



Determinants of intangible assets value: The data mining approach

Chih-Fong Tsai^{a,1}, Yu-Hsin Lu^{b,2}, David C. Yen^{c,*}

^a Department of Information Management, National Central University, Jhongli, Taiwan, ROC

^b Department of Accounting, Feng Chia University, Taichung, Taiwan, ROC

^c Department of DSC & MIS, Miami University, Oxford, OH 45056, USA

ARTICLE INFO

Article history:

Received 11 July 2011

Received in revised form 31 January 2012

Accepted 12 February 2012

Available online 19 February 2012

Keywords:

Feature selection

Data mining

Firm value

Intangible assets value

Neural networks

ABSTRACT

It is very important for investors and creditors to understand the critical factors affecting a firm's value before making decisions about investments and loans. Since the knowledge-based economy has evolved, the method for creating firm value has transferred from traditional physical assets to intangible knowledge. Therefore, valuation of intangible assets has become a widespread topic of interest in the future of the economy. This study takes advantage of feature selection, an important data-preprocessing step in data mining, to identify important and representative factors affecting intangible assets. Particularly, five feature selection methods are considered, which include principal component analysis (PCA), stepwise regression (STEPWISE), decision trees (DT), association rules (AR), and genetic algorithms (GA). In addition, multi-layer perceptron (MLP) neural networks are used as the prediction model in order to understand which features selected from these five methods can allow the prediction model to perform best. Based on the chosen dataset containing 61 variables, the experimental result shows that combining the results from multiple feature selection methods performs the best. GA \cap STEPWISE, DT \cup PCA, and the DT single feature selection method generate approximately 75% prediction accuracy, which select 26, 22, and 7 variables respectively.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

The market value of a firm's shares ultimately reflects the value of all its net assets. In the industrial era, physical assets, such as land, capital, and labor were critical factors to judge a firm's value. However, in modern economies, the development of communication technology, electronic commerce, and the Internet enables these resources to circulate around the world quickly, letting the knowledge-based economy era evolve. Therefore, the important factors for successful companies are the capability and the efficiency in creation, expansion, and application of knowledge [27]. The method for creating firm value transfers from traditional physical production factors to intangible knowledge. In this situation, a large part of a firm's value may reflect its intangible assets. To evaluate the firm's value, we not only consider the tangible assets, but also respect the power of intangible assets [9,14].

Intangible assets are a firm's dynamic capability created by core competence and knowledge resources, including organization structure, employee expert skills, employment centripetal force,

R&D innovation capability, customer size, recognizable brand, and market share. Many studies [18,19,32,59] investigate various types of important factors in intangible assets valuation. Gleason and Klock [19] indicate that advertising and R&D expenditures are positively related to Tobin's Q , a proxy for intangible assets, but the firm size has a negative relation with it. Wiwattanakantang [59] examines the effect of controlling shareholders, including various types of controlling, participation in management, and pyramids on corporate value and finds no significant effect on Tobin's Q . Fukui and Ushijima [18] investigate the industry diversification of the largest Japanese manufacturers. Regression results show that the average relationship between diversification and intangible assets is negative. However, research to date [36,59] provides mixed evidence on the various factors affecting intangible assets.

Regarding literature, studies focusing on different domain problems discover different factors that affect intangible assets. This leads to an important research question of what factors are more representative to judge or even predict a firm's intangible assets value. Therefore, this study first reviews related literature from diverse domains including accounting, finance, management, and marketing to collect relatively important factors affecting intangible assets. Then, we consider feature selection to select important features (or factors) from a given dataset. In data mining, feature selection is a very important step for obtaining quality mining results [21], as it aims to filter out redundant or irrelevant features from the original data [63]. The remaining selected features are

* Corresponding author. Tel.: +1 513 529 4827; fax: +1 513 529 9689.

E-mail addresses: cftsai@mgt.ncu.edu.tw (C.-F. Tsai), lomahsin@gmail.com (Y.-H. Lu), yendc@muohio.edu (D.C. Yen).

¹ Tel.: +886 3 4 22 7151; fax: +886 3 4254604.

² Tel.: +886 5 2720411x24506.

more representative and have more discriminative power over a given dataset.

There are a number of statistical and data mining based feature selection methods that are widely used for many business domains [8,23,47]. In this study, we consider five feature selection methods to assess their prediction performance of intangible assets. They are principal component analysis, stepwise regression, decision trees, association rules, and genetic algorithms.

Because of fewer regulations and less disclosure of intangible capital, financial reporting cannot actually reflect the value of intangible assets. The problem in the traditional financial accounting framework is that reporting lacks the recognition of intangible capital value and creates an information gap between insiders and outsiders [58]. Therefore, we expect the empirical results in this paper to allow us to not only understand the best feature selection method for effectively evaluating intangible assets but also to provide other information different from financial statements. This will help investors and creditors to better evaluate the investment or lending opportunities, and help them make more effective decisions.

