

IMPROVING THE ACCURACY OF ESTIMATED INTRINSIC VALUE THROUGH INDUSTRY-SPECIFIC VALUATION MODELS

Yanfu Li, Chengdu Technological University

ABSTRACT

This study aims to improve the accuracy of estimated intrinsic value by the industry-specific valuation model. Different industries have unique characteristics. As such, they should be valued by different valuation models. This study offers a comprehensive overview of the characteristics of financial and information technology industries and identifies the appropriate industry-specific valuation models for each industry. As the features of firms may still vary greatly even within the same industry, this study further classifies each industry into several sectors according to the Industry Classification Benchmark. After that, a series of corresponding valuation models for each sector are recommended. Detailed explanations for the recommendations are provided for each sector. This study contributes to the literature of valuation methodology by identifying the corresponding valuation models for different sectors/industries. More accurate estimation of intrinsic value can be expected as a result of more compatible valuation model.

JEL: G12, G14, C10

KEYWORDS: Industry Characteristic, Industry-Specific Valuation Method

INTRODUCTION

As a basic rule in business valuation, the selected valuation model should be compatible with the characteristics of the business being valued, to better estimate its intrinsic value. The “apples to apples” comparison offers the most defensible way to demonstrate what a business is worth. In valuation practice, equity analysts prefer to focus on general characteristics of firms within a specific industry, and then apply differing valuation models to different industries. However, equity analysts have not reached a consensus about the valuation model selection standard. In fact, they often have different valuation model preferences and choices for the same industry. Apparently, different valuation model choices produce different, and even inconsistent valuation results reducing the reliability of value estimates.

Until recently, the majority of existing studies tend to concentrate on the evaluation and comparison of valuation model performance. Few studies take into account the characteristics of industry or firm and the valuation model compatibility. This study aims to improve the accuracy of estimated intrinsic value by the industry-specific valuation model. This study offers a comprehensive overview of the characteristics of financial and information technology industries and then identifies the appropriate industry-specific valuation models for each industry. Industry-specific valuation models have good prospects in company valuation practice. They can effectively assist the equity analysts to select an appropriate valuation model based on characteristics of company being valued. More accurate estimation of intrinsic value can be expected when using a more compatible valuation model. The rest of the study is organized as follows: the literature review section provides a general overview of relevant literature. The next section discusses characteristics of financial and information technology industries, and the corresponding valuation models. Lastly, concluding comments are provided.

LITERATURE REVIEW

In today's valuation practice of listed firms, equity analysts apply different valuation models to different industries. However, existing studies rarely connect industry characteristics with the suitability of valuation models. Most theoretical works concentrate on the comparison of valuation models. Asquith et al. (2005) contrast the performance of a series of valuation models at the firm level. The models are sales, earnings, cash flow and book value-based valuation models. The authors conclude the sales-based valuation model outperforms other models in general. However, the accounting item of sales is not always a reliable value indicator since the sales figure can fluctuate extensively, especially for cyclical businesses. Other accounting items may do a better job in terms of intrinsic value measurement. Kim and Ritter (2000) argue the price to book value model is better than the price to sales and price to earnings models. The authors reveal that accounting figures of sales and earnings are often volatile and easily subject to management manipulation. Although book value is indeed an ideal value indicator under certain circumstances, the valuation methodology should pay more attention to the value creation of company than anything else. Cheng and McNamara (2000) emphasize that earnings are the most important driver of intrinsic value. Other models such as price to book value model cannot be used as a primary valuation model.

Bernard (1995) further reveals that earnings are a more accurate value indicator than other indicators such as dividends, where price to earnings model outperforms the dividend yield model in general. In fact, dividend-based valuation models also generate accurate valuation result when the company being valued is a traditional and matured company with stable dividend payout policy. However, researchers often encounter companies without dividends or the dividend payout ratio is not consistent with their profitability. Gleason et al. (2013) discover the residual income model significantly outperforms other valuation models in the valuation of companies without dividend or positive cash flow.

Since the application of different valuation models into different industries is becoming the mainstream in company valuation practice, a few theoretical works have started to investigate the industry-specific valuation model. Normally, these studies are based on the observation of equity analysts' usage. Specifically, the valuation reports of listed companies and interviews with equity analysts are the major research resources. Imam et al. (2008) conducted a semi-structured interview with 42 UK sell-side equity analysts who specialized in different industries, together with a content analysis on 98 equity research reports. The authors conclude that equity analysts have their own "favorite" models for a specific industry and these "favorite" models may not be the same.

Demirakos et al. (2004) carried out a similar content analysis on 104 equity reports across three industries. The authors find the earnings-based model is the major valuation model for beverage, electronic and pharmaceutical industries. The sales-based model is also very popular. In addition, the above two studies further rank a series of absolute and relative models according to researchers' usage and preferences across different industries. However, Imam et al. (2008) and Demirakos et al. (2004) offer little reason to explain why a particular valuation model is appropriate for a specific industry. Their model ranking is mainly based on the researchers' preference and observed usage.

Liu et al. (2002) rank several valuation models based on a series of quantitative metrics. However, the authors only test the performance of several relative valuation models across nine industries. Imam et al. (2013) measure the performance of both absolute and relative valuation models at the industry level, the authors then rank the valuation models based on the accuracy of the prices produced. In general, the target price is the future price level that a listed firm's stock is likely to reach in the next 6-12 months. The target price is based on the estimated future intrinsic value. The future intrinsic value is often predicted by using the current value estimate. Thus, the target price is not the direct product of a valuation model. Rather, it contains a large percentage of subjective pricing factors. The current performance of valuation models

cannot be tested via its “future” target price. In fact, it is better to test the valuation model via the “current” value estimate which is directly produced by the valuation model without any adjustments.

INDUSTRY-SPECIFIC VALUATION MODEL

Financial Industry: Commercial Banks

Commercial banks are a major player in the financial industry. It takes in deposits, offers loans and basic investment products to both personal and institutional customers. As an important financial intermediary in the economy, Dong (2008) states that commercial banks generate income mainly through the spread between the interest it pays to raise funds and the interest it charges those who borrow the funds. In addition, monopolization is a significant characteristic of commercial banks. The barrier to entry is high and it is often under strict government control in many countries. Compared to firms in other industries such as manufacturing, the fixed assets of commercial banks accounts for a low percentage of their total assets. The small capital base often causes commercial banks extremely sensitive to negative earnings. Zhang et al. (2010) indicate that although commercial banks use loan loss reserves to absorb the expected losses of loans, unexpected losses must be charged against the equity capital. Therefore, the adequacy of equity is important and commercial banks are required by regulators to maintain a reasonable capital ratio. Equities are the last protection for depositors under the extreme situation.

In the valuation of commercial banks, it is not necessary to value the total asset or whole enterprise value due to the unique role of debt in their capital structures. Damodaran (2009) states that debt should be viewed as the raw material for commercial banks to generate income. Enterprise value-based valuation models such as enterprise value to earnings before interest, tax, depreciation and amortization (EBITDA) has been ranked as the 6th valuation model choice for commercial banks by Imam et al. (2008) and Demirakos et al. (2004). Fink (2012) suggests it is appropriate to select equity-based multiples that ignore debt and uncertain cash flow, and focuses directly on the important equity capital of commercial bank. The author regards the current book value of commercial bank as a reliable starting point and recommends the price to book multiple as a primary valuation model. In addition, Wild et al. (2001) further pointed out that as a measure of net asset value, book value is appropriate for valuing the commercial bank which is composed chiefly of marketable financial assets, since their book values may approximate their current market values. Damodaran (2009) states that accounting rules which govern bank accounting have historically been different from the accounting rules for firms in other industries. Banks have a “mark-to-market” accounting standard and book value is a surprisingly reliable indicator of current value (Fink, 2012). Although mispricing of financial asset may exist, the current market price is still a good proxy of current value.

Imam et al. (2008) rank the price to book as the number one valuation model for the financial industry, and the price to earnings as the second model of choice. However, other studies argue that price to earnings may not be a suitable valuation model for commercial banks. Dong (2008) states that significant earnings fluctuation of the cyclical commercial bank may reduce the effectiveness of price to earnings multiples, since the performance of a commercial bank is over-sensitive to interest rate changes. The author further indicates that volatile earnings is not a reliable indicator of the true performance of a commercial bank. Stable book value is more meaningful when earnings are abnormally high or low. Besides, the loan loss reserve is an important protection measure for commercial banks against the expected loan losses. The loss reserve has been recognized as an expense in the income statement, and thus the amount of reserve is negatively related to the earnings of a commercial bank. Zhang et al. (2010) find that different banks have different attitudes toward credit risk. The more conservative the commercial bank is, the higher the level of reserves and thus the lower earnings level. Therefore, earnings cannot reflect the true performance of a commercial bank. On the other hand, book value is less sensitive to the level of loan loss reserve. The equity analysts should focus on price to book while reducing the usage of price to earnings in the valuation

of commercial bank. In addition, the residual income model is also a popular valuation model especially when the commercial bank being valued has negative earnings, no dividend payment or negative cash flow.

Financial Industry: Insurance

In many studies, insurance is defined as the equitable transfer of risk of loss, from one entity to another in exchange for payment. As a special type of institute in the financial industry which provides economic protection against the identified risks occurring or discovered within a specified period, Damodaran (2009) indicates that the insurance firm offers either life or nonlife insurance and earns income via insurance policy underwriting and investment. Insurance firms derive their profit from the spread between the return on invested assets and the claims paid to its policy holders. Nissim (2013) states that in the valuation of insurance firms, valuation models such as discounted cash flow, which focuses on operating activities, omits a major part of value creation (investment). In addition, cash flows from the investment portfolio and insurance operation are subject to great uncertainty. Therefore, the cash flow-based model of discounted cash flow (DCF) cannot be a primary valuation model. The DCF model has been ranked as the 4th valuation model of choice for insurance firms by Imam et al. (2008) and Demirakos et al. (2004). The free cash flow to firm model is even worse than the free cash to equity, since the definition of debt is unclear and its role is special. In addition, dividend-based models such as discounted dividend model and dividend yield slightly outperform the DCF model. The dividend is easier to estimate than free cash flow, especially under the condition that the insurance firm being valued has established a long-term dividend policy that bears an understandable and consistent relationship with the company's profitability (Pinto et al., 2020). In addition to cash dividends, stock buybacks are also a common way for the large and mature insurance firms to return cash to their shareholders. Damodaran (2009) suggests adding the stock buybacks each year to the dividends paid and compute the composite payout ratio.

With regard to the valuation of insurance firms in developed countries, Dong (2008) states that equity analysts often focus directly on the equity value. Similar to commercial banks, the book values of insurance firms are solid measures of most balance sheet items. The major assets and liabilities of insurance firms are highly liquid and often close to their fair values. Nissim (2013) further indicates that insurance firms are required by regulations to maintain minimum equity. These regulations affect the value of the insurance firms and make the book equity a relatively useful measure of the scale of operations. In addition, Nissim (2013) examines the accuracy of a series of relative models in the valuation of U.S. insurance firms. The book value multiples performed significantly better than earnings-based multiples. However, unlike other firms in the financial industry such as commercial banks, the earnings of insurance firms tend to be stable and less subject to the business cycle effect. Thus, the earnings-based multiple is also a popular choice. Although price to book outperforms price to earnings in the valuation of insurance firm, the gap between their valuation performances is not significant if the earnings are based on forecasted figures (Nissim, 2013). Therefore, the price to earnings has been ranked as the 2nd choice model for insurance firm by Imam et al. (2008) and Demirakos et al. (2004).

