					(9.52)
Leveraget		0.2108		−0.0161	−0.0618**
		(1.31)		(−0.11)	(−2.29)
Debt maturityt	−0.1191**		−0.1286**		0.0208
(Prop. long)	(−1.97)		(−2.22)		(1.24)
Cash holdingst			−0.1861*	0.1929	
			(−1.82)	(1.04)	
Growth opportunitiest	−0.0781***	0.0273	−0.0835***	−0.0032	−0.0038
	(−3.64)	(1.29)	(−3.50)	(−0.18)	(−1.01)
Growth opportunitiest x debt maturityt	0.0521* (1.82)		0.0602* (1.86)		
Growth opportunitiest x Leveraget		−0.1688* (−1.83)		−0.0563 (−0.68)	
Tangibilityt	0.0692*		0.0443		
	(1.93)		(1.36)		
Profitabilityt	−0.2652***		−0.2267***		0.1196***
	(−3.26)		(−2.69)		(3.30)
Non-debt tax shieldst	0.4823		0.5702**		
	(1.62)		(2.13)		
Sizet	0.0166***	0.0171**	0.0202***	0.0189**	0.0014
	(3.15)	(2.28)	(3.98)	(2.44)	(0.65)
Asset maturity structuret		0.0006***		0.0006***	
		(3.68)		(3.30)	
Earnings volatilityt		0.1905		0.2812	
		(1.11)		(1.65)	
Firm qualityt		−0.0264		−0.0253	
		(−1.29)		(−1.06)	
Term structuret		−0.0005		−0.0021	
		(−0.13)		(−0.49)	
Effective tax ratet		0.0060		0.0043	
		(0.63)		(0.38)	

(Continues)

TABLE 7 (Continued)

	Two-equation system		Three-equation system		
Independent variable	**Leverage**	**Debt maturity**	**Leverage**	**Debt maturity**	**Cash holdings**
Net working capitalt					−0.0467***
					(−2.72)
CAPEXt					−0.1537***
					(−4.13)
Dividend dummyt					0.0139***
					(3.38)
Net debt issuancet					0.0380
					(1.54)
Observations	1,680	1,680	1,680	1,680	1,680
AR(1) test	−5.71***	−7.05***	−5.64***	−7.15***	−5.79***
AR(2) test	−0.27	1.73*	−0.37	1.92*	0.30
AR(3) test	-	0.38	-	0.19	-
Hansen test (*df*)	126.84(84)***	46.77(57)	147.37(112)**	78.13(76)	88.83(84)
Panel C: Singapore					
$Leverage_{t-1}$	0.5310***		0.4551***		
	(11.82)		(9.73)		
$Debt\ maturity_{t-1}$		0.4288***		0.4361***	
(Prop. long)		(11.03)		(12.30)	
$Cash\ holdings_{t-1}$					0.5787***
					(14.19)
$Leverage_t$		−0.0586		−0.0059	−0.1765**
		(−0.48)		(−0.05)	(−5.00)
$Debt\ maturity_t$	−0.0503		−0.0391		0.0228
(Prop. long)	(−1.04)		(−0.88)		(0.85)
$Cash\ holdings_t$			−0.3595***	0.0401	
			(−5.14)	(0.25)	
$Growth\ opportunities_t$	−0.0704***	0.0301*	−0.0662***	0.0341**	−0.0075
	(−4.84)	(1.92)	(−5.53)	(2.13)	(−1.16)
$Growth\ opportunities_t$ x $debt\ maturity_t$	0.0526*		0.0506**		
	(1.80)		(2.02)		
$Growth\ opportunities_t$ x $leverage_t$		0.1047		0.0907	
		(1.41)		(1.24)	
$Tangibility_t$	0.0780**		0.0023		
	(2.50)		(0.07)		
$Profitability_t$	−0.1560***		−0.1659***		0.0261
	(−4.09)		(−4.38)		(0.91)
$Non\text{-}debt\ tax\ shields_t$	−0.4816**		−0.4183**		
	(−2.27)		(−2.14)		
$Size_t$	0.0116***	0.0466***	0.0091**	0.0469***	−0.0052*
	(2.99)	(7.89)	(2.23)	(8.29)	(−1.94)
$Asset\ maturity\ structure_t$		0.0004***		0.0004***	
		(3.33)		(2.93)	

TABLE 7 (Continued)