In other words, the contribution of this paper is two-fold. First, for the feature selection field, this paper shows the applicability of the state-of-the-art feature selection algorithms to the domain of intangible assets evaluation, which has never been studied before. Second, for intangible assets evaluation, this paper attempts to use the state-of-the-art feature selection algorithms to identify critical factors affecting a firm's value.

The remainder of this paper is organized as follows: Section 2 reviews related studies about firm value and also briefly describes the feature selection methods; Section 3 describes the experimental methodology; Experimental results are presented in Section 4. Finally, the conclusion is provided in Section 5.

2. Literature review

2.1. Intangible assets

2.1.1. Definition

Today, effective applications of knowledge and information technology have become the most crucial issue and competitive advantage for nearly every organization. In particular, it is commonly found that the market values of knowledge based firms are much higher than the book values, as the stock was irrationally exuberant [19]. This is because the market value of a firm's shares ultimately reflects the value of all its net assets. In the industrial era, physical assets, such as land, capital, or labor were critical factors to create a firm's value. However, the primary method for creating firm value today is based on the transformation from traditional physical production-factors to intangible knowledge [14].

Intangible assets are a firm's dynamic capability created by core competence and knowledge resource, including organization structure, employee expert skills, employment centripetal force, R&D innovation capability, customer size, recognizable brand, market share, etc. It represents the future growth opportunities and profitability that go toward increasing firm value. Therefore, when we evaluate a firm's value, we not only consider the tangible assets, but also respect the power of intangible assets [9,14].

2.1.2. Factors affecting intangible assets

In literature, the factors affecting intangible assets can be classified into six categories: intangible capital, ownership structure, corporate governance, firm characteristics, industry characteristics, and reactions of analysts and customers. They are described as follows:

In intangible capital, many empirical models [18,19,44] use the intangible assets value as a forward-looking performance measure. This value represents the market's valuation of the expected future stream of profits, based on the assessment of the return that can be generated from the firm's tangible and intangible assets. Therefore, any intangible investment increases a firm's value as tangible assets would. Innovation and brand loyalty are viewed as investments that can increase a firm's intangible assets with predictably positive effects on future cash flow and intangible assets [19].

Ownership structure of firms in Taiwan (an emerging country), unlike the companies in many developed countries (e.g., US, UK, and Japan), are under the common administrative and financial control of a few wealthy old families whose ownership is concentrated in controlling shareholders [28,39]. Recently, many studies indicate that the controlling shareholders always obtain effective control of the firm and cause the agency problem between themselves and minority shareholders [35]. Controlling shareholders extract wealth from the firm by holding high voting rights, but only bear a little cost by holding low cash flow rights. In this situation, they could make decisions for the entrenchment of minority shareholders' interests that could result in the degradation of intangible assets value. In business groups, the situation of entrenchment is more serious [39,48].

When the agency problem arises in companies (which can affect a firm's intangible assets value), corporate governance may play an important role in monitoring [36]. These monitoring mechanisms are usually based on the board of directors [33,61] as the board is charged with monitoring management to protect shareholders' interests and avoid intangible assets being entrenched. The empirical evidence on the efficacy of the monitoring that outsiders provide (proxy for board independence) appears in many studies [42,61]. Otherwise, large non-management shareholders or institutional shareholders play a role in restraining managerial agency costs [36]. If there is more than one large shareholder in a firm, the large shareholders may monitor each other, hence reducing the agency costs [59].

Otherwise, a firm's intangible assets value may be affected directly or indirectly by factors related to the nature of the firm. Sales growth is a proxy for growth opportunities that increase intangible assets, but the firm size is likely to be inversely related to expected growth opportunities [18,19]. Rao et al. [44] find that firms with higher growth opportunities have lower leverage. However, previous studies, e.g., [37], show that firms with higher leverage can enjoy a tax benefit. They can deduct interest costs, which results in greater cash flow and thus has a positive relationship with intangible assets. Capital intensity also affects intangible assets value, because it is a proxy for investment opportunities.

Besides firm characteristics, difference characteristics of various industries will affect the intangible assets value of firms. The degree of industry concentration should affect the firm's relative bargaining power. When an industry is fragmented and concentration is low, the degree of competition in the industry is likely to be more intense and the firm's bargaining power decreased. Therefore, Anderson et al. [2] indicate that higher concentration can provide more market power that can lead to a higher intangible assets value. On the other hand, Rao et al. [44] argue that a higher intangible asset reflects better market efficiency rather than market power. The effect of the concentration index on intangible assets value is negative.

Finally, Lang et al. [32] indicate that more analysts following a company means that more information is available, the firm's information environment is better, and the cost of capital is reduced. Otherwise, an analyst is one of the outside users of financial statements and owns professional domain knowledge, while additional analyst following should bring about more scrutiny,

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات