

APPROPRIATE INDEXES TO MEASURE FINANCIAL CONSTRAINTS OF VIETNAMESE FIRMS

CHỈ SỐ PHÙ HỢP ĐỂ ĐO LƯỜNG SỰ HẠN CHẾ TÀI CHÍNH CỦA CÁC DOANH NGHIỆP VIỆT NAM

Thai Thi Hong An*, Ha Le Hong Ngoc

The University of Danang - University of Economics, Vietnam

*Corresponding author: anth@due.edu.vn

(Received: February 19, 2024; Revised: July 16, 2024; Accepted: August 25, 2024)

Abstract - This paper focuses on testing the applicability of various financial constraints measurements in the context of the Vietnamese market. Using a sample of non-financial quoted firms throughout 2010-2019; our paper contributes to current corporate finance literature with a novel and simple measurement of financial shortages that is effectively applicable for Vietnamese firms, namely the Age-size-cash flow- interest coverage index (ASCIC). The index is the combination of age and size, which reflect information asymmetry; cash flow, and interest cover ratio that present repayment capacity and solvency risk respectively. The outcomes indicate that while the ASCIC index produces measurement results comparable to other indices, it utilizes a more straightforward calculation method. In light of Vietnam as a country with considerable development potential but substantial financial limitations, it is imperative to identify a financial constraint measurement index that is both simple and effective.

Key words - Investment; cash flow; financial constraints; index; Vietnam

1. Introduction

Identifying appropriate proxies of financial constraints has been an issue of debate, as financial constraints are not only the key to studying the impact of financing shortage on investment, capital structure, and risk management strategies but also relate to topics ranging from the cross-section of returns to the transmission of monetary policy [1]. As financial constraints are elusive, it is usually measured indirectly either by the level of estimated investment-cash flow sensitivities or through related variables of financial constraints, such as information asymmetric or agency costs [2]. Currently, four popular indexes often used to evaluate firms' budget limitations, including the Kaplan-Zingales index [3] (KZ hereafter), Whited-Wu index [4] (WW hereafter), Size-Age index [5] (SA hereafter), and Age-size-cash flow-leverage index [6] (ASCL hereafter). However, each of them has its own weakness that make them may not be applicable to all market samples [7]. This means that when studying with a single-country sample, it is crucial to identify the suitable metric for financial constraints.

This paper focuses on Vietnam, where the capital market is characterized by some adverse financial attributes, such as insufficient market information, loose corporate governance mechanisms, and problem of financial restrictions. This, in turn, has limited the entry into financial markets for financially constrained firms, which has been an evident phenomenon of the Vietnam

Tóm tắt - Bài báo này tập trung vào việc kiểm tra tính phù hợp của các chỉ số dùng để đo mức độ hạn chế tài chính doanh nghiệp trong bối cảnh thị trường Việt Nam. Sử dụng mẫu các công ty niêm yết giai đoạn 2010-2019; bài báo đóng góp một phép đo mới và đơn giản về tình trạng hạn chế tài chính của các công ty Việt Nam, gọi là chỉ số ASCIC. Chỉ số này là sự kết hợp của tuổi và quy mô, phản ánh sự bất đối xứng thông tin; dòng tiền và khả năng trả lãi - thể hiện khả năng trả nợ và rủi ro thanh toán. Kết quả cho thấy trong khi ASCIC đưa ra kết quả đo lường có hiệu quả tương đương với các chỉ số khác, nó được tính toán đơn giản hơn. Xét đến việc các công ty Việt Nam có nhiều tiềm năng mở rộng hoạt động kinh doanh của mình nhưng lại phải đối mặt với những hạn chế đáng kể về mặt tài chính, việc xác định một chỉ số đo lường khó khăn tài chính vừa đơn giản vừa hiệu quả là điều cần thiết.

Từ khóa - Đầu tư; dòng tiền; hạn chế tài chính; chỉ số, Việt Nam

financial system especially.

Our study contributes to existing literature in some aspects. First, in the context of Vietnamese market, comparing among common measurements of financial constraints; we document that WW and ASCL are the most appropriate ones. Second, we construct a new index called Age-size-cash flow-interest coverage (ASCIC hereafter). In particular, ASCIC is the combinations of age, size, cash flow position, and the interest coverage ability of firms. With this new metric, constrained firms are those firms that face information asymmetric problems, and have low repayment capacity and high solvency risk. This approach's main advantage is that it is based on a simple scoring system, so it is easy to calculate when being as efficient as other popular indexes. Considering Vietnam's status as a nation with substantial development potential but significant financial constraints, it is crucial to identify a financial constraint measurement index that is both simple and effective. This allows not only firm managers but also policymakers to easily evaluate the financial status of firms, enabling them to implement timely and appropriate solutions to address firm financial challenges and enhance their operational efficiency.

2. Literature review and new index development

2.1. Existing indexes of financial constraints

Empirical studies find several measurements to partition

firms into financially constrained/unconstrained groups, but there are still no approaches that everyone can agree on. The literature has provided many possibilities, including KZ, WW, SA, and ASCL index, which will be described in more detail below. There are various causes of existential debate following the relative merits of each approach, for example, the validity of empirical or theoretical assumptions that these methods rely on. Additionally, some of these approaches are based on endogenous financial selections that may not be in straightforward correlation with financial constraints. For instance, it is the fact that, while external cash rising may contribute to releasing the constraints of a firm, a high level of cash holding that serves a precautionary motive, on the other hand, may also be an indication of constrained status [5].

The KZ index is known as one of the most popular approaches in sorting firms into constrained or unconstrained groups. [8] developed this index from the version of [3]. In comparison with [3], who use a sample of manufacturing companies with positive net sales growth over 1969- 1984 period, [8] increase their findings applicability by narrowing their focus on a sample accounting for manufacturing enterprises with positive actual sales growth in the last year. It is noticeable that, by design, [8]'s approach consists of a larger number of enterprises in a constrained group than that according to the KZ classification scheme. In which, while [8] identify firms as "constrained" if they are in the top 33% of all firms each year, [3] the study concentrates only on low-dividend firms as they argue that only 15% of the firms are more likely to be budget limited. In terms of methodology, while [3] employ a logit regression to link their identifications to 5 accounting variables (i.e., Cash flow/Total assets; Tobin's Q; Long-term debt/ Total assets; Dividend/Total assets; Cash holding/Total assets) to sort firms into constrained categories, [8] depend on regression's coefficients to generate an index that is a linear combination of these five ratios. As designed, the higher the KZ index, the higher the likelihood of being constrained.

WW Index is another popular measurement generated by [4]. Different from the widely used KZ index, WW is based on firm characteristics that may present external finance constraints. Furthermore, most of the components of this index present for asset returns. By design, firms that display a high WW index will be sorted in a constrained category. In particular, those are often small, under-invest, and have low bond-ratings. In contrast, following KZ, constrained firms are large, over-invest, and have high bond-ratings [4].

SA index is constructed by [5]. In which, financial constraint is modelled as a nonlinear function of firm size and age. The relationship can be explained as follows: the nature of small firms is high business-individualistic and bankruptcy risks, which may either prevent them from obtaining an external source of finance or increase the cost of accessing external funds. Additionally, small firms might have a short operating history, which may exclude them from being able to access credit markets [7]. SA

index implies that when small firms become more mature, their financial constraints would be sharply lower. In other words, the higher the index value, the greater the firm's financial constraint status is.

Age-size-cash flow-leverage index (ASCL) of [6] can be considered as the first score-based index of budget restrictions, which is the main inspiration for us to conduct the current study. In a study of unquoted firms from 6 European countries, [6] build an index, which captures firm age, size, cash flow, and leverage. These elements were explained as the best proxy for information asymmetry (age, and size), the repayment capacity (cash flow), and the level of default risk (leverage ratio). [6] agree with [5] that age, and size are the most valid shifters of the fund supply curve. While the larger firms are favoured by financial institutions since they are less likely to face informative asymmetry issues, and have lower risk of default in comparison to small firms, the older companies have transparent credit history records that credit suppliers can base on to decide whether to provide loans or not. Apart from age and size, [6] state that cash flow could describe firms' capacity of repayment while long-term debt ratios affect banks' willingness to provide credit directly. Less indebted firms are preferred since they are less likely to be insolvent.

ASCL of a firm lies within the lowest point at 0 (i.e. lowest possibility of constraints) to the highest score of 4 (i.e. highest constraints). Firms who have the point of 0 are the old, large businesses with high availability of cash flow and high capacity to cover the debt obligations. Thus, they have the lowest ability to fall into budget constraints. The opposite scenario can be seen with firms getting 4.

2.2. New index construction

In this section, we construct a new index called ASCIC. With ASCIC, we use firm age, size, and cash flow scores since these elements have undeniable impacts on the financial situations of firms as shown by studies of [3], [4], and [6]. The index includes interest coverage ratio since it can reflect the financial sustainability of a firm. This ratio shows not only the interest rate bearing by firms and their amount of debt commitment but also their repayment capacity.

Compared to other ratios, the interest coverage ratio provides a clearer picture of a company's ability to meet its short-term financial obligations than leverage ratios, particularly in terms of understanding corporate financial constraints. It directly assesses a company's capacity to pay interest from its operating income. A higher ratio means the company has more earnings relative to its interest expenses, signaling a better ability to service its debt. It focuses on operational performance (i.e., its calculation is based on EBIT), and it provides insight into the company's core earning potential rather than its capital structure or total debt levels. Besides, it is a strong prediction of financial stress [9]. A low- interest coverage ratio indicates that a company might struggle to meet its interest payments, potentially leading to financial distress or bankruptcy. It reflects immediate financial stress more effectively than leverage ratios. A decline in this ratio indicates that a company is facing operational issues and is struggling with debt

repayment, even if leverage ratios seem manageable. In contrast, leverage ratios emphasize the amount of debt in relation to equity or assets but do not directly measure the company's ability to meet its interest obligations. They tell us how much debt the company has, but not how easily it can handle interest payments. These ratios can sometimes give a misleading picture if a company has significant amounts of debt but also substantial earnings. For example, a company might have a high debt-to-equity and a debt-to-asset ratio but still have a high interest coverage ratio, indicating that it can comfortably service its debt. Besides, leverage ratios do not provide insight into the company's operational earnings relative to its debt servicing requirements. They focus more on the balance sheet composition rather than cash flows or operational performance. In short, while leverage ratios are important for understanding a company's overall debt levels and capital structure, the interest coverage ratio provides a more direct and practical measure of a company's ability to meet its interest expenses, which is crucial for assessing financial constraints and potential distress.

Our new index is even simpler than ASCL since the calculations only involve to a given year, and all scores will be given 1 if they are smaller than the median of the industry, so they are easier to compute and use.

The validity of interest coverage ratios in reflecting firms' financial status has been demonstrated by many popular previous studies, including [3] and [4]. For example, according to [3], least constrained firms display the strongest investment sensitivity to change in cash flow. They find that firms with high ratios of interest coverage have more healthy financial positions and are less likely to be constrained.

In short, the new index is constructed as follows:

$$\text{ASCIC} = \text{Age score} + \text{Size score} + \text{Cash flow score} + \text{Interest coverage score}$$

Where:

Age score = 1 if firm age lower than industry median, and 0 otherwise;

Size score = 1 if firm size smaller than industry median, and 0 otherwise;

Cash flow score = 1 if firm cash-flow-to-assets ratio lower than industry median, and 0 otherwise;

Interest coverage score = 1 if the ratio of interest paid over total interest-bearing debts is lower than the industry median and 0 otherwise.

Similar to ASCL, our index can range from the lowest point at 0 (i.e. lowest possibility of constraints) to the highest score of 4 (i.e. highest constraints). Firms who have the point of 0 are the old, large businesses with high availability of cash flow and high capacity to cover the debt obligations. Thus, they have the lowest ability to fall into budget constraints. The opposite scenario can be seen with firms getting 4.

3. Data

Our data is provided by FiinGroup for the period from

2010 to 2019. We do not include crisis periods (i.e., the Global financial crisis (2007-2009) and COVID-19 (2020-2022)) to ensure the stability in corporation data). Information after 2022 is not available. Since in a developing market like Vietnam, data from listed firms is more reliable than that of unlisted firms, all investigated firms are publicly listed firms. We exclude financial institutions and utility firms as they have many differences in their operating, investing, and financing activities compared to the other industries. Then, based on firm-level data, we calculate five indexes as follows:

Table 1. Index summary

Index	Calculation
WW	$-0.091 * (\text{Cashflow}/\text{Total assets}) - 0.062 * (\text{Dividend dummy}) - 0.044 * \text{Natural-logarithm}(\text{Total assets}) - 0.035 * \text{Growth-in-sales} + 0.102 * \text{Industry's Growth-in-sales} + 0.021 * (\text{Long-term debts}/\text{Total assets})$ <p>Where: Dividend dummy = one if the firm pays dividend, and zero otherwise</p>
KZ	$-1.002 * (\text{Cash flow}/\text{Total assets}) - 39.368 * (\text{Dividend}/\text{Total assets}) - 1.315 * (\text{Cash holding}/\text{Total assets}) + 0.283 * \text{Tobin's Q} + 3.139 * (\text{Long-term debt}/\text{Total assets})$ <p>Where: Q is Tobin's Q = (Book value of assets - book value of equity + market value of equity)/Book value of assets</p>
SA	$\text{SA} = -0.737 * \text{Natural-logarithm}(\text{Total assets}) + 0.043 * (\text{Natural-logarithm}(\text{Total assets}))^2 - 0.040 * \text{Age}$ <p>Size dummy + Age dummy + Cash flow dummy + Long-term leverage dummy</p> <p>Where: Size dummy=1 if size is smaller than industry median, and 0 otherwise Age dummy = 1 if firm is younger than industry median, and 0 otherwise</p>
ASCL	<p>Cash flow dummy = 1 if the average value of cash flow-to-capital ratio of the previous two years is lower than the industry median, and 0 otherwise</p> <p>Long-term leverage dummy = 1 if the average value of long term-debt-to-assets ratio of the previous two years is higher than the industry median, and 0 otherwise</p>
ASCIC	$\text{Size dummy} + \text{Age dummy} + \text{Cash flow dummy} + \text{Interest coverage dummy}$ <p>Where: Size dummy=1 if firm's size is smaller than industry median, and 0 otherwise Age dummy = 1 if firm's age is smaller than industry median, and 0 otherwise Cash flow dummy = 1 if firm's cash flow lower than the industry median, and 0 otherwise Interest coverage dummy= 1 if the firm's interest coverage ratio is lower than industry median, and 0 otherwise.</p> <p>(Note: Interest coverage ratio = Earnings before interests and tax/Interest expense)</p>

The statistics summary of the five indexes is presented below:

Table 2. Statistics summary

	N	Mean	Std. Dev.	Min	Max
WW	10,510	-1.191	0.086	-1.541	-1.013
KZ	10,827	-0.622	1.593	-7.534	2.223
SA	14,439	6.183	5.142	-1.960	16.553
ASCL	19,928	1.360	0.767	0	4
ASCIC	19,928	0.764	0.934	0	4

4. Result

First, we perform a Pearson's correlation to assess the relationship across 5 indexes of financial constraints, including WW, KZ, SA, ASCL, and ASCIC, to see the association between them. As can be seen from Table 3, except for KZ-WW, there are considerable associations between pairwise splitting schemes. Since we build ASCIC to use as an alternative measure of ASCL, and they have some components in common, ASCIC and ASCL are highly associated with each other.

Table 3. The Pearson correlation coefficient across financial constraints' measurements

	WW	KZ	SA	ASCL	ASCIC
WW	1				
KZ	-0.003	1			
SA	-0.360 ^a	0.089 ^a	1		
ASCL	0.220 ^a	0.227 ^a	0.167 ^a	1	
ASCIC	0.238 ^a	0.153 ^a	0.387 ^a	0.795 ^a	1

^c p<0.05, ^b p<0.01, ^a p<0.001

The most popular components of indexes used to measure budget limitation are firm age, size, level of cash flow, debt ratios, and dividend pay-out ability. Thus, to see how well the financial constraints index reflects these elements, we run another Pearson's correlation matrix, and use the last column to highlight the suitable indexes to reflect each component.

Interestingly, although SA index is the function of firm age and size, it shows insignificant correlation with Age. ASCIC is consistent with ASCL when they give uniform signs with all 6 components, as shown in Table 4. WW, KZ, ASCL, and ASCIC are both moving opposite to firm age when older firms are supposed to be less financially constrained than the young ones. The Size of enterprises also should have a negative correlation with these indexes since large firms often face less budget limitation than

smaller firms; however, only WW, ASCL, and ASCIC give us the right predicted signs of correlation. Turning to cash flow, once again, we are looking for a negative sign because a firm with high cash flow level may be less likely to suffer financial constraints. With this perception, WW, KZ, ASCL, and ASCIC are better than SA in reflecting cash flow position.

Moving to long-term-, and total-debt-to-assets ratios, the higher these ratios are, the more financial constraints a firm is [6], implying the higher these indexes should be. Thus, a positive sign between financial constraint indices and debt proxies is expected, like what KZ, SA, ASCL, and ASCIC have shown.

The final component is the dividend pay-out ratio, which is predicted to move opposite with financial limitation. In this case, WW, KZ, ASCL, ASCIC seem to be superior to SA. In short, based on Table 4, we can first assume that, for Vietnamese firms, ASCL, ASCIC are more suitable than WW, SA and KZ in reflecting financial constraints.

