The Impact of Intangible Assets on Capital Structure: An Empirical Data of Thai Listed Companies[†]

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Abstract

In the dynamic landscape of the capital market, the phenomenon of asymmetric information poses intriguing challenges for scholars and practitioners alike. This study delves into the intricate interplay between intangible assets and capital structure within the context of the Thai stock market. By examining a robust sample comprising 767 companies spanning eight diverse industries in Thailand during the fiscal year 2019, this research endeavors to enrich the existing discourse on capital structure determinants. Our findings underscore the pivotal role of intangible assets in shaping capital structure dynamics, echoing prior empirical evidence. Notably, the negative association between intangible assets and capital structure suggests their profound implications in optimizing financial decisions, warranting vigilant scrutiny and strategic consideration.

Keywords: Intangible asset, Capital structure, Long-term debt ratio, Thai listed company, Archival research

Introduction

At present, the Thai capital market plays a pivotal role in Thailand's modern economy. However, due to the different abilities and conditions of different market participants in obtaining information, the problem of information asymmetry appears, causing the imbalance of choice among market participants (Leary, 2010; Abebe, 2022). At the same time, in the era of knowledge economy, the proportion of intangible assets such as technology patents and intellectual property rights in enterprise assets is increasing year by year, and they occupy an increasingly important position in enterprises (Mehta & Madhani, 2008). However, it should also be noted that compared with tangible assets, some intangible assets (such as goodwill, brand, etc.) have greater uncertainty, their value is difficult to be accurately quantified, and they are more susceptible to market risks, technological changes and other factors, so there may be risks of poor collaterality and low liquidation value, resulting in more challenging valuation of intangible assets (Zambon et al., 2020). On the other hand, the rationality of capital structure is also related to the long-term development of enterprises (Gao, 2021; EFRAG, 2021; Yang et al., 2022). Therefore, in this context, this research examines the impact of intangible assets on capital structure in the Thai stock market, aiming to contribute to existing research on capital structure and its determinants.

Based on the literature review and theoretical analysis of information asymmetry, this research has reasons to believe that the valuation and realization of intangible assets have great uncertainty, their value is often difficult to quantify accurately, and the risk coefficient is higher than other assets (Barker, 2022). At the same time, managers know more about the real risks of the firm than creditors and investors (Leary, 2021). In order to reduce the risk coefficient within the enterprise, managers can choose to strategically disclose the financial situation of the enterprise, and tend to shift the actual risk to creditors or investors (Wang, 2019).

In addition, through empirical research, this study hopes to put forward favorable suggestions from strengthening the importance of intangible assets, increasing the transformation of technology research and

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development investment, adjusting financing methods, utilizing intangible assets and capital structure, so as to adjust and optimize the capital structure of listed companies in Thailand.

Literature review

In corporate finance, information asymmetry refers to the fact that corporate insiders (usually managers) have more information than external investors in terms of corporate asset value, risk status, and investment opportunities. This information asymmetry causes the market to be unable to correctly price corporate debt, and market investors are unable to correctly price the company's actual value(Halov,2006).

CésarCamisón et al. (2022) took Spanish small and medium-sized tourism enterprises as a sample to examine the impact of family control and public information on financial structure. The research results show that the importance of family reputation to intangible assets has an indirect positive impact on corporate leverage capabilities.

Ahmad (2021) and Cao (2015) used data from 280 non-financial companies listed on the Pakistan Stock Exchange from 2000 to 2018 to study the impact of information asymmetry on corporate financing decisions, and the impact of capital structure changes on the level of information asymmetry and feedback effects on the speed of recapitalization. The research results show that information asymmetry has a positive impact on the capital structure of enterprises, and information asymmetry will affect the financing decisions of enterprises. Therefore, corporate managers prefer debt financing rather than new equity financing, because information asymmetry will increase financing costs and limit access to resources.

Gao et al. (2022) explored the relationship between information asymmetry, capital structure and capital cost in various countries. The results showed that companies with higher information asymmetry tend to use more debt capital, which may be due to information asymmetry. There are different impacts on different types of capital costs. In addition, in countries with developed banking industries, the positive relationship between information asymmetry and market leverage is more obvious.

In the global capital market, the rise of intangible assets has attracted the attention and research of many scholars at home and abroad. Mehta & Madhani (2008) pointed out that intangible assets such as knowledge, skills, relationships, processes, brands or culture are crucial strategic resources in modern business society. In the industrialized countries of the world, as industries transform from manufacturing to services, driven by knowledge workers, intellectual capital has become an important asset. The government has also begun to emphasize the importance of intangible assets to economic growth and social development (Tian et al., 2016).

The vast majority of intangible assets have monopoly characteristics and excess profitability, and have strong characteristics that are difficult to imitate. This characteristic of intangible assets can bring sustained economic benefits to enterprises (Ge & Du, 2009). Intangible assets such as customer relationships, supplier relationships, employee performance, and brand loyalty determine a company's performance to a large extent and are key performance indicators of corporate profitability and future performance sustainability. They are also Potential sources of corporate competitive advantage (Lev & Gu, 2016). Intangible assets such as patented technologies and secret formulas, if properly protected, can be continuously upgraded and improved, bringing economic benefits that are difficult to achieve with other assets (Mehta & Madhani, 2008). Therefore, enterprises are encouraged to pay attention to intangible assets, and investment in intangible assets is a necessary condition for enterprises to provide value-added products and services. Investors need to understand the importance of intangible assets and the value and growth that can be achieved through them (Nichita, 2019).

Intangible assets refer to identifiable non-monetary assets held for the production or provision of goods or services, leased to other entities, or used for management purposes, including patent rights, non-patented technologies, trademark rights, copyrights, land use rights, Trademark rights, goodwill, etc. (IASB, 2024; Swatdikun 2019).

Barker et al. (2022) evaluated intangible asset accounting solutions corresponding to balance sheet recognition and compared them with current IFRS practices, arguing that asset recognition in the balance sheet must take into account the impact of income statement measurement, investment expenses can only be recognized in the balance sheet, and the expense must be recognized separately from the transaction.

Black & Zyla (2018) introduced the determination of intangible assets, initial measurement of intangible assets, amortization of intangible assets, and presentation and disclosure of financial statements. and the belief that goodwill is a special intangible asset that is generated only when one or more other entities are acquired in a business combination, this belief is defined as "an asset that represents the future economic benefits generated by other assets acquired in a business combination".

In empirical research, the disclosure of intangible asset information mainly exists before financial statements and in notes. In financial reporting, "intangible assets" include assets that do not contain tangible assets (excluding financial assets). The connotation of this definition mainly includes 2 points: 1) being under the control of the subject due to past events; 2) future economic benefits are expected to flow to the subject (Black & Zyla, 2018; Mehta & Madhani, 2008).

Clarke (2024) defines intangible assets as "non-physical, identifiable non-monetary assets". This article breaks down this definition further:

1) Identification: For an identifiable intangible asset, this means it must be separable or arise from legal/contractual rights. Separable intangible assets are items that can be separated from the entire entity, meaning they can be acquired from the entity without having to acquire the entire company. Items that can be classified as separable intangible assets are typically rights such as licenses or patents that one entity acquires from another entity.

2) Non-monetary assets: Bank accounts or long-term investments that will receive a fixed amount do not qualify as intangible assets because these are monetary assets. This means that items such as accounts receivable or loans receivable cannot be accounted for under IAS 38 even if they are not physical. Another major asset that cannot be physically acquired may be an investment in company stock. All of these are examples of assets, but they would be treated as financial assets under IFRS 9 rather than intangible assets under IAS 38.

3) No substance: Simply put, the items covered by IAS 38 are the items you cannot touch and are usually technology based. Therefore, this may include brand names, R&D-related development costs, patents, goodwill and similar items, and the company may actually only hold legal documents rather than physical objects.

Lim et al. (2020) divided intangible assets into identifiable intangible assets and goodwill (i.e., the remaining purchase price after deducting tangible assets and identifiable intangible assets), and concluded that intangible assets should not be reported in financial statements Theoretical Perspectives. The study also points out that the theoretical measurement of intangible assets does not include internally generated intangible assets, such as those resulting from a company's own R&D or brand management efforts.

Arslan (2020) pointed out in TAS-38 that intangible fixed assets are identifiable non-physical non-monetary assets. These categories include: Rights, licenses, trademarks, patents (in development), copyrights or royalties, franchise advances, quota rights such as export quotas, import quotas and production quotas, movies (produced by another business for a fee films), computer software (excluding components of tangible assets), artwork (paintings, sculptures, statues and historical artifacts) and development expenditures.

Scholars also have different measurement methods for intangible assets. The valuation of identifiable intangible assets under different accounting practices concluded that there is no actual evidence to support current valuations that differentiate between acquired, internally generated and value-added identifiable intangible assets (Su & Wells, 2015). There are also scholars who use the intangible assets disclosed in financial statements to define and measure intangible assets (Xie & Zhang, 2023). In recent years, the market value of a company has been much higher than its book value. This difference is also known as the stock of intangible assets or intellectual capital. Intellectual capital is considered the sum of intangible assets not recognized in traditional financial statements (Castilla-Polo and Gallardo-Vázquez, 2016).

The importance of capital structure is also self-evident. Research on capital structure by many scholars has shown that by changing the composition and proportional relationship of corporate capital value, it can help companies minimize capital costs, maximize corporate value, and help corporate

shareholders obtain better results, more returns (Abeywardhana, 2017). Over the years, scholars have continuously improved capital structure theory and verified it through continuous empirical research.

Research points out that the financing methods used by enterprises have a great impact on changes in capital structure. According to the Myers-Majluf model, when there is information asymmetry between external investors and corporate managers in terms of corporate asset status and investment opportunities, corporate financing choices will be different. When a company's earnings are insufficient, companies tend to give priority to financing through debt (debt that has nothing to do with information asymmetry) rather than financing through company ownership transfer (Myers & Majluf, 1984; Wu, 2021).

In empirical studies on the ownership structure of East Asian listed companies and French listed companies, when the company's major shareholders hold a smaller proportion of cash flow rights, the company's shareholders tend to choose to use the capital structure (i.e., debt financing) because the increase in debt will not Dilute shareholders' equity. Conversely, shareholders will use the capital structure if they believe that debt will increase the risk of bankruptcy. Then shareholders tend to reduce the company's debt level and reduce debt financing (Claessens et al., 2002; Bruslerie & Latrous, 2007).

Some studies have also pointed out that a company's capital structure is not only related to the company itself, but also to external factors. The larger the company, the stronger its debt capacity, the higher the ratio of debt to assets, the more tangible assets that can be used as collateral, the stronger the company's credit financing capacity, and the easier it is to obtain more loan opportunities, which is positively related to the capital structure (Myers, 1984; Oliveira et al., 2020; Sun et al., 2017).

Modigliani & Miller (1958) gives a broad definition of capital structure, that is, capital structure refers to the ratio of a company's debt to equity. In essence, the study of capital structure is the study of proportions, about the relationship between corporate debt and equity. Therefore, capital structure can also be understood as the debt ratio, that is, the leverage ratio, which refers to the proportion of debt capital in various types of corporate capital proportion.

Capital structure is generally measured by a ratio, the capital structure ratio. Capital structure ratio is an important indicator to measure a company's financial status (Luigi & Sorin, 2009). It reflects the interrelationship between corporate debt, owner's equity and assets, as well as the company's financial risk and long-term solvency (Thippayana, 2014).

Two common capital structure ratios are as follows:

1) Debt ratio, which is the percentage of total debt divided by total shareholders' equity, is used to measure the company's financial structure and expresses the relative relationship between creditors' equity and shareholders' equity.

$$\text{Debt ratio} = \text{Debt/Equity} \tag{1}$$

2) Long-term debt ratio, which is the percentage of long-term debt divided by total shareholders' equity, is used to measure the company's long-term financial structure and expresses the relative relationship between long-term creditors' equity and shareholders' equity.

$$\text{Long-term debt ratio} = \text{Long-term debt/Equity} \tag{2}$$

Regarding the impact of intangible assets on capital structure, many scholars have not formed a unified view.

Jonassen & Cornéer (2021) studied the impact of intangible assets on the capital structure of 1065 different companies in 9 different industries in Sweden from 2000 to 2020 and found that intangible assets support debt guarantees for all leverage proxy indicators. The study also found that the relationship between intangible assets and leverage is inconsistent across industries. In some industries, intangible assets are considered to have a greater impact on capital structure decisions than in others. The strongest results are found in the technology and healthcare industries, which have the largest share of intangible assets and are statistically significant, with intangible assets being positively related to leverage. Thus, the results are clear

for firms active in industries with the highest levels of innovation complexity, suggesting that industries with high levels of innovation are more likely to exploit intangible assets.

Ruth and Nyvoll (2019) took 808 IT services listed companies around the world as a sample and used panel data regression analysis to explore the impact of increasingly important factors such as R&D intensity, intangible assets and macroeconomic factors on the capital structure of the IT services industry. The findings indicate that IT services firms tend to have lower leverage than other industrial firms in G7 countries and that standard determinants of capital structure have the same impact on leverage as previous research has shown. The study also found that intangible assets are positively related to leverage, liabilities and equity.

Lim et al. (2020) based on the fair value of identifiable intangible assets of all U.S.-listed target companies acquired by U.S.-listed acquirers from 2002 to 2014, examined the tangible and intangible asset valuations of these companies compared with the pre-acquisition target companies regarding the relationship between financial leverage, it was found that companies with higher tangible assets have higher average financial leverage. There is a positive relationship between financial leverage and identifiable intangible assets. Intangible assets are identifiable and individually valuable in normal transactions, which means they should have considerable value in the hands of different owners, and valuable intangible assets tend to generate large amounts of cash flow when lenders issue loans. The borrower's ability to generate cash flow is often the primary consideration. Therefore, the study believes that intangible assets can support debt not only through their collateral but also through their ability to generate cash flow.

Horsch et al. (2021) used patent invalidation cases from the U.S. Court of Appeals for the Federal Circuit to study intangible capital and leverage, showing that intangible capital has a causal supporting effect on leverage. This partial average effect is more pronounced among firms that use patents as collateral for loans, less creditworthy firms, and smaller firms.

Peng et al. (2021) took Taiwan's listed companies from 2013 to 2019 as the research object, mainly exploring whether intangible assets can be used as guarantees, financing and mortgage tools for the company, and whether intangible assets will affect the composition of the company's capital structure. Empirical results show that there is a significant positive correlation between intangible assets and corporate capital structure, which indicates that intangible assets can be used as a financing tool and become an additional option when companies face financial difficulties. Therefore, in the era of knowledge economy, intangible assets, like tangible assets, can be used as collateral for loans.

Lim et al. (2020) believe that it is implausible that intangible assets have a negative impact on leverage, because any valuable asset should improve the company's debt capacity at least to some extent, but also believe that this positive impact may be very Small or even insignificant, almost indistinguishable from zero.

Larkin (2013) pointed out that consumers' positive perception of corporate products and brands can improve a company's credit rating and reduce the volatility of its future cash flows, thereby reducing the company's financial and operating risks and giving the company more incentive to maintain a relatively high level of profitability. High leverage and low cash holdings.

Ma (2021) believes that when banks decide to grant loans, they mainly consider the company's repayment ability and interest payment ability, rather than the proportion of various asset types of the company. Banks are more inclined to analyze the company's expected cash flow capabilities, which can increase the debt support capacity of intangible assets.

Tahat et al. (2018) took British non-financial companies as a sample and found that companies with high intangible resource intensity have more sustainable income streams. Intangible assets (R&D and goodwill) have the ability to create wealth in the future and are significantly related to debt levels.

In general, due to different research perspectives and research methods, researchers have reached different conclusions on the impact of intangible assets on corporate debt levels (Veljkovic et al., 2021). The first view is that intangible assets may have nothing to do with leverage. A second, counterargument is that intangible assets may also provide important material support for leverage, especially given the rising share of intangible assets in the value of many companies.

Based on the above literature review and theoretical analysis, under the realistic condition of insufficient information, the internal managers of enterprises have more information than the external investors in terms of enterprise asset value and investment risk. Although intangible assets, as a growth potential, enhance the company's competitive advantage and enterprise value in the era of knowledge economy, the characteristics of some intangible assets compared with tangible assets are as following: They are more vulnerable to market turbulence, technological change and other factors, with greater uncertainty and greater risk than tangible assets. Therefore, this thesis believes that enterprise managers are more inclined to creditor's debt financing when using intangible assets for financing, because in this way, the risk of intangible assets can be transferred to creditors to reduce the internal risk of enterprises. The following hypothesis is proposed:
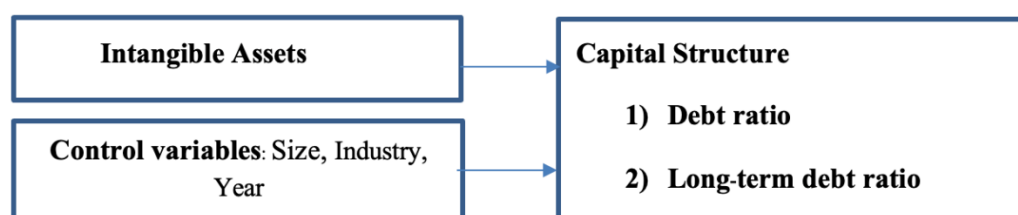

Figure 1 Conceptual framework.

Figure 1 illustrates a notable revelation: The substantial positive impact of intangible assets on enterprise capital structure. This finding underscores the importance of intangible assets in shaping the capital structure of businesses. By showcasing this relationship, the figure highlights the critical role that intangible assets play in influencing corporate financial decisions. The depicted positive effect suggests that companies with higher intangible asset holdings tend to exhibit distinct capital structures, reflecting the intrinsic value and impact of intangible assets on organizational financial dynamics.

Methodology

This study draws on domestic and foreign theories and literature on intangible assets and capital structure, analyzes and summarizes the research results of others, and adds the view of this study according to the basic ideas of empirical research to form the preliminary hypothesis of this study. Based on the above assumptions, descriptive statistics and quantitative analysis of relevant variables and data of listed companies in Thailand are carried out.

First, relevant variables and data are identified through archival research, and descriptive statistics are performed on these data and variables. Then, based on these secondary data, through correlation analysis, multiple linear regression analysis and other methods, the intangible assets and capital structure of listed companies in Thailand and their mutual relations are studied and designed. Finally, a conclusion is drawn to verify the relevant hypothesis. According to the above criteria, this research finally constructs the balanced panel data of 767 listed Thai companies in 2019. Refinitiv Eikon is the financial markets database owned by the London Stock Exchange Group and used for this study. Considering the research direction, this study focuses on the debt aspect of enterprises, so the debt-equity ratio is analyzed as an indicator to measure the capital structure. The research model is as follows:

$$CS = \alpha + \beta_1 IA_i + \beta_2 ctrl_i + \varepsilon \tag{3}$$

where   CS refers to capital structure
         IA refers to intangible asset
         Ctrl refers to control variables which are tangible asset, size, industry, year
         α refers to constant
         β refers to co-efficient
         ε refers to error
         i refers to given firm

From the research model, it can be seen that the variables studied in this research are:

1) Intangible assets refer to the proportion of intangible assets and total assets in the balance sheet of a listed company. Since the listed companies in Thailand selected in this study come from different industries, the characteristics of the samples are quite different. If individuals such as patent rights, Copyrights and other intellectual property rights, non-patented technologies and concessions are used as the indicators of intangible assets, it will be difficult to directly compare the overall level of intangible assets. Thus, this research tends to choose the ratio of intangible assets to total assets as the measurement index of intangible assets. The specific formula is as follows:

Intangible assets ratio = Net intangible assets/Total assets   (4)

2) Capital structure refers to the ratio of debt to equity. At present, the capital structure indicators commonly used in research include total debt ratio, short-term debt ratio and long-term debt ratio. According to international accounting standards, the difference between short-term and long-term liabilities is whether the maturity is more than 1 year. In fact, the long-term and short-term debt ratio is not only the difference in time period, generally long-term debt is the active financing for the future development of the enterprise during the strategic planning, while short-term debt is more passive, and in many cases it is the financing that the enterprise is forced to accept due to the break of the capital chain in the operation process. The choice of long-term and short-term financing reflects the business decisions of enterprises to a certain extent (Li et al., 2013). The sample enterprises selected in this thesis cannot measure their capital structure with short-term or long-term debt ratio due to differences in corporate strategy, development direction and other aspects. In summary, the ratio of debt to equity is chosen as the measurement index of capital structure in this thesis. The specific formula is as follows:

Debt ratio = Debt/Equity   (5)

Long-term debt ratio = Long-term debt/Equity   (6)

3) Company size refers to the size of a company measured by its total assets. This thesis comprehensively considers the social production contribution degree and the demand degree, and chooses total assets as the index representing the scale of enterprises. In the process of financing, the size of a company is an important factor in the decision-making of the capital supplier. The more obvious the scale effect of a listed company, the lower its operating risk and expected bankruptcy cost, and the easier it is to gain the favor of investors, thus affecting the capital structure of the company. The specific formula is as follows:

Company size = Natural logarithm of total ending assets   (7)

Results and discussion

This section conducts correlation and regression analysis between variables and introduce the research results. It provides supplementary evidence for the background of continuous development of intangible assets in financial statements.

First, descriptive statistics are conducted on intangible assets and capital structure of listed companies in Thailand respectively by industry. The results are as follows:

Table 1 Descriptive analysis of intangible asset by industry.

Industry	Mean	Standard deviation	Maximum	Minimum	Rank
1) Agro & Food industry	0.022	0.077	0.574	0.000	5
2) Consumer products	0.018	0.036	0.164	0.000	6
3) Financials	0.006	0.010	0.066	0.000	8
4) Industrials	0.014	0.024	0.113	0.000	7
5) Property & construction	0.023	0.101	0.895	0.000	4
6) Resources	0.080	0.501	4.885	0.000	1
7) Services	0.044	0.100	0.633	0.000	2
8) Technology	0.037	0.070	0.375	0.000	3
Overall	0.033	0.191	4.885	0.000	-

       Table 1 provides a descriptive analysis of intangible assets by industry. The index of intangible assets is the value of intangible assets/total value of assets. On average, Thai listed companies reported intangible asset values of 0.033, with standard deviation at 0.191. The maximum is 4.885 while the minimum report is at 0.000. Across the 8 industries, resource companies reported intangible asset values of 0.080 with a standard deviation at 0.501. The maximum is 4.885 The minimum report is at 0.000. This was followed by the services industry reporting intangible asset values of 0.044 with a standard deviation at 0.100. The maximum is 0.633 The minimum report is at 0.000. Notably, the technology industry reported intangible asset values of 0.037, with a standard deviation at 0.070. The maximum is 0.375. The minimum report is at 0.000. The lowest intangible asset report was in the financial industry, which reported an intangible asset value of 0.006, with a standard deviation at 0.010. Maximum is 0.066. Minimum report at 0.000.

Table 2 Descriptive analysis of debt ratio as capital structure by industry.

Industry	Mean	Standard deviation	Maximum	Minimum	Rank
1) Agro & food industry	1.036	2.837	21.610	0.000	3
2) Consumer products	0.692	1.467	12.094	0.000	7
3) Financials	1.088	1.405	6.500	0.000	2
4) Industrials	0.592	0.866	6.233	0.000	8
5) Property & construction	1.097	1.556	11.658	0.000	1
6) Resources	0.983	1.159	8.365	0.000	4
7) Services	0.810	1.684	12.638	0.000	6
8) Technology	0.820	1.062178	4.918759	0	5
Overall	0.885	1.559	21.610	0.000	-

    Table 2 provides a descriptive analysis of debt ratios by industry. On average, listed Thai companies reported a debt ratio of 0.885 with a standard deviation at 1.559. The maximum is 21.610 and the minimum report at 0.000. Among the 8 industries, the property & construction industry reported a debt ratio of 1.097 with a standard deviation at 1.556. Maximum is 11.658 Minimum report at 0.000. This was followed by a financial reporting debt ratio of 1.088 with a standard deviation at 1.405. The maximum is 6.500 and the minimum report is at 0.000. Third, the agro & food industry reported a debt ratio of 1.036 with a standard deviation at 2.837. The maximum is 21.610 and the minimum report is at 0.000. The lowest debt ratio was in industry, which reported a debt ratio of 0.592 with a standard deviation at 0.866. The maximum is 6.233 and the minimum report at 0.000.

Table 3 Descriptive analysis of long-term debt as capital structure by industry.

Industry	Mean	Standard deviation	Maximum	Minimum	Rank
1) Agro & food industry	41.906	100.551	682.500	0.000	5
2) Consumer products	35.039	76.261	490.877	0.000	6
3) Financials	64.047	70.706	263.593	0.000	1
4) Industrials	19.806	29.158	132.988	0.000	8
5) Property & construction	45.855	54.867	229.315	0.000	3
6) Resources	62.524	86.018	587.739	0.000	2
7) Services	44.538	119.247	1,047.414	0.000	4
8) Technology	24.426	40.449	221.862	0.000	7
Overall	42.756	82.012	1,047.414	0.000	-

    Table 3 provides a descriptive analysis of long-term debt ratios by industry. On average, Thai listed companies reported a long-term debt ratio of 42.756 with a standard deviation at 82.012. The maximum is 1,047.414 and the minimum report is at 0.000. Among the 8 industries, the financials industry reported a long-term debt ratio of 64.047 with a standard deviation at 70.706. The maximum is 263.593 and the minimum report is at 0.000. This was followed by the resources industry report's long-term debt ratio of 62.524 with a standard deviation at 86.018. The maximum is 587.739 The minimum report is at 0.000. Third, property & construction reported a long-term debt ratio of 45.855 with a standard deviation at 54.867. The maximum is 229.315 and the minimum report is at 0.000. The lowest long-term debt ratio is in industry, which has a long-term debt ratio of 19.806 with a standard deviation at 29.158. The maximum is 132.988 and the minimum report is at 0.000.

Table 4 Descriptive analysis of the variables.

variable	Mean	Standard deviation	Maximum	Minimum
Intangible asset	0.033	0.191	4.885	0.000
Debt ratio	0.885	1.559	21.610	0.000
Long-term Debt ratio	42.756	82.012	1047.414	0.000
Size	23.322	1.753	30.061	19.180

    Table 4 provides a descriptive analysis of variables. On average, Thai listed companies reported intangible asset values of 0.033, with standard deviation at 0.191. Maximum is 4.885, minimum report at40.00. Debt ratio was 0.885 with standard deviation at 1.559. The maximum is 21.610 The minimum report is at 0.000. On average, Thai listed companies reported a long-term debt ratio of 42.756, with standard deviation at 82.012, maximum is 1047.414 and minimum reported at 0.000. **Table 4** provides a

descriptive analysis of size. The mean value of size was 23.322 with standard deviation at 1.753. The maximum is 30.061 The minimum report is at 19.180.

Table 5 Correlation analysis.

	Intangible asset/ Total assets	Tangible asset/ Total assets	Size	Debt/Equity	Long term Debt/Equity
Intangible asset/Total assets	1.000				
Tangible asset/Total assets	−0.856	1.000			
Size	0.033	0.394	1.000		
Debt/Equity	0.033	−0.003	0.146	1.000	
Long term debt/Equity	0.077	−0.039	0.228	0.740	1.000

    Table 5 provides correlation analysis among independent, dependent and control variables of Thai listed companies. It indicates that intangible assets and company size have positive impact on debt ratio, while tangible asset have negative impact on debt ratio. It also reveals that intangible assets and company size have positive impact on long term debt ratio, while tangible asset has negative impact on long-term debt ratio. The correlation coefficient between intangible assets and debt ratio is 0.033, indicating that companies with more intangible assets have higher debt ratios. Likewise. The correlation coefficient between intangible assets and long-term debt ratio is 0.077, indicating that companies with more intangible assets have higher long-term debt ratios. In addition, in the comparison of correlation coefficients, the correlation coefficient of company size is the highest, indicating that company size has a very important impact on the company's debt ratio and long-term debt ratio. Tangible assets are negatively related to the debt ratio and long-term debt ratio with coefficients of −0.003 and −0.039, reflecting that companies with more tangible assets have less debt and long-term demand.

Table 6 Regression analysis.

	Coefficients	Standard Error	t Stat	*p*-value
Debt ratio				
Intercept	0.197	0.500	0.394	0.693
IA/Total assets	−2.659	0.903	−2.943	0.003***
TA/Total assets	−2.874	0.850	−3.382	0.001***
Industry	0.003	0.027	0.099	0.921
LnSize	0.160	0.031	5.096	0.000***
R Square = 0.036, Adjusted R-Square 0.031, n = 767, F= 0.000				
Long-term debt ratio				
Intercept	−6.891	23.816	−0.289	0.772
IA/Total assets	−248.18	43.007	−5.771	0.000***
TA/Total assets	−274.096	40.45	−6.776	0.000***
Industry	1.466	1.267	1.157	0.248
LnSize	14.005	1.497	9.354	0.000***
R Square = 0.111, Adjusted R-Square = 0.106, n = 767, F = 0.000				

***, * denotes significant level at 1 %, 10 % respectively

    Table 6 shows the R-square value of the model is 0.036 which means that intangible assets, tangible assets, formula size and industry can explain the reason for the change of the debt ratio of 0.036. The

regression coefficient of intangible asset is –2.659 (t = –2.943, p = 0.003 < 0.05), which means that the intangible asset of the company has a significant negative impact on the debt ratio. The regression coefficient of tangible asset is –2.874 (t = –3.382, p = 0.001 < 0.05), which means that the tangible asset of the company has a significant negative impact on the debt ratio. The regression coefficient of LnSize is 0.160 (t = 5.096, p = 0.000 < 0.05), which means that size of the company has a significant positive impact on the debt ratio.

It also reveals R-square value of the model is 0.111 which means that intangible assets, tangible assets, formula size and industry can explain the reason for the change of the long-term debt ratio of 0.111. The regression coefficient of intangible asset is –248.18 (t = –5.771, p = 0.000 < 0.05), which means that the intangible asset of the company has a significant negative impact on the long-term debt ratio. The regression coefficient of tangible asset is –274.096(t = –6.776, p = 0.000 < 0.05), which means that the tangible asset of the company has a significant negative impact on the long-term debt ratio. The regression coefficient of LnSize is 14.005 (t = 9.354, p = 0.000 < 0.05), which means that size of the company has a significant positive impact on the long-term debt ratio.

Conclusions

This study explored how intangible assets impact the capital structure of listed companies in the Thai stock market using data from 767 companies across 8 industries in Thailand in 2019. The findings indicate that intangible assets have a negative influence on the capital structure of listed companies in Thailand. This suggests that as the proportion of intangible assets within a company's asset base increases, there's a tendency for the company to use less debt in its capital structure. Its recommendations could benefit practitioners and policymakers alike. Corporate decision-makers could use this understanding to make informed financing decisions, potentially reconsidering their capital structure strategies. Additionally, investors and financial analysts should recognize the significance of intangible assets in evaluating a company's financial health and risk profile.

The study also highlights the need for further research to explore the mechanisms behind the observed relationship between intangible assets and capital structure. Future investigations could delve into how different types of intangible assets influence capital structure decisions and how contextual factors within the Thai market shape this relationship.

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