Traditional valuation models often underestimate the value of life insurance companies with a high growth perspective. Hence in recent valuation practice of insurance companies in emerging markets, a unique appraisal value model derived from the actuarial science has gained its popularity. Dong (2008) states that the appraisal value model measures the intrinsic value as sum of embedded value and the present value of future new business, where the embedded value equal to the adjusted net worth plus the value of in-force business. Although the appraisal value model is complicated and has not been widely used by equity analysts, it is ideal for the strong growth life insurance firm since it considers the values from net asset, existing business and new business at the same time.

Financial Industry: Securities

Securities companies, also known as investment banks or brokerage houses offer securities brokerage, investment banking and asset management services, and actively participate in proprietary trading. Unlike commercial banks and insurance companies, most securities companies have large positive betas and their performances are closely correlated to the movement of stock market. The stock performance of securities companies has often been regarded as the most direct and sensitive indicator of the overall stock market movement. In addition, securities companies often conduct valuation assignment on both public and private companies. Most literature tends to concentrate on how securities companies value other firms, not on how to value themselves. This section attempts to fill the gap and provide a better understanding of the specific models for the valuation of securities companies.

First consider securities companies which lack adequate diversification and concentrate on a risky business such as proprietary stock trading to generate revenues. Their risks are significant and their earnings are extremely sensitive to investment decisions and the stock market condition. Their volatile and uncertain earnings are not a good performance indicator. The earning-based valuation model is not suitable for these securities companies. Further, similar to commercial banks and insurance companies, securities companies are also required by regulators to maintain minimum loss reserve for their proprietary trading. Their loss reserves are recognized as expenses in their income statements and may cause their earnings not to be comparable. The reserves for different securities companies is subject to different business structures and specific regulatory requirements. Securities companies which lack diversification and earnings protection measures often produce higher loss reserves. The when valuing securities companies which rely heavily on proprietary stock trading to generate profit, the price to book multiple is preferred over the price to earnings approach. Given the uncertainty of stock markets, the future performance and cash flows of securities companies are difficult to forecast. The absolute valuation models such as DCF and DDM are not suitable.

Second, consider securities companies which focus on low-risk brokerage, investment banking and asset management services. Their profitability tends to be stable and less subjective to the movement of the stock market. Therefore, Zhang et al. (2010) indicates that earnings are a chief driver of intrinsic value. The price to earnings approach is the primary valuation model for mature securities companies that operate in stable businesses. Third, the recent consolidation and diversification caused many securities companies to gradually abandon the single business structure and operate in multiple businesses. They start to focus on the defensive investment banking business and securities asset management business to enhance their earning quality and gain higher valuation premium.

However, in the valuation of securities companies with strong growth perspectives, value estimates generated by traditional valuation models such as price to earnings multiples tend to be volatile. Besides, trailing earnings cannot reflect the potential risk and investment gain the company may have in the future. Therefore, the true value of growing securities companies may be severely underestimated. Imam et al. (2008) emphasize the importance of earning growth rates in the valuation of a growing company. The authors recommend the PEG (P/E to Earnings) as an alternative valuation model as it considers both price to earnings and earnings growth rate in the next 3 to 5 years.

Table 1: Recommended Valuation Models - Financial Industry

Sector	Recommended Valuation Models
Commercial Banks	Price to book value model, Price to earnings model, Residual income model
Insurance	Price to book value model, Price to earnings model, Appraisal value model
Securities	Price to book value model, Price to earnings model, Price/Earnings to growth model

Source: Own resource

Information Technology Industry: Software & Computer Services

The software & computer services sector is a category of IT firms that related to the research, development and distribution of information technology-based products and consultancy services. software & computer services firms are intangible-rich where many firms derive most of their value from intangible assets such as technology. Therefore, the core technology of a software & computer services firms plays an important role in its business model, and the “technology value” generated from the core technology accounts for a large percent of the firm’s total intrinsic value. Software & computer services firms typically specialized in the development of one particular group of related products. Their core technologies are usually unique and thus cannot be compared to other technologies. Thornton et al. (2011) states that relative valuation models which compare the subjective company with its peers do not have significant advantage over the absolute valuation models for the software & computer services sector. Pinto et al. (2020) also indicate that in the valuation of a high growth industry with great uncertainty, equity analysts devote little space to accounting. Accrual based relative valuation models are only appropriate for more stable industries. Demirakos (2004) also argues that accounting measures of performance are less relevant for intangibles-rich firms or for firms with large portfolios of growth opportunities.

Regarding valuation model choices, Zhang et al. (2010) indicate that software & computer services firms do not require enormous capital investment in tangible assets such as the infrastructure. Their intangible assets such as goodwill, patent, technology, software and human resources may account a large percentage of total assets. However, current accounting rules impose the limitation of non-recognition of self-generated intangibles. In addition, since the products of research are subject to great uncertainty and are difficult to quantify, accounting rules generally require that all R&D investments be expensed in the period where they occur. Damodaran (2009) criticizes current accounting rules as mistreating R&D investment and causes both capital expense and book values to be understated. In fact, investment in R&D should be capitalized and recorded as an asset. Therefore, the value of intangible assets is difficult to be fully measured by the book value, and this reduces the effectiveness of book value as a reliable value indicator. Besides, book value also cannot take into account the value generated from future growth. Therefore, book value-based valuation models such as the price to book value and enterprise value to book value models have been ranked as the most unsuitable models for the software & computer services sector by Demirakos et al. (2004) and Imam et al. (2008).

The valuation model should be more forward-looking and take into account both high earnings growth and uncertainty in the future. Since the cash flow is generally more stable than earnings and less subject to manipulation by management, sophisticated DCF valuation models which estimate the intrinsic value as the present value of future cash flow have been regarded as the most appropriate choices for software & computer services firms. However, the valuation model selection varies greatly across the different company life stages (start-up, growth and mature) of software & computer services firms. The following sections analyze the characteristics of firms within three life stages respectively, and then introduce their corresponding valuation models.

For consider small start-up firms which account for a large percentage of the total firms within the software & computer services sector. Most of these firms are non-listed. They have a short operating history and limited accounting data. Therefore, their valuations must be made under many assumptions. Further, many adjustments are also required when the public business valuation techniques are adopted in the valuation of private firm in the early stage. Since many start-up firms do not have comparable listed firms, their market capitalizations or market prices are usually estimated by the comparable transaction method.

With regard to valuation models for small software & computer services firms, Thornton et al. (2011) state that many firms are still in the technology R&D stage and they have little revenues. Their future earnings and growth rates are also difficult to estimate due to the absence of adequate accounting records. In addition,

the mis-categorization of R&D investment as an operating expense can result in understating earnings. Therefore, the historical earnings based-valuation models such as trailing market capitalization to earnings (trailing P/E), and future earnings-based models such as the forward market capitalization to earnings (forward P/E) are meaningless. As most firms do not have a profit yet, dividend payout is impossible for them and the dividend-based valuation model such as the discounted dividend and dividend yield are both not suitable. Software & computer services firms have great uncertainty in their early stages, Zhang et al. (2010) indicated the modified discounted cash flow model (MDCF), which weighs several uncertain elements to arrive at the end valuation, is the most suitable valuation model. Unlike the traditional discounted cash flow model where a single (most-likely) scenario is used, the MDCF is a type of risk-adjusted net present value model. It considers several possible scenarios for the start-up firm and assessing the probability of each scenario.

Second, as the R&D process continues and firms move into the growth stage, the certainty of success and of receiving the anticipated cash flows increases substantially, resulting in a corresponding increase in the company's value (Robin et al., 2009). At this stage, the earnings of firms turn into positive figures and become less volatile than before. Thus, the earning becomes a chief and reliable value driver. Zhang et al. (2010) highlight the importance of both current earnings and future earnings growth rates in the valuation of growth software & computer services firms. The authors recommend the price/earnings to growth model (PEG) as a superior alternative model over the price/earnings (P/E). The traditional P/E model is unable to take into account the firm's high growth perspective in the future, the PEG provides an effective solution to overcome this deficiency. In addition, the growing software & computer services firms require continuing capital injection to advance their R&D progress of technology product. They adopt a variety of ways to finance growth. This causes their capital structure to vary significantly. Pinto et al. (2020) recommend the enterprise value to EBITDA as a more appropriate model than P/E for comparing companies with different financial leverage. The EBITDA is pre-interest earnings and the EPS is post-interest, the enterprise value only considers the total value of equity and debt, and disregards the capital structure difference.

Third, after firms finish the R&D process of their core technology and product, the technology uncertainty and overall business risk is reduced sharply. Therefore, unlike small start-up firms, the importance of the modified discounted cash flow model declines significantly. There is no point to considering many possible scenarios in the stable stage, especially for the mature software & computer services firms with minimal uncertainty. Hence, the traditional DCF model gains popularity. Demirakos et al. (2004) and Imam et al. (2008) rank the DCF model as the top valuation model for mature IT companies with stable and sustainable cash flow. In addition, compared to early-stage firms with strong growth perspective and volatile earnings, the mature software & computer services firms have limited reinvestment opportunities. Most of their technology investments generate a return on invested capital just exceeding their cost of capital. Earnings tend to be stable and easy to predict, thus earnings-based models such as the price to earnings is a popular valuation model for matured firms without profitable reinvestment projects. Matured firms with large retained earnings balances but few reinvestment opportunities tend to distribute their retained earnings to their shareholders through cash dividend and share buyback. Pinto et al. (2020) states that dividend-based models such as the discounted dividend and dividend yield are appropriate for dividend-paying firms that have an understandable and consistent relationship with their profitability. Dividend-based models are appropriate for matured firms which have already established sustainable dividend policy.

Information Technology Industry: Technology Hardware

Unlike the emerging software & computer services sector which attract investors' attention in recent years, the technology hardware sector is a "traditional" but still very important part of the information technology industry. Software & computer services firms rely heavily on the technology hardware. Company-wide networks and the internet itself only work because of a huge backbone of servers. Therefore, technology

hardware firms still receive a fair amount of equity analyst attention. In general, the technology hardware sector includes firms which develop, manufacture and distribute a variety of technology hardware such as, communication and medical equipment, computers, technical instruments, industrial and consumer electronics. Technology hardware firms spread widely along the industry chain. The products vary greatly for firms located at the upstream and downstream of the industry chain. Upstream technology hardware firms specialize in the business to business (B2B) products of electrical parts, integrated circuits, computer chip and accessories. Downstream firms manufacture a range of final technology products directly for the consumers.

Product differences cause the characteristics of firms to vary greatly. This section classifies technology hardware firms into the two categories. The first category is capital-intensive business which includes the upstream firms of electrical parts and accessories manufacturers, and the downstream firms without strong R&D capability. The second category is the capital and technology-intensive business which contains the upstream firms of integrated circuits and computer chip manufacturers. This category also includes downstream producers of the final product. The Porter's Five Forces theory is adopted to analyze the characteristics of technology hardware firms, then a series of corresponding valuation models are recommended.

For the capital-intensive business such as the manufacturers of electrical parts and accessories, a high threat of new entrants exists. Their low barrier to entry significantly increases competition and reduce their overall profitability. Zhang et al. (2010) point out the major reason for their low entry barrier is because these firms only require relatively large initial investment in manufacturing facilities. There is little need for a higher level of proprietary technology and patents. In addition, Dong (2008) indicates the low switching cost of products such as electrical parts and accessories significantly increases the customer bargaining power further decreasing their profitability. For electrical parts products such as resistors, capacitors and diodes, manufacturers must meet certain industry standards and thus have good product compatibility with many downstream electronic products.

Similar to electrical parts, hardware accessories must be compatible with the final products. Therefore, the product difference is not huge. The threat of substitutes is high since there are many similar products available in the market. Zhang et al. (2010) recommend the price to book value model (P/B) as an appropriate valuation model of choice for manufacturing firms with the following features: a large amount of fixed assets, relatively stable book value, low return on assets and rampant rivalry with peers. Although book value is often used as a value indicator for the firms in the case of discontinued operations, Pinto et al. (2020) state that book value is also appropriate for the firms without strong growth prospects and less uncertainty in the future. In addition to book value, sales-based models such as price to sales (P/S) and enterprise value to sales (EV/S) are also suitable valuation models for the manufacturing businesses, since their revenues are subject to less uncertainty, distortion and are easy to predict. The EV/S model is capable of distinguishing between undervalued companies and debt-burdened companies, since enterprise value disregards the capital structure difference. Most capital-intensive businesses such as electrical parts and accessories manufacturers often struggle with low profitability. Many firms over-rely on debt to finance their operations. Since manufacturing firms usually have substantial depreciation and amortization expenses to depress their earnings, Pinto et al. (2020) suggest that EBITDA controls for differences in depreciation and amortization among businesses. The enterprise value to EBITDA (EV/EBITDA) is frequently used in the valuation of manufacturing businesses with little goodwill, negative net income but positive gross profit.

Second, capital and technology-intensive businesses have significantly different features. Most of their products are highly complex and require a large amount of intelligence and funds input. In general, capital and technology-intensive businesses such as integrated circuits and computer chip manufacturers have exceptionally high barriers to entry to preserve their profitability. Wang et al. (2007) indicates that

integrated circuits and computer chip manufacturers have high possibility of failure. They often require large initial capital and knowledge investment. Hence, the cash flow-based valuation model such as discounted cash flow model (DCF) and price to cash flow (PCF) are the primary choices for the fast-growing firms with volatile earnings and large risk.

Capital and technology-intensive firms have considerable property, plant and equipment (PPE) related fixed cost and R&D expense in the early stages. But, they have low production-related variable expenses in the later stages as result of the economies of scale. Besides, the moderately high switching cost forces most downstream firms to stay with their existing upstream suppliers of integrated circuits and computer chip product. They are less inclined to pay for the high switching cost unless there is a large technology improvement (Wang et al., 2007). The sales-based multiples of price to sales (P/S) and enterprise value to sales (EV/S) are both appropriate valuation models for the firms with stable revenue. In addition to the huge amount of tangible assets such as PPE, capital and technology-intensive businesses also have a large amount of intangible assets such as goodwill and intelligence properties. Therefore, Zhang et al. (2010) indicate the price to book value model (P/B) is not a good choice for firms with a large proportion of intangible assets. Book value cannot take into account value generated from fast growth in the future. The authors further recommend the price/earnings to growth model (PEG) as a superior alternative for taking into account firms' high growth perspective in the future.

After the capital and technology-intensive hardware stage, manufacturers finish their R&D process and move into the production stage. Their profitability usually increases sharply until the mature stage. In the mature stage, their earnings tend to be stable and many firms have a large amount of retained earnings. Dong (2008) indicates the earnings-based model of price to earnings (P/E) becomes the major model choice for firms with mature and stable earnings. The importance of dividend yield (DY) and discounted dividend model (DDM) also increases as many firms start to distribute their earnings.

Table 2: Recommended Valuation Models - Information Technology Industry

Sector	Recomendad Valuation Models
S&C Services	Discounted free cash flow model, Price/Earnings to growth model, Enterprise value to EBITDA model
Technology Hardware	Price to book value model, Enterprise value to sales model, Discounted dividend model

Source: Own resource

CONCLUDING COMMENTS

This study aims to improve the accuracy of estimated intrinsic values by industry-specific valuation models. This study offers a comprehensive overview of the characteristics of financial and information technology industries, and then identifies appropriate industry-specific valuation models for each industry. In particular, this study focuses on a range of commonly used valuation models including multi-period absolute models and single-period relative models. Since the features of firms may still vary greatly even within the same industry, this study further classifies each industry into several sectors according to the Industry Classification Benchmark. After that, a series of corresponding valuation models for each sector are recommended, detailed explanations for recommendation are given for each sector.

This study contributes to the literature of valuation methodology by identifying the appropriate valuation models for different sectors/industries. More accurate estimation of intrinsic value can be expected as a result of industry-specific valuation models. Industry-specific valuation models have good prospects in company valuation practices. They can effectively assist the equity analysts to select the appropriate valuation model based on characteristics of the company being valued. However, this study has a limitation that only two industries are included. Further studies on other industries and their corresponding valuation models are necessary and meaningful.

REFERENCES

- Asquith, P., Mikhail, B.M. & Au, A.S. (2005). Information content of equity analyst reports. *Journal of Financial Economics*, 75 (2), 245-282.
- Bernard, V.L. (1995). The Feltham-Ohlson framework: implications for empiricists. *Contemporary Accounting Research*, 11 (2), 733-747.
- Cheng, C.S.A., & McNamara, R. (2000). The valuation accuracy of the price-earnings and price-book benchmark valuation methods. *Review of Quantitative Finance and Accounting*, 15 (4), 349-370.
- Damodaran, A. (2009). Valuing companies with intangible assets. Working Paper, New York University.
- Demirakos, E.G., Strong, N.C., & Walker, M. (2004). What valuation models do analysts use? *Accounting Horizons*, 18 (4), 221-240.
- Dong, H. (2008). Target price, recommendation and earning forecast. Working Paper, Sichuan University.
- Fink, J. (2012). How to value bank stocks? Working Paper, Investing Daily.
- Gleason, C.A., Johnson, W.B., & Li, H. (2013). Valuation model use and the price target performance of sell-side equity analysts. *Contemporary Accounting Research*, 30 (1), 80-115.
- Imam, S., Barker, R., & Clubb, C. (2008). The use of valuation models by UK investment analysts. *European Accounting Review*, 17 (3), 503-535.
- Imam, S., Chan, J., & Shah, S.Z.A. (2013). Equity valuation models and target price accuracy in Europe: evidence from equity reports. *International Review of Financial Analysis*, 28, 9-19.
- Kim, M., & Ritter, J.R. (1999). Valuing IPOs. *Journal of Financial Economics*, 53 (3), 409-437.
- Liu, J., Nissim, D., & Thomas, J. (2002). Equity valuation using multiples. *Journal of Accounting Research*, 40 (1), 135-172.
- Nissim, D. (2013). Relative valuation of U.S. insurance companies. *Review of Accounting Studies*, 18 (2), 324-359.
- Pinto, J.E., Henry, E., Robinson, T.R., & Stowe, J.D. (2020). Equity asset valuation. John Wiley & Sons.
- Robin, G.N., & Malak, J.M. (2009). Valuation of early-stage technology companies. Working Paper, Cogent Valuation.
- Thornton, M., & Cairns, I. (2011). The challenge of valuing technology. Working Paper, Grant Thornton.
- Wang, K., Deng, Y., & Li, D. (2007). Mergers, acquisitions, company valuation. Economic Science Press.
- Wild, J.J., Bernstein, L.A., & Subramanyam, K.R. (2001). Financial statement analysis. McGraw-Hill/Irwin.

Zhang, Q., Wang, D., Cui, Y., Yuan, X., & Zhang, J. (2010). Mergers and acquisitions. Economic Science Press.

BIOGRAPHY

Yanfu Li is Lecturer at Chengdu Technological University. His research interests include company valuation, merger and acquisition. His research appears in journals such as Securities Market Herald, Research on Economics and Management, and Logistics Engineering and Management.