It is worth emphasizing that we can group two measurement approaches for financial constraint indexes: one for WW, KZ, and SA indexes and the other for ASCL and ASCIC indexes. The first group is derived from regression models where the dependent variables are also the index components. That means this group is mainly relevant to the sample based on which the regressions are conducted. The second group, on the other hand, is constructed by combining a small set of financial indicators into a straightforward measure, often using simple scoring/ranking systems. It focuses on core financial metrics and provides a more accessible measure of financial constraints without the need for extensive regression analysis. This approach is more practical for quick assessments and can be used in a variety of financial analysis and reporting contexts.

We further identify the "appropriate" proxies by analysing the associations between five indexes and changes in main capital sources from inside (retained earnings) and outside (borrowing from banks, net share issuing, net trade credit). The analysis results are presented in Table 5. These indexes should move together with the financial constraints. This means that the higher the indexes are, the weaker the availability of funds will be. In other words, these indexes should move opposite with the changes in capital.

Table 4. Association between indexes and main components

	Predicted sign	WW	KZ	SA	ASCL	ASCIC	"Appropriate" indexes
Age	-	-0.047 ^a	-0.060 ^a	0.025	-0.378 ^a	-0.332 ^a	WW, KZ, ASCL, ASCIC
Size	-	-0.796 ^a	0.194 ^a	0.467 ^a	-0.196 ^a	-0.244 ^a	WW, ASCL, ASCIC
Cash flow	-	-0.141 ^a	-0.116 ^a	0.033 ^b	-0.181 ^a	-0.148 ^a	WW, KZ, ASCL, ASCIC
Long-term debt ratio	+	-0.177 ^a	0.450 ^a	0.162 ^a	0.303 ^a	0.062 ^a	KZ, SA, ASCL, ASCIC
Total debt ratio	+	-0.150 ^a	0.451 ^a	0.130 ^a	0.231 ^a	0.106 ^a	KZ, SA, ASCL, ASCIC
Dividend pay-out ratio	-	-0.335 ^a	-0.294 ^a	0.141 ^a	-0.018 ^c	-0.060 ^a	WW, KZ, ASCL, ASCIC

^c p<0.05, ^b p<0.01, ^a p<0.001

Table 5. Association between indexes and changes in capital

	Predicted sign	WW	KZ	SA	ASCL	ASCIC	“Appropriate” indexes
Change in total borrowing	-	-0.079 ^a	0.007	0.066 ^a	-0.058 ^a	-0.058 ^a	WW, ASCL, ASCIC
Change in long-term debt	-	-0.086 ^a	0.032 ^c	0.073 ^a	-0.002	-0.067 ^a	WW, ASCIC
Change in short-term debt	-	-0.085 ^a	0.010	0.068 ^a	-0.042 ^a	-0.034 ^b	WW, ASCL, ASCIC
Change in retained earnings	-	-0.071 ^a	0.029 ^b	0.028 ^c	-0.038 ^a	-0.042 ^a	WW, ASCL, ASCIC
Change in net share issuing	-	-0.054 ^b	0.020	0.026	-0.036 ^c	-0.048 ^b	WW, ASCL, ASCIC
Change in net trade credit	-	0.001	-0.013	0.030 ^b	-0.025 ^c	-0.016	KZ, ASCL, ASCIC

^c p<0.05, ^b p<0.01, ^a p<0.001

As can be seen from Table 5, among 5 indexes, WW, ASCL and ASCIC are able to reflect the financial restriction of observed firms better than KZ, SA (is stated for the Vietnamese market only). Especially, the correlation coefficients between ASCIC and changes in all six sources of fund have consistently negative and significant signs. The results indicate that while the ASCIC index produces prediction results comparable to other indices, it utilizes the most straightforward measurement method of financial constrained position for Vietnamese listed firms.

5. Conclusion

Using the sample of Vietnamese quoted firms from 2010 to 2019, we contribute to existing literature with a novel, effective, and simple way to measure firms' financial constraints, namely ASCIC. The index is the combination of age and size, which reflect information asymmetry; cash flow, and interest cover ratio that present repayment capacity and solvency risk respectively. In terms of application, among other indexes, our approach is considered to be easier to compute and use as its calculations only involve a given year and all scores of its components will be given 1 if they are smaller than the median of the industry. Our study, therefore, contributes to the existing literature on evidence of the applicability of different financial constraint measurements.

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