	Two-equation system		Three-equation system		
Independent variable	**Leverage**	**Debt maturity**	**Leverage**	**Debt maturity**	**Cash holdings**
Earnings volatility$_t$		0.0849		0.1229	
		(0.94)		(1.44)	
Firm quality$_t$		0.0276*		0.0154	
		(1.89)		(1.14)	
Term structure$_t$		−0.0016		−0.0019	
		(−0.28)		(−0.35)	
Effective tax rate$_t$		−0.0170		−0.0086	
		(−1.03)		(−0.59)	
Net working capital$_t$					−0.1065***
					(−5.68)
CAPEX$_t$					−0.2354***
					(−4.88)
Dividend dummy$_t$					−0.0053
					(−1.08)
Net debt issuance$_t$					0.0403
					(1.33)
Observations	2,626	2,626	2,626	2,626	2,626
AR(1) test	−8.73***	−8.65***	−8.42***	−8.66***	−8.23***
AR(2) test	−0.92	−0.72	1.12	−0.66	−0.08
Hansen test (*df*)	162.31(84)***	86.27(84)	191.35(112)***	105.08(112)	95.11(84)

Note: The structural equations are estimated by two-step system GMM estimator with robust standard errors. For definition of variables, see Table A1. *t*-Statistics are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively. AR(1) and AR(2) tests are tests for first-order and second-order serial correlation in residuals, respectively, under the null of no serial correlation. Hansen test is the test of over-identifying restrictions under the null of valid instruments.

its mean (1.284), the total impact of debt maturity on leverage is positive (the complementary effect). However, with the maximum level of growth opportunities (4.705), the total impact of debt maturity on leverage becomes negative (the substitution effect). This means that for high-growth firms, the underinvestment problem is more severe, consistent with the prediction of Myers' (1977) underinvestment hypothesis. Similar results are also found in Singaporean firms. In sum, the above results suggest that in Thailand and Singapore, debt maturity is used as a strategic complement to leverage in reducing liquidity risk when firms have normal growth but when those firms have extremely high growth, the underinvestment problem may outweigh the liquidity risk problem.

4.2.2 | Debt maturity equation

Table 5 reports the result of the debt maturity model using the pooled OLS regressions. The result shows a significant and positive effect of leverage on debt maturity (proportion of long-term debt) in all countries, and provides further evidence that leverage and debt maturity are used as strategic complements in reducing liquidity risk. Firms with high leverage lengthen their debt maturity to mitigate the liquidity risk. This finding is consistent with Stohs and Mauer (1996) and Brick and Liao (2016).

Consistent with Brick and Liao (2016), cash holdings have a significant and positive impact on debt maturity in all countries, suggesting that larger cash holdings result in firms increasing their debt maturity. Acharya et al. (2007) find that constrained firms tend to save cash in growth environments if their hedging needs are high. This relationship can also be explained by the notion that firms may simultaneously borrow long-term debt and hold a stock of cash to hedge uncertain future financing conditions (Sun, 2014). Liquidity risk can be exasperated if the level of cash holding does not meet the current liabilities of the business. Thus Yan, Hall, and Turner (2014) advocate for a liquidity

risk management through the provision of additional risk exposure information.

Surprisingly, the result shows that debt maturity statistically increases with growth opportunities for Thai and Singaporean firms. Although it is consistent with the empirical result found by Stohs and Mauer (1996) and Elyasiani et al. (2002) for the U.S. firms, it contradicts Myers' (1977) prediction that high-growth firms shorten their debt maturity to reduce the underinvestment incentive. However, this positive relationship between debt maturity and growth opportunities can be justified by the theoretical prediction of Hart and Moore (1994). Hart and Moore argue that firms with long-term growth opportunities use long-term debt to control the overinvestment problem as long-term debt reduces firms' capability to increase funds for future investments. Moreover, the insignificant impact of growth opportunities on debt maturity indicates that there is no economic relationship between debt maturity and growth opportunities. This insignificant impact of growth opportunities on debt maturity implies that firms in these countries use only a low-leverage strategy as a tool to reduce the underinvestment problem.

Furthermore, consistent with Dang (2011), the statistically insignificant coefficient on the interaction term between growth opportunities and leverage in all countries suggests that the overall positive effect of leverage on debt maturity is unaffected by the level of growth opportunities. Debt maturity increases with leverage irrespective of growth opportunities. This supports liquidity risk theory.

4.2.3 | Cash holdings equation

Table 6 is the result of the cash holdings model and indicates that leverage and debt maturity (proportion of long-term debt) are key determinants of cash holdings across the countries as expected. The signs of the relationship between cash holdings and leverage and between cash holdings and debt maturity are consistent with those in the leverage and debt maturity equations.

This result is in line with Opler et al. (1999), Guney, Ozkan, and Ozkan (2007), Bates et al. (2009) and Brick and Liao (2016). One plausible explanation is a substitution effect, which states that firms use borrowings as a substitute for cash holdings. Another explanation is the overinvestment hypothesis. Debt payments reduce firms' ability to accumulate cash. Consequently, firms with higher leverage may have less cash balances.

The significant positive coefficient on debt maturity suggests that the level of cash holdings increases with the maturity of debt. Although this contradicts the argument of Harford et al. (2014) that firms with shorter debt maturity may hold larger cash balances to reduce refinancing risk, Sun (2014) argues that firms may simultaneously borrow long-term debt and hold a stock of cash when they expect to face uncertain future financing conditions. This finding is consistent with Brick and Liao (2016).

Growth opportunities are positively related to cash holdings only in the FE (within) regression for Thai firms. As previously discussed, high-growth firms may hold large cash balances to (a) avoid passing up valuable investment opportunities, (b) avoid expensive external funding (Myers & Majluf, 1984; Ozkan & Ozkan, 2004) or (c) minimize their financial distress costs (Ferreira & Vilela, 2004; Myers, 1984). As for Indonesian and Singaporean firms, growth opportunities appear to have a negative but insignificant effect on cash holdings. According to the overinvestment hypothesis, firms with poor growth opportunities may accumulate more cash reserves to have sufficient funds to invest in future projects, even if these projects are not profitable (Bates et al., 2009; Ferreira & Vilela, 2004).

4.2.4 | Joint determination of leverage, debt maturity and cash holdings

Table 7 shows the result of the joint determination of leverage, debt maturity and cash holdings. The first two columns report the estimation of a system of equations for leverage and debt maturity. The next three columns report the estimation of a system of leverage, debt maturity and cash holdings equations. In each equation, leverage, debt maturity, cash holdings and their first-lagged levels are treated as endogenous. The last rows indicate the specification tests that assess the conditions required for the GMM estimator to yield consistent estimates. In all equations, as expected, the Arellano-Bond test for first-order serial correlation in first differences is significant, while the test for second-order serial correlation in first differences is insignificant with the exception of Indonesia. This means that there is no serial correlation in the error term in the level equations and the second lagged level of the endogenous variables can be used as an instrument in the regressions of Thai and Singaporean firms. As for Indonesian firms, the third lagged level is employed. Moreover, we follow the rule of thumb to keep the number of instruments less than the number of firms as Roodman (2009) argues that too many instruments can over fit the endogenous variables and weaken the Hansen test. Hence, only the second- (or third- for Indonesian firms) to fourth-lagged levels of the endogenous variables are used as instruments. However, the Hansen test of over-identifying restrictions for the leverage

TABLE 8 Determinants of firm investment

Independent variable	Predicted sign	Thailand	Indonesia	Singapore
Firm investment$_{t-1}$	+	0.3028***	0.2072***	0.1450***
		(4.53)	(4.75)	(3.95)
Leverage$_{t-1}$	−	−0.4492***	−0.2097	−0.3703***
		(−3.38)	(−1.65)	(−3.61)
Debt maturity$_{t-1}$	−	−0.2705***	−0.0669	−0.0426
(Prop. long)		(−2.69)	(−1.15)	(−0.41)
Cash holdings$_{t-1}$	+	0.3914	0.2583*	0.0629
		(1.60)	(1.72)	(0.41)
Growth opportunities$_{t-1}$	+	−0.1030***	−0.0081	0.0103
		(−3.43)	(−0.26)	(0.25)
Growth opportunities$_{t-1}$ x debt maturity$_{t-1}$	−	0.1967***	0.0432	0.0718
		(3.05)	(1.27)	(0.80)
Growth opportunities$_{t-1}$ x Leverage$_{t-1}$	−	0.4216**	0.0941	0.2559***
		(2.50)	(0.95)	(3.13)
Cash flow$_{t-1}$	+	−0.0864	0.2181**	−0.0003
		(−1.01)	(1.97)	(0.00)
Constant		0.1625***	0.0738	0.0577
		(2.91)	(1.31)	(1.10)
Observations		2,172	1,680	2,624
AR(1) test		−4.87***	−4.75***	−5.73***
AR(2) test		1.68*	−0.08	0.40
AR(3) test		−1.21	–	–
Hansen test (*df*)		118.05(114)	188.04(168)	166.42(168)

Note: The dependent variable is *firm investment*, measured by capital expenditures less depreciation, all divided by lagged net property, plant and equipment. *Leverage* is measured by total debt divided by the market value of equity plus total liabilities. *Debt maturity* is measured by long-term debt that matures after 1 year divided by total debt. C*ash holdings* are measured by the ratio of cash and short-term investments to total assets. *Growth opportunities* are measured by market value of equity plus book value of total liabilities, all divided by total assets. *Cash flow* is measured by EBITDA divided by total assets. *t*-Statistics are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively. AR(1), AR(2) and AR(3) tests are tests for first-order, second-order and third-order serial correlation in residuals, respectively, under the null of no serial correlation. Hansen test is the test of over-identifying restrictions under the null of valid instruments.

equation in all countries is rejected, meaning that those results may suffer from the over identification problem and should be interpreted with caution.

The results show that firms in all countries have target levels for leverage, debt maturity and cash holdings as the coefficients on the lagged dependent variables are statistically at the 1% level. For Thai firms, as the magnitude of the coefficient on the lagged leverage variable that reflects the adjustment cost ranges between 0.5903–0.6002, the estimated speed of adjustment towards target leverage is 40%. This means that Thai firms can make full adjustment towards their target leverage in 2.5 years (1/0.40). However, Indonesian and Singaporean firm have the higher estimated speeds of adjustment towards target leverage (47 and 54% in the three-equation systems, respectively).

In the leverage equation, the results show that when cash holdings are added as an endogenous variable in the three-equation system, the magnitudes of the coefficients slightly change, but their significance levels and signs remain the same in all countries, except for tangibility that loses its significance. However, when addressing the endogeneity among leverage, debt maturity and cash holdings, the sign of coefficient on debt maturity in both the two-equation and three-equation systems (negative sign) reverses, compared to that in the single equation (positive sign). The negative relationship between leverage and debt maturity (the proportion of long-term debt) suggests that debt maturity is used as a substitute for leverage to control the underinvestment problem. This is consistent with Billett et al. (2007) and with Myers' (1977) underinvestment hypothesis that firms lower leverage or

shorten debt maturity to reduce the underinvestment incentive. Nevertheless, there is no statistically negative relationship between leverage and debt maturity in Singaporean firms.

The coefficients on cash holding and growth opportunities are still significant at the 1% level and have negative signs in all countries, same as the single-equation results. These findings are similar to the results of existing studies on cash holdings (Brick & Liao, 2016) and growth opportunities (Barclay et al., 2003; Billett et al., 2007; Dang, 2011; Elyasiani et al., 2002; Johnson, 2003; Li et al., 2020). However, in contrast to the single-equation result, the coefficient on the interaction term between growth opportunities and debt maturity (the proportion of long-term debt) in all countries exhibits the positive sign. This finding is in line with Billett et al. (2007). The significant positive coefficient on the interaction term contradicts the prediction of the underinvestment hypothesis that the coefficient on the interaction term is expected to be negative, as discussed earlier. The significant positive coefficient on the interaction however implies that high-growth firms in all countries may also face liquidity risk because the effect of debt maturity on leverage can turn from negative to positive when growth opportunities increase (Thailand: $\partial LEV/\partial MAT = -0.1131 + 0.0749GTH$, Indonesia: $\partial LEV/\partial MAT = -0.1286 + 0.0602GTH$ and Singapore: $\partial LEV/\partial MAT = +0.0506GTH$). This supports liquidity risk theory as high-growth firms not only shorten debt maturity to reduce the underinvestment incentive, but also decrease leverage to reduce liquidity risk. The sign and significance of the coefficients on the other control variables are generally consistent with the single-equation results.

As for the debt maturity equation, when adding cash holdings as an endogenous variable in the three-equation system, the results are generally consistent with those in the two-equation system in all countries. Furthermore, when addressing the endogeneity problem, the results from two-equation and three-equation systems are similar to those in the FE (within) regression. Consistent with Johnson (2003) and Billett et al. (2007), the debt maturity equation appears less well behaved than the leverage equation. Leverage is not statistically significant in all countries. This insignificant impact of leverage opposes our postulate that leverage is a key determinant of debt maturity. However, Antoniou, Guney, and Paudyal (2006) find that leverage is statistically insignificant for French and German firms in their dynamic debt maturity model estimated by the two-step system GMM. Similarly, Pour and Khansalar (2015) also report this insignificance of leverage for a pooled sample of firms in 24 OECD countries in their dynamic debt maturity model estimated by the two-step system GMM.

The estimates of cash holdings in all countries are either insignificant or weakly significant. The coefficient on growth opportunities is insignificant in Thai and Indonesian firms, while it is positively significant in Singaporean firms. The insignificant effect of growth opportunities on debt maturity is in line with Antoniou et al. (2006), Terra (2009) and Dang (2011). The insignificant coefficient on the interaction term is also in line with Dang (2011). As for the other variables, the results are in line with the single-equation analysis.

The results for the cash holdings equation show that after accounting for the endogeneity problem, debt maturity loses its significance while a significant and negative relationship between leverage and cash holdings still holds in all countries. The significance and sign of the coefficients on leverage and debt maturity are consistent with those in the leverage and debt maturity equations in the single equation system. The negative relationship indicates that firms with high leverage may use borrowings as a substitute for cash holdings. The finding is in line with Ozkan and Ozkan (2004), and Brick and Liao (2016). This is also consistent with the pecking order theory, which states that firms exhaust their internal cash prior to opting for debt followed by equity funding. Hence in a high growth environment with many positive NPV projects firms would be likely to exhaust their cash reserves and raise more leverage. The insignificant coefficient on debt maturity can be interpreted as debt maturity not being important to firms' policy on cash holdings. This finding is also reported by Ferreira and Vilela (2004), and it is consistent with Al-Najjar and Belghitar (2011) and Kim, Seo, and Sohn (2011), where they find that the coefficient on growth opportunities is insignificant. This does not support the views that firms with high growth opportunities accumulate cash to avoid passing up investment opportunities or expensive external funding or to reduce their financial distress costs. The results for the other variables are consistent with the single-equation results.

The overall findings from the analysis of the dynamic models show that the sign and significance of the coefficients on leverage, debt maturity, cash holdings and growth opportunities may be inconsistent with those reported in the single-equation analysis. This inconsistency highlights the importance of accounting for the joint determination of leverage, debt maturity and cash holdings when assessing the relationships among these financial policy variables and firm characteristics.

4.2.5 | Effect of growth opportunities and corporate financial policy on firm investment

Table 8 is the result of the firm investment, leverage, debt maturity, cash holdings. The two interaction terms

(growth opportunities*debt maturity, and growth opportunities*leverage) are treated as endogenous variables. In the case of Thai firms, the AR(2) test is rejected at the 10% level. This means that there is serial correlation in the error term in the level equations and the second lagged level of the endogenous variables cannot be used as an instrument in the regression of Thai firms. Therefore, the third and fourth lags are used as instruments. The Hansen test of over-identifying restrictions for the leverage equation is not rejected, meaning that there is no the over identification problem.

In all countries, the lagged investment is positive and significant at the 1% level. This supports the view that future investments can determine the past investments. However, the results for the other variables are mixed. The results for Thai firms are broadly consistent with the previous empirical findings (Aivazian, Ge, & Qiu, 2005a, 2005b and Lang, Ofek, & Stulz, 1996), except for lagged growth opportunities. The coefficients on lagged leverage and lagged debt maturity are negative and significant at the 1% level. These two results support Myers' (1977) underinvestment hypothesis that firms lower leverage or shorten debt maturity to reduce the underinvestment incentive. The insignificant coefficient on lagged cash holdings is consistent with the result in the cash holding equation, which suggests that firms with high growth opportunities may not accumulate cash to avoid passing up investment opportunities. Although the negative impact of lagged growth opportunities contradict the view that firms with high growth opportunities should have high investments, this finding is in line with the argument that firms with high growth opportunities may face the underinvestment problem.

In the case of Indonesia, the coefficients on lagged leverage, lagged debt maturity and lagged growth opportunities are negative but insignificant while the coefficients on lagged cash holdings and lagged cash flow are significantly positive. This means that leverage, debt maturity and growth opportunities do not affect the investment decision in Indonesian firms. However, cash policy is important to the investment decision as the coefficients on cash holdings and cash flow are significantly positive as expected. The insignificant effects of the two interaction terms are in line with the results for leverage, debt maturity and growth opportunities.

As for Singapore, the results show that leverage affects the investment decision in Singaporean firms ($\partial INV_{t-1}/\partial LEV_{t-1} = -0.3703 + 0.2559GTH_{t-1}$). The result supports the underinvestment hypothesis that firms lower leverage to reduce the underinvestment incentive. Moreover, the indirect positive impact of growth opportunities in the interaction term is consistent with the view that growth opportunities induce more investments. However, cash policy does not appear to be significant to the investment decision as the coefficients on cash holdings and cash flow are insignificant.

4.2.6 | Robustness tests

Additional robustness tests of the empirical findings in this study are conducted by using alternative measures of cash holdings. In the above empirical analysis, cash holdings are measured by the ratio of cash and short-term investments to total assets. This measure is the traditional measure of cash holdings that is widely used in literature. In the robustness tests, the ratio of cash and short-term investments to net sales are employed. Tables A2 and A3 in the appendix, the ratio of cash and short-term investments to net sales is used to re-estimate the equations. The results show that the estimates of the relationships among growth opportunities, leverage, debt maturity, cash holdings and firm investment are qualitatively similar to those obtained from the traditional measure, suggesting that the estimated relationships are robust to the choice of a cash holdings measure.

5 | CONCLUSION

This study investigates the simultaneous relationships among leverage, debt maturity and cash holdings and also explores how these jointly determined financial policy choices influence firms' investment activities ex-post in three major AEC countries (Thailand, Indonesia and Singapore) during the period from 2005 to 2014 using the two-step system GMM estimator. Unlike previous studies ours is the first to examine the simultaneous relationships between firms leverage, debt maturity, cash holdings and Investment in high growth environments. In order to examine the potential interdependencies among leverage, debt maturity and cash holdings, three types of models are employed: a single-equation model that does not consider the endogeneity among leverage, debt maturity and cash holdings; a two-equation model that considers the endogeneity between leverage and debt maturity; and a three-equation model that considers the endogeneity among leverage, debt maturity and cash holdings.

The empirical results support several contributions. First, the results highlight the importance of considering the simultaneity of leverage, debt maturity and cash holdings, suggesting that future research should not ignore this endogeneity bias as it may lead to flawed conclusions. The overall findings from the analysis of the two-equation and three-equation models show that the

coefficients on leverage, debt maturity, cash holdings and growth opportunities may be inconsistent with those reported in the single-equation model.[6]

Second, we find support for both the underinvestment hypothesis and liquidity risk theory. High-growth firms not only shorten debt maturity to reduce the liquidity risk, but also decrease leverage to mitigate the underinvestment incentive. Third, we find that cash holdings significantly affect the decision on leverage in these countries. This implies that firms value financial flexibility in high growth environments. However, there is no support for the impact of cash holdings on debt maturity. Finally, there is evidence that debt policy and growth opportunities affect firms' investment decision in Thailand and Singapore. However, cash policy is more important in Indonesia.

Our findings have implications to capital market participants and regulatory policy makers. From an investor standpoint in the fund allocation decision our results aid towards the formulation of effective benchmarks that can assist in identifying abnormal return opportunities. Furthermore, from a regulatory standpoint, as our work sheds insight on the dynamics of how leverage, debt maturity and cash holdings simultaneously effect each other and the firm's investment policy our findings can assist towards the better understanding of the economy wide systematic risks at a macro level and hence shape regulatory policy aimed at reducing the macroeconomic risks in these high growth environments.

Our work also opens up few new and fruitful research avenues. It would be interesting to study the simultaneous effect of a firms leverage, debt maturity, cash holdings and investments on its financial flexibility as surveys of Chief Financial Officers show that financial flexibility is the dominant consideration when firms choose their corporate capital structures (see Brounen, De Jong, & Koedijk, 2004; Graham & Harvey, 2001). In the same vein, a study of simultaneous effects of a firm's leverage, debt maturity, cash holdings and investments on its dividend policy in high growth environments can shed important insights to investors. Furthermore, at a more local level an investigation as to why debt policy and growth opportunities affect firms' the investment decision in Thailand and Singapore whilst the cash policy is more important in Indonesia could shed insight into the structural differences between the nations that could have important policy level implications.

ENDNOTES

[1] For instance, Titman and Wessels (1988), Rajan and Zingales (1995) and Frank and Goyal (2009) investigate the determinants of capital structure. Barclay and Smith (1995) and Stohs and Mauer (1996) examine the determinants of debt maturity structure, while Kim, Mauer, and Sherman (1998) and Opler, Pinkowitza, and Stulz (1999) explore the determinants of corporate cash holdings.

[2] Expect data policy: The data that support the findings of this study are openly available in Datastream and Worldscope databases and are available on request by the authors.

[3] Market frictions, such as transaction and adjustment costs, can hinder firms from instantaneously adjusting their leverage, debt maturity and cash holdings towards their targets following new circumstances, leading to delays in the adjustment process.

[4] Johnson (2003) and Dang (2011) report the mean (median) leverage of 0.21 (0.18) and 0.228 (0.189), respectively.

[5] We have conducted a variance inflation test (VIF) on all variables in our equations and find that the all VIF scores are below 7, well below the established threshold of 10. VIF is essentially $1/(1\text{-}r_i^2)$ with r_i^2 the determination coefficient of the prediction of all other variables for the Ith variable; diagonal elements of R^{-1}, with R^{-1} the inverse of the correlation matrix (VIF = 1 if orthogonal); values >10 ($r_i^2 > 0.9$) indicates variance over 10 times as large as case of orthogonal predictors. See Seiler (2004).

[6] However, the relationship between leverage and debt maturity still hold after considering the endogeneity among leverage, debt maturity and cash holding.

DATA AVAILABILITY STATEMENT

I confirm that all data used in the study are publicly accessible and can be made available on request.

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APPENDIX A.

TABLE A1 Variable definitions

Variable	Definition
Panel A: Leverage equation	
Leverage	Total debt divided by the market value of equity plus total liabilities
Growth opportunities (Tobin's Q)	Market value of equity plus book value of total liabilities, all divided by total assets
Tangibility	Ratio of net property, plant and equipment to total assets
Profitability	Ratio of operating income to total assets
Non-debt tax shields	Ratio of depreciation and amortisation to total assets
Size	Natural logarithm of total assets in 2006 price
Panel B: Debt maturity equation	
Debt maturity	Long-term debt that matures after 1 year divided by total debt
Growth opportunities (Tobin's Q)	Market value of equity plus book value of total liabilities, all divided by total assets
Asset maturity structure	Net property, plant and equipment divided by depreciation
Size	Natural logarithm of total assets in 2006 price
Earnings volatility	Standard deviation of EBITD over the 3 years preceding the sample year, scaled by average total assets for that period
Firm quality (abnormal earnings)	Difference between EPS in years $t + 1$ and t to share price in year t
Term structure	Difference between yields on 10Y government bonds and 3M treasury bills
Effective tax rate	Income taxes divided by pre-tax income
Panel C: Cash holdings equation	
Cash holdings	Ratio of cash and short-term investments to total assets
Growth opportunities (Tobin's Q)	Market value of equity plus book value of total liabilities, all divided by total assets
Net working capital	Net working capital net of cash holdings, all divided by total assets
Size	Natural logarithm of total assets in 2006 price
CAPEX	Capital expenditures divided by total assets
Dividend dummy	1 if a firm paid a common dividend in a given year, 0 otherwise
Net debt issuance	Long-term borrowings minus long-term debt reduction, all divided by total assets
Profitability	Ratio of operating income to total assets
Panel D: Firm investment equation	
Firm investment	Capital expenditures less depreciation, all divided by lagged net property, plant and equipment
Growth opportunities (Tobin's Q)	Market value of equity plus book value of total liabilities, all divided by total assets
Cash flow	EBITDA divided by total assets

Note: As for Singapore, term structure is the difference between the yields of 10-year government bonds and those of 1-year treasury bills since their final 3-month and 6-month treasury bills had been discontinued since 2013, and the yields of 1-year treasury bills are almost identical to those of 3-month treasury bills, as shown in Table A2.

TABLE A2 Robustness of the joint determination of leverage, debt maturity and cash holdings

	Thailand			Indonesia			Singapore		
Independent variable	**Leverage**	**Debt maturity**	**Cash holdings**	**Leverage**	**Debt maturity**	**Cash holdings**	**Leverage**	**Debt maturity**	**Cash holdings**
$Leverage_{t-1}$	0.6078***			0.5352***			0.5150***		
	(11.78)			(8.46)			(12.16)		
$Debt\ maturity_{t-1}$		0.5165***			0.7334***			0.4462***	
(Prop. long)		(10.97)			(10.93)			(12.15)	
$Cash\ holdings_{t-1}$			0.5358***			0.4893***			0.5658***
(Net sales)			(7.47)			(6.13)			(9.70)
$Leverage_t$		0.0747	−0.1528***		0.1727	−0.2893***		0.0098	−0.4142***
		(0.60)	(−2.86)		(1.01)	(−2.76)		(0.08)	(−3.75)
$Debt\ maturity_t$	−0.1043*		0.0933*	−0.1113**		0.1044**	−0.0128		0.0923
(Prop. long)	(−1.70)		(1.87)	(−2.25)		(2.32)	(−0.26)		(1.22)
$Cash\ holdings_t$	−0.0570**	0.1359**		−0.0551*	0.0647		−0.0188	0.0484*	
(Net sales)	(−2.20)	(2.38)		(−1.87)	(1.29)		(1.58)	(1.75)	
Growth $opportunities_t$	−0.0763***	0.0262	−0.0013	−0.0791***	0.0246	−0.0249*	−0.0639***	0.0353**	−0.0263
	(−4.26)	(1.54)	(−0.15)	(−4.09)	(1.14)	(−1.81)	(−4.87)	(2.25)	(−1.62)
Growth $opportunities_t$ x $debt\ maturity_t$	0.0694** (2.36)			0.0586** (2.14)			0.0315 (1.09)		
Growth $opportunities_t$ x $leverage_t$		0.1389 (0.98)			−0.1635* (−1.83)			0.0872 (1.19)	
$Tangibility_t$	0.0494			0.0578*			0.0752***		
	(1.64)			(1.73)			(2.60)		
$Profitability_t$	−0.2934***		−0.1043*	−0.3063***		−0.1000	−0.1721***		−0.1404*
	(−5.33)		(−1.92)	(−3.90)		(−1.17)	(−4.65)		(−1.87)
$Non\text{-}debt\ tax\ shields_t$	−0.4597***			0.4663*			−0.5298***		
	(−2.78)			(1.74)			(−2.60)		
$Size_t$	0.0146***	0.0328***	−0.0019	0.0191***	0.0188**	0.0139**	0.0121***	0.0441***	0.0160
	(3.89)	(4.25)	(−0.31)	(4.18)	(2.49)	(2.02)	(3.25)	(7.90)	(1.44)
Asset maturity $structure_t$		0.0004 (0.72)			0.0006*** (2.96)			0.0003** (2.16)	
$Earnings\ volatility_t$		−0.0857			0.1983			0.0847	
		(−0.57)			(1.81)			(0.93)	
$Firm\ quality_t$		−0.0271			−0.0296			0.0196	
		(−1.17)			(−1.28)			(1.35)	
$Term\ structure_t$		0.0159**			−0.0046			−0.0030	
		(2.48)			(−1.07)			(−0.53)	
Effective $tax\ rate_t$		0.0454			0.0095			−0.0073	
		(1.33)			(0.74)			(−0.48)	
Net $working\ capital_t$			−0.0801***			−0.1470***			−0.1744***
			(−3.29)			(−3.54)			(−3.02)
$CAPEX_t$			−0.2237**			−0.3081***			−0.4034***
			(−2.50)			(−3.05)			(−2.71)

TABLE A2 (Continued)

	Thailand			Indonesia			Singapore		
Independent variable	**Leverage**	**Debt maturity**	**Cash holdings**	**Leverage**	**Debt maturity**	**Cash holdings**	**Leverage**	**Debt maturity**	**Cash holdings**
Dividend dummy$_t$			−0.0179**			0.0065			−0.0205
			(−2.34)			(0.50)			(−1.26)
Net debt issuance$_t$			0.0482			0.2094***			0.1588*
			(0.67)			(2.67)			(1.75)
Observations	2,172	2,172	2,172	1,680	1,680	1,680	2,626	2,626	2,626
AR(1) test	−8.35***	−7.74***	−2.70***	−5.76***	−7.15***	−3.52***	−8.49***	−8.71***	−3.83***
AR(2) test	−0.38	0.25	1.11	−0.36	1.76*	1.25	0.70	−0.69	1.29
AR(3) test	-	-	-	-	0.29	-	-	-	-
Hansen test (*df*)	165.87*** (112)	125.11 (112)	80.84 (84)	140.21** (112)	87.46 (76)	89.24 (84)	176.63 (112)	118.35 (112)	95.77 (84)

Note: Cash holdings are measured by the ratio of cash and short-term investments to net sales. The structural equations are estimated by two-step system GMM estimator with robust standard errors. For definition of variables, see Table A1. *t*-Statistics are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively. AR(1), AR(2), AR(3) tests are tests for first-order, second-order and third-order serial correlation in residuals, respectively, under the null of no serial correlation. Hansen test is the test of over-identifying restrictions under the null of valid instruments.

TABLE A3 Robustness of determinants of firm investment

Independent variable	Predicted sign	Thailand	Indonesia	Singapore
Firm investment$_{t-1}$	+	0.2615***	0.2008***	0.1506***
		(3.82)	(4.51)	(4.05)
Leverage$_{t-1}$	−	−0.4431***	−0.1916	−0.4145***
		(−3.20)	(−1.65)	(−4.16)
Debt maturity$_{t-1}$	−	−0.2517**	−0.0540	−0.0715
(Prop. long)		(−2.38)	(−1.00)	(−0.70)
Cash holdings$_{t-1}$	+	0.0879	0.0550	−0.0158
(net sales)		(0.92)	(1.55)	(−0.67)
Growth opportunities$_{t-1}$	+	−0.0894*	0.0057	−0.0067
		(−2.88)	(0.20)	(−0.17)
Growth opportunities$_{t-1}$ x debt maturity$_{t-1}$	−	0.1814***	0.0264	0.0966
		(2.65)	(0.84)	(1.10)
Growth opportunities$_{t-1}$ x leverage$_{t-1}$	−	0.3860**	0.0723	0.2543***
		(2.40)	(0.73)	(3.12)
Cash flow$_{t-1}$	+	−0.0646	0.2950***	−0.0152
		(−0.78)	(2.08)	(−0.11)
Constant		0.1688***	0.0702	0.1042**
		(3.01)	(1.46)	(2.17)
Observations		2,172	1,680	2,624
AR(1) test		−4.69***	−4.71***	−5.72***
AR(2) test		1.53	−0.08	0.43
AR(3) test		−1.19	–	–
Hansen test (*df*)		127.05 (114)	180.54 (168)	172.85 (168)

Note: The dependent variable is *firm investment*, measured by capital expenditures less depreciation, all divided by lagged net property, plant and equipment. *Leverage* is measured by total debt divided by the market value of equity plus total liabilities. *Debt maturity* is measured by long-term debt that matures after 1 year divided by total debt. C*ash holdings* are measured by the ratio of cash and short-term investments to net sales. *Growth opportunities* are measured by market value of equity plus book value of total liabilities, all divided by total assets. *Cash flow* is measured by EBITDA divided by total assets. *t*-Statistics are in parentheses. *, ** and *** indicate significance at 10, 5 and 1% levels, respectively. AR(1), AR(2) and AR(3) tests are tests for first-order, second-order, and third-order serial correlation in residuals, respectively, under the null of no serial correlation. Hansen test is the test of over-identifying restrictions under the null of valid instruments.



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