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Management efficiency performance of construction businesses: Australian data

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Abstract

Purpose – Construction businesses are perceived uncertainly by investors, and are generally assumed to represent more risk than other businesses. Added to this is the perception of poor business management practices being adopted by construction companies, sometimes resulting in business-failure. Fluctuations in construction workload contribute to investor anxiety. In this light, the paper aims to present a study of the comparative management efficiency performance of construction companies.

Design/methodology/approach – Publicly listed Australian construction companies over the ten-year period 1998-2007 are examined. Performance is compared with a select number of "blue chip" companies as a benchmark. In total, 19 management efficiency measures are used including asset management ratios, debt and safety ratios, and cash flow ratios. The construction companies used in the study engage in work covering the full range of construction activities.

Findings – The results indicate that construction companies perform as well as, and in some cases better than, other businesses, dispelling some of the misconceptions about construction businesses.

Originality/value – The paper's finding will be useful to those investing in the construction industry, and will lead to a better public perception of construction businesses.

Keywords Benefit-cost ratio, Construction industry, Australia, Management effectiveness, Investment appraisal

Paper type Research paper

Introduction

There is a common perception that investment in shares of construction companies is riskier than other types of businesses; there is a belief that management practices result in high debt levels and poor financial positions (Mason and Harris, 1979). The volatility of construction companies' share prices consequently can be high and depends on the fluctuations in national and international economies (Wagle, 2006). In this light, this paper addresses the underlying perceptions and beliefs about construction companies, and provides information to assist investors better understand the financial management of construction companies. In particular, the paper evaluates various measures and ratios in order to better understand the management efficiency of construction companies.

The paper presents an analysis for 30 publicly listed construction companies over a ten-year period from 1998 to 2007. The selection of the sample is based on type of work

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and no other bias; companies whose business is not predominantly construction are excluded from the study. The companies are further categorised by type of work, in order to differentiate characteristics that the type of work may convey. The performance of these companies is then compared with a select group of companies (referred to here as the "blue chip" portfolio), followed popularly by investors because of their supposedly strong investment performance. Conclusions are drawn on the comparative performance of construction companies and this portfolio of blue chip companies, and some existing evidence when available. This enables the previously mentioned perceptions and beliefs relating to construction companies to be addressed as being justified or not, and to better understand the viability of investing in construction companies.

Financial management efficiency ratios evaluated include asset management ratios, debt and safety ratios, and cash flow ratios. See Barnes (1987) and Langford *et al.* (1993) for commentary on ratios and their place in giving informed views of companies. A total of 19 ratios are examined. The background to the use of ratios as a means of assessing the financial health of construction businesses is discussed.

The study, as noted previously, is based on a sample of Australian construction companies. And although company performance relates to the surrounding business environment, and national economy (Ball *et al.*, 2000), it is believed that many of the trends, will carry over to other countries, which have western style construction, and business practices.

Background

It is a generally accepted practice to assess company performance using financial ratios; the practice is widely understood and long accepted as a way of establishing a company's financial structure and characteristics (Cheah and Yee, 2006; Horrigan, 1968; Langford *et al.*, 1993), and as a way of comparing that company against industry benchmarks. Financial ratios can also be used as input to a financial risk analysis, and may provide the only substantial and reliable information on a company's financial health (Mintzberg and Waters, 1989). And, even though there is a considerable debate on the value relevance of financial ratios and their ability to immediately impact share prices, they are easy to obtain and are useful in providing information and understanding for long-term investors who are more interested in the longevity of a company.

With experience, analysts have developed acceptable ranges and norms for some financial ratios. Companies operating outside of those ranges signal potential risk. Nevertheless, these ranges and norms are subjective and are not universally accepted. Some believe it is not appropriate to compare financial ratios between different business types and even sizes (Kangari *et al.*, 1992; Basha *et al.*, 2007). Consequently, differences in these ratios can only suggest a difference in the general industry characteristics, unless the values of the ratios are extremely unfavourable (Barnes, 1987).

Numerous studies have been conducted using financial ratios to build empirical models that signal the likelihood of insolvency of a business. These studies include Mason and Harris (1979), Argenti (1983), Kangari *et al.* (1992), Edum-Fotwe *et al.* (1996), Abidali and Harris (1995), Beaver *et al.*, 2005 (extending the original work of Beaver, 1966), Singh and Tiong (2006), and McCabe and Pilateris (2003).

A company's financial performance, as measured by ratios, may not be in agreement with share price performance (Wagle, 2006; Abdul-Rasheed and Tajudeen,

2006), and some investors may choose to not consult financial ratio information before investing. Poor share market price does not imply poor financial standing of a company. The ratios are calculated based on actual company performance, whereas the share price is dependent on the markets' perceptions and opinions, and trading volatility. And since many investors perceive that investing in construction carries risk, particularly with fluctuating economies, the disagreement between share price and ratios may be greater with construction companies than for companies in other industries (Hood *et al.*, 2006). However investing in construction company shares has an advantage of offering diversification within a share portfolio (Abdul-Rasheed and Tajudeen, 2006).

Construction investment can be secure despite some investors' perceptions being to the contrary (Mason and Harris, 1979; Ellis *et al.*, 2006, 2007; Ball *et al.*, 2000; Akintoye and Skitmore, 1991; Hillebrandt *et al.*, 1995). Performance however may be different between countries (Cheah *et al.*, 2004; Cheah and Yee, 2006) and between companies of different size (Singh and Whittington, 1968; Lea and Lansley, 1975; Asenso and Fellows, 1987; Hall and Weiss, 1967; Samuel and Smith, 1968; Akintoye and Skitmore, 1991; Cheah and Yee, 2006).

Research data and methods

Data sample

A sample of 30 construction companies was selected from the public listings on the Australian Stock Exchange (ASX). The sample was determined by isolating listed companies on the Australian Stock Exchange classified under GICS industry group "Capital Goods" and by establishing which companies were engaged in building and construction. This search yielded 84 construction companies. However, companies that were not purely engaged in construction and building and companies that engaged in mining operations or consultancy were excluded from the analysis, leaving 30 construction firms in the sample. Market capitalization ranged from AUD$23 million to AUD$13 billion. The selected blue chip portfolio used for benchmarking contained companies from the top 100 ASX firms, engage in banking, retailing, insurance, mining and telecommunication, and are popularly supported and successful companies.

The construction companies are categorized by type of work undertaken. Those companies whose predominant work involves the construction of houses, apartments, commercial buildings, shops, hotels, and industrial complexes are collectively referred to as the "Property" group below. Those companies whose predominant work involves the construction of roads, bridges, water, sewerage, railway, and other infrastructure are collectively referred to as the "Civil" group below. These groupings reflect the common industry areas in which construction companies choose to bid and win work. Only a few companies were found to diversify across the whole construction industry, and hence the group division is a reasonable one. Companies that win their work solely from the mining industry are excluded; such work is very dependent on fluctuations in commodity prices.

Data sources

The relevant data were extracted from a number of electronic databases. Share returns were extracted from the Securities Industry Research Centre of Asia-Pacific (SIRCA, n.d.). The financial ratios were obtained from FinAnalysis (n.d.), DatAnalysis (n.d.) and Bloomberg (n.d.). Direct comparison between the blue chip portfolio and the

construction companies is not always possible because of the different nature of the businesses. Examples of this are comparisons of borrowings and debt ratios between financial institutions and construction companies.

Comparison measurements

The management efficiency measures used in this comparison study are grouped into three categories, with a total of 19 particular measures. Because of space limitations, only the most important results are included in this paper. The full set of results and the complete study are available from the authors.

(1) Asset management ratios (five measurements):
- capital turnover;
- inventory turnover;
- asset turnover;
- property, plant and equipment (PPE) turnover; and
- depreciation to operating revenue.

(2) Debt and safety ratios (eight measurements):
- gross gearing;
- net gearing;
- financial leverage;
- net interest expense cover;
- current ratio;
- quick ratio;
- gross debt to cash flow; and
- net debt to cash flow.

(3) *Cash flow ratios* (six measurements):
- receivables to operating revenue;
- creditors to operating revenue;
- capital expenditure to operating revenue;
- days inventory;
- days receivables; and
- days payables.

These financial ratios are all commonly used by analysts and quoted in financial textbooks. See for example Fraser and Ormiston (2007) for financial indicators used in the analysis of financial statements. Appendix 1 lists the underlying formulae. Appendices 2-4 list the ten-year results for these measures in the order of the previous list.

Asset management ratios

Asset management ratios are indicative of how effective a company manages its assets (capital investment, stock inventory, and plant and equipment) to generate revenue.

Generally, the higher the ratio the more profitable the company is. These ratios could also be compared with other companies to assess over- or under-investment in assets.

Capital turnover

One useful asset management ratio is capital turnover. McCall (2006) believes that it is the most important ratio for contractors because it demonstrates short-term financial strength. This ratio measures the amount of sales revenue compared to that of the amount of capital invested by the business. A lower ratio indicates either high current assets or low revenue generation.

The data show that the construction companies have always had a higher capital turnover than the blue chip portfolio after 1998, with the Civil group performing the best. This may be because of their greater ability to generate revenue.

Inventory turnover

Another useful ratio is inventory turnover. It is suggested to have the ability to "determine how productive the company has been utilising their inventory" (FinAnalysis, n.d.). It is also a measure of assessing how a company is managing and selling its inventory.

The data show that the construction companies and the blue chip portfolio have similar inventory turnovers. This indicates that the construction companies are just as efficient in using their current inventory as the market's most prominent businesses. Within construction, the Civil group performed better than the Property group. The construction companies show an ability to maximise the use of their short-term resources to generate revenue.

Asset turnover

In terms of the efficient use of all assets, it is important to analyse asset turnover. Asset turnover measures how well a company uses its assets to generate sales.

The asset turnover data reveal that the productivity of construction companies has been slightly lower than that of the blue chip portfolio. Sales have been around 1.50 to 1.75 of total assets respectively for each group. The Civil group performed above the average in the productivity of their total assets. Cheah *et al.* (2004) found most large international engineering and construction companies have an asset turnover of less than 1.30, and they believed this was less than average.

Property, plant and equipment (PPE) turnover

While construction companies may have faired less well in asset turnover compared to other groups, they are in fact more productive when measured by sales to property, plant and equipment (PPE). This measure should be considered concurrently with levels of depreciation in order to obtain a complete picture of PPE productivity.

The data show that the construction companies have strong productivity ratios. The construction companies' PPE turnovers averaged around ten for most of the ten-year period, and were always higher than that of the blue chip portfolio. The superior PPE turnover performance, together with solid inventory turnover, indicates that the construction companies are efficient in generating sales from both short- and long-term assets. Of the construction companies, the Property group had the better performance.

Depreciation to operating revenue

Depreciation to operating revenue ratio is closely related to that of PPE turnover because depreciation is the direct effect of ownership of PPE assets. A large ratio indicates that more depreciation expense has been claimed relative to sales in the accounting books.

The data show four distinct groups. The blue chip portfolio generally has the highest depreciation to operating revenue ratio at around 5 to 10 per cent. This is followed by the Civil companies at 2 to 4 per cent, and then the average of all construction companies at 1 to 2 per cent. Below these is the Property group with minimal depreciation expense compared to sales. A low value for this ratio indicates construction companies have good asset management strategies and are able to generate greater revenues from depreciable assets than comparable companies. Moreover, the declining trend of this ratio shows that construction companies are improving their efficiency in generating revenue from depreciable assets.

Debt and safety ratios

Debt and safety ratios are used to measure both the ability of a company to pay off its short-term debt and the sustainability of the level of its long-term debt. In effect, a company cannot accumulate high levels of debt, or it will soon face financial difficulties in servicing these debts. When these ratios reach unsustainable levels, the company attracts poor credit ratings and is likely to be unable to repay all its creditors if it were to become insolvent. Nonetheless, there is no exact optimal level for each of the debt ratios; they are dependent on industry sector and historical levels. Certain industries can sustain higher levels of debt and still not be considered financially risky.

Gross gearing and net gearing

One of the most popular ratios in measuring financial soundness of a company is the gearing ratio (McCabe and Pilateris, 2003). The gearing ratio can be further broken down into gross gearing and net gearing. These ratios reflect the way a company structures its finances and how it funds its activities. Higher gearing ratios indicate that a company is in a less favourable financial position because most activities are funded through borrowings (Padget, 1991). Effectively, the net gearing reflects what the company still owes per dollar of the owner's equity after it exhausts all its cash in repaying debt.

From the gross gearing data, there does not seem to be any indication that the construction companies have excessive debt levels. This is in contrast to common perceptions that most construction activities are funded through borrowings. In fact, when taking cash into account, the construction companies tend to have lower gearing ratios. This indicates that they have a well-founded financial position, and are not directly prone to interest rate fluctuations as generally perceived.

Other features that can be observed from the data include the peaks in both ratios in year 2000, which coincided with the contraction of the construction industry following the introduction of the Goods and Services Tax (GST). The effect of an industry-wide contraction may cause the debt levels to increase relative to shareholders' equity. This is because construction companies may find equity funding not as attractive due to a fall in share prices. Of the construction companies, the Civil group demonstrated the stronger performance.

Financial leverage

Another way of measuring level of debt is to calculate financial leverage - total assets divided by shareholders' equity. Since assets are either funded by debt or equity, the higher the financial leverage, the riskier it is, as more assets are funded through debt.

The data show a convergence of the construction companies with the blue chip portfolio over the ten-year period. For the construction companies, total assets relative to shareholders' equity fell, on average, from 3.7 to 3 over the ten-year period. That is, for every $3 that the company has in assets, $1 comes from equity, and the other $2 come from liabilities; or the debt to equity ratio is 2 or 200 per cent. As Curtin (1993) suggests, a debt to equity ratio of less than 200 per cent is a more conservative approach to leveraging. US contractors carry slightly more financial risk than their Australian counterparts at 250 per cent (Ellis *et al.*, 2006).

There is a difference between the gross gearing and the debt to equity ratio because not all liabilities are debt. Even though debt makes up a major part of liabilities in a company's account, liabilities also include other items such as wages payable, accounts payable, unpaid taxes, obligations, and long-term product warranties. Consequently, the debt to equity ratio is larger than the gross gearing ratio.

Net interest expense cover

Measuring debt levels permits the assessment of the longer-term sustainability of a company because high levels of debt could affect the long-term profitability if the company is unable to pay its interest payments. Net interest expense cover assesses the company's short-term viability through its ability to generate revenue to service its debt. This ratio measures how many times the company is earning more than its interest expense. High ratios indicate low financial risk (Solomon and Pringle, 1980).

The data give no clear indication that the construction companies are in any difficulty in meeting their debt commitments. The construction companies are earning ten to 15 times more than their interest repayments. This performance is similar to that of the blue chip portfolio. Consequently, this ratio further reinforces the point that the construction companies, on average, are in a sound financial position.

Current ratio

The current ratio is commonly used to measure short-term solvency, to evaluate the ability of a company to pay its debts as they become due. It reflects the number of times the company is able to service its short-term debt.

Harris and McCaffer (1995) and Pamulu *et al.* (2007) propose that, for contractors, a value greater than 1 is satisfactory. This is supported by Cheah *et al.* (2004), where the majority of large international contractors were found to have a current ratio of slightly more than 1. On the other hand, Curtin (1993) suggests a minimum of 1.2; this value is the same as the result given in the CFMA survey (Ellis *et al.*, 2006) of the US contractors' ratios. The data shows that the construction companies have slightly higher current ratios on average compared to that of the blue chip portfolio for the ten-year period. The construction companies averaged around 1.4 for the current ratio, with the Property group slightly above and the Civil group slightly below. These values are contrasted with that of the blue chip portfolio worsening from 1.1 to 0.9 in the ten-year period. This result indicates that the construction companies are more

liquid, financially safer and more able to repay loans than both the blue chip portfolio and overseas contractors.

Quick ratio

The quick ratio (also known as "acid-test" or "liquid ratio") is a more rigorous test of short-term solvency, similar to the current ratio, but with adjustment for current inventory. Current inventory is removed from the current asset because inventory is sometimes not readily convertible to cash or may be a source of losses due to obsolescence.

The data illustrate the superior financial position of the construction companies. They averaged around 1, while the blue chip portfolio dropped to around 0.5. This suggests that construction companies would not be required to sell-off their inventories even if all their current liabilities were due at the same time. The assessment of both the current and quick ratios dismisses the popular perception that construction companies are exposed to high financial risks.

A comparison can be made between Australian and US construction companies in 2006 and 2007 (see Table I). It is clear from this comparison that the financial soundness of Australian construction companies in terms of short-term solvency and liquidity is comparable with US firms and is also showing an improvement in these measures in the succeeding year 2007.

Gross debt to cash flow and net debt to cash flow

Another way of ensuring a company has the ability to service its annual debt is by finding the gross debt to cash flow ratio and the net debt to cash flow ratio.

In the calculations, gross cash flow is the sum of NOPLAT (net operating profit less adjusted taxes) and depreciation expense for that year. The net debt to cash flow takes into account cash that the company has in hand, which can be used to repay the debt immediately. Both formulae essentially calculate the number of years it requires to pay off total debt with current annual cash inflow.

The construction companies tend to have higher gross debt to cash flow ratios than the blue chip portfolio. The ratios reached as high as 5 in some years before falling to 3 in 2007. A closer investigation shows that it is the Property group lifting the average, with the Civil group's ratios about the same as the blue chip companies. This may be because the Property group is more capital intensive, and hence requires more investment and debt.

When considering net debt to cash flow however, a better picture is revealed for the construction companies. Once cash was taken into account, the averaged ratios dropped to around 2, and were just slightly above that of the blue chip portfolio's

Ratio	Country	2006	2007
Current ratio	Australia	1.32	1.46
	USA[a]	1.30	–
Quick ratio	Australia	0.93	1.07
	USA[a]	1.20	–

Source: [a]Ellis *et al.*, 2006

Table I.
Comparison between Australian and US construction companies

average. The Civil group performed better than the Property group, a finding consistent with that of net gearing.

Cash flow ratios

Cash flow ratios measure the cash cycle of a company resulting from its business activities. They are mostly used to indicate if a company is likely to experience a shortage of cash, arising from a mismatch between the cash inflow and the cash outflow. Beaver *et al.* (2005), extending the original 1966 work of Beaver) identifies cash flow ratios as the best classifier between failing and surviving companies. This view is supported by Fadel (1977), who demonstrates cash flow ratios' ability to predict future returns. However, optimal levels for these ratios vary depending on industry types and historical practices in collecting and paying funds. Nonetheless, the blue chip portfolio provides a good comparison because the portfolio is well diversified and should represent the best of publicly listed companies.

Receivables to operating revenue and Creditors to operating revenue

Ratios such as receivables to operating revenue and creditors to operating revenue are used to measure the amount of credit given and received by a company. Companies frequently give trade credits to their clients to increase sales, and their proportion of the total revenue is reflected in the receivables to operating revenue ratio. At the same time, companies are given credit periods by their suppliers and subcontractors to pay off their goods and services, and this amount is taken into account in the creditors to operating revenue.

The data show that both the construction companies and the blue chip portfolio have a higher creditor to operating revenue ratio than receivables to operating revenue ratio, and both ratios for the construction companies are higher than the benchmark group. This may be historical industry practice, because construction activities usually take longer to realise gain and hence are given longer periods to complete payment. This explanation is consistent with that suggested by Basha *et al.* (2007), who find that contractors tend to have additional credits granted by both suppliers and the bank. The data indicates that construction companies are financially sound, and are able to secure credit from suppliers at higher levels than required by their own credit customers.

Capital expenditure to operating revenue

The construction companies were found to have a low capital expenditure to operating revenue ratio. There is a clear distinction between the average of the blue chip portfolio and that of the construction companies. Construction companies are generally thought to have large investments in plant, machinery and equipment; however, relative to operating revenue, the cash paid on these items was generally lower than 6 per cent. This implies that construction companies utilise their assets longer (consistent with low depreciation to operating revenue) and require less investment in assets than commonly believed. The blue chip portfolio had ratios mostly around twice that value.

Days inventory, days receivables and days payables

Other measures of efficiency are obtained through days inventory, days receivables and days payables financial ratios.

Days inventory calculates the average number of days it takes for a company to sell its inventory to customers. The construction companies generally took over 60 days to sell off inventory to customers, with the Property group higher than this, and the Civil group lower than this. The blue chip portfolio shows an average of 32 days. This is indicative of the longer operating cycle of construction companies relative to the blue chip companies.

In terms of days receivable and days payable, the construction companies tended to have longer number of days before collection of receivables and payment of payables than the blue chip benchmark. These results are consistent with the previous results for debtors and creditors compared to operating revenue. Over the ten-year period, days receivables for the construction companies increased from 40 to 50 days on average, while days payables increased from 60 to 70 days. In comparison, the blue chip portfolio averaged 25 days and 42 days, respectively.

However, the gap between days payables and days receivables shows that construction companies do better than the blue chip companies on this measurement; construction companies report an average gap of 19 days compared to 17 days reported by blue chip companies. A comparison can also be made between Australian and US construction companies in 2006 and 2007 (see Table II). The gap between days payables and days receivables for Australian construction companies has been much better than that of the US companies, indicating that they are more liquid and less exposed to financial risk.

Conclusion

This paper shows that publicly listed Australian construction companies, over the ten-year period from 1998 to 2007, were some of the most financially stable and liquid companies on the ASX. When compared with the blue chip portfolio, construction companies exhibited longer cash flow cycles, larger operating revenue and higher solvency ratios.

The study has indicated that, contrary to common perception, construction companies perform well, and often better than what are regarded as blue chip companies on the ASX.

Construction companies were found to have strong financial fundamentals, as measured by asset management, debt and cash flow ratios. From asset management ratios, compared to the blue chip portfolio, it can be seen that the construction companies are generally more productive. Higher capital turnover and PPE turnover are the result of their effectiveness in generating significant levels of operating revenue from their assets. This is especially the case for the Civil group. Efficiency in large civil engineering companies is also suggested by Hillebrandt *et al.* (1995) and Ball *et al.* (2000). Results for inventory and asset turnovers show no clear advantage. Such performance in asset turnover could be the result of construction companies expanding and acquiring more assets over time. Another explanation could be that these companies keep high levels of cash, as discussed in the following.

Table II.
Days between payables and receivables comparison between Australian and US construction companies

	2006	2007
Australia	32	22
USA[a]	10	–

Source: [a]Ellis *et al.*, 2006

Companies involved in civil infrastructure activities were generally more productive in generating revenue from their current inventory and other assets. The depreciation to operating revenue ratio does not produce any adverse indicators for the construction companies.

Evidence from debt ratios does not support the common perception that construction companies are heavy borrowers. Not only were their current and quick ratios more favourable than that of the blue chip portfolio, the construction companies actually kept higher levels of cash or cash equivalents. From an accounting perspective, this indicates that they are more liquid than the blue chip portfolio. Higher liquidity means that the construction companies are better prepared to weather unexpected defaults in client payments, longer cash flow cycles, interest rate fluctuations, and industry contractions caused by economic recessions. For example, there was no fall in earnings of construction companies when the industry underwent contraction after the introduction of GST in 2000.

This is reinforced by favourable current and quick ratios. The Civil group in particular had more cash than debt in some of the years. Indeed, there seemed to be no solid evidence that the construction companies were heavy borrowers, or more likely to become insolvent because of debt-servicing problems. For one, their debt levels were the same or lower than that of the most popular companies on the ASX. Further, their debt-servicing abilities were also strong over the ten-year period. These results of high liquidity and sustainable debt levels for the construction companies are consistent with findings by Cheah *et al.* (2004), who proposed that low debt ratios were generally associated with high liquidity ratios, and this was very desirable from an accounting perspective. The results for the construction companies show that they are in a strong financial position with appropriate debt levels. Consequently, it can be viewed that these publicly listed construction companies are financially secure (Mason and Harris, 1979).

While the analysis of cash flow ratios suggests a long cash flow cycle for the construction companies, there is a strong linkage between the cash inflow and the cash outflow. This represents stability in cash flow. Also, the number of days to collect funds from the debtors has always been shorter than the number of days to pay the creditors over the past ten years. This means liquidity is not an issue. The general characteristics of construction companies emerge as ones with more creditors than debtors, longer cash cycles, and longer days inventory.

Comparisons were made between Australian and the US construction companies in 2006 and 2007. These observations demonstrate that Australian construction companies are more liquid and exposed to less financial risk than their US counterparts.

Future research

The paper demonstrates generally sound financial health of construction companies. Some suggestions were given for such performance. However examining the underlying reasons in greater depth would provide further understanding of construction company performance.

There is also the issue of how geographically localised are the results. Cheah and Yee (2006) demonstrated empirically the distinction of contractors' growth trends between continents.

The global financial crisis in 2008 occurred after the study period, but its impact on construction companies would be interesting to analyse.

References

Abdul-Rasheed, A. and Tajudeen, A. (2006), "Performance analysis of listed construction and real estate companies in Nigeria", *Journal of Real Estate Portfolio Management*, Vol. 12 No. 2.

Abidali, A. and Harris, F. (1995), "A methodology for predicting company failure in the construction industry", *Construction Management and Economics*, Vol. 13, pp. 189-96.

Akintoye, A. and Skitmore, M. (1991), "The profitability of UK construction contractors", *Construction Management and Economics*, Vol. 9, pp. 311-25.

Argenti, J. (1983), "Predicting corporate failure", *Accountant Digest*, Vol. 138.

Asenso, H.O. and Fellows, R.F. (1987), "Profitability and size of UK contractors", *Building Technology and Management*, March, pp. 19-20.

Ball, M., Farshchi, M. and Grilli, M. (2000), "Competition and the persistence of profits in the UK construction industry", *Construction Management and Economics*, Vol. 18, pp. 733-45.

Barnes, P. (1987), "The analysis and use of financial ratios: a review article", *Journal of Business Finance of Accounting*, Vol. 14 No. 4.

Basha, I., El-Yamany, A. and Zayed, T. (2007), "Performance evaluating model for construction companies: Egyptian case study", *Journal of Construction Engineering and Management*, Vol. 133 No. 8, pp. 574-81.

Beaver, W., McNichols, M.F. and Rhie, J. (2005), "Have financial statements become less informative? Evidence from the ability of financial ratios to predict bankruptcy", *Review of Accounting Studies*, Vol. 10 No. 1, pp. 93-122.

Beaver, W.H. (1966), "Financial ratios as predictors of failure, empirical research in accounting: selected studies", *Journal of Accounting Research*, pp. 71-111.

Bloomberg (n.d.), *Bloomberg Terminal*, available at: www.bloomberg.com/ (accessed 21 September 2008).

Cheah, C. and Yee, C. (2006), "Fundamental analysis of profitability of large engineering and construction firms", *Journal of Management in Engineering*, Vol. 22 No. 4, pp. 203-10.

Cheah, C., Garvin, M. and Miller, J. (2004), "Empirical study of strategic performance of global construction firms", *Journal of Real Estate Portfolio Management*, Vol. 130 No. 6, pp. 808-17.

Curtin, J.J. (1993), *The Basic Bond Book*, Associated General Contractors of America and National Association of Surety Bond Producers, Washington, DC.

DatAnalysis (n.d.), *DatAnalysis*, AspectHuntley, Sydney, available at: www.aspecthuntley.com.au/af/dathome?xtm-licensee=dat (accessed 15 June 2008).

Edum-Fotwe, F., Price, A. and Thorpe, A. (1996), "A review of financial ratio tools for predicting contractor insolvency", *Construction Management and Economics*, Vol. 14 No. 3, pp. 189-98.

Ellis, M., Earl, R. and Evans, K. (2006), *CFMA's 2006: Financial Survey Results. In Accounting and Reporting CFMA – BP*, Construction Financial Management Association, Princeton, NJ.

Ellis, M., Earl, R. and Evans, K. (2007), *CFMA's 2007: Construction Industry Annual Financial Survey. In Accounting and Reporting CFMA – BP*, Construction Financial Management Association, Princeton, NJ.

Fadel, H. (1977), "The predictive power of financial ratios in the british construction industry", *Journal of Business Finance & Accounting*, Vol. 4 No. 3, pp. 339-52.

FinAnalysis (n.d.), *FinAnalysis*, AspectHuntley, Sydney, available at: www.aspecthuntley.com.au/af/finhome?xtm-licensee=finanalysis (accessed 29 July, 2008).

Fraser, L. and Ormiston, A. (2007), *Understanding Financial Statements*, 8th ed., Prentice-Hall, Englewood Cliffs, NJ.

Hall, M. and Weiss, L.W. (1967), "Firms size and profitability", *Review of Economics and Statistics*, pp. 319-31.

Harris, F. and McCaffer, R. (1995), *Modern Construction Management*, Blackwell Science, Oxford.

Hillebrandt, P., Cannon, J. and Lansley, S. (1995), *The Construction Company in and out of Recession*, Macmillan, London.

Hood, J., Fraser, I. and McGarvey, N. (2006), "Transparency of risk and reward in UK public-private partnerships", *Public Budgeting & Finance*, Vol. 26 No. 4, pp. 40-58.

Horrigan, J. (1968), "A short history of financial ratio analysis", *The Accounting Review*, Vol. 43 No. 2, pp. 284-94.

Kangari, R., Farid, F. and Elgharib, H. (1992), "Financial performance analysis for the construction industry", *Journal of Construction Engineering and Management*, Vol. 118 No. 2, p. 349.

Langford, D., Iyagba, R. and Komba, D. (1993), "Prediction of solvency in construction companies", *Construction Management and Economics*, Vol. 11, pp. 317-25.

Lea, E. and Lansley, P. (1975), "Management for survival", *Building*, 21 March, pp. 103-6.

McCabe, B. and Pilateris, P. (2003), "Contractor financial evaluation model (CFEM)", *Canadian Journal of Civil Engineering*, Vol. 30 No. 3, p. 487.

McCall, J. (2006), "Understanding a contractor's financial statement", *Risk Management Association, Philadelphia, PA*, pp. 1-17.

Mason, R.J. and Harris, F.C. (1979), "Predicting company failure in the construction industry", *Proceedings Institution of Civil Engineers*, Vol. 66, pp. 301-7.

Mintzberg, H. and Waters, J.A. (1989), "Of strategies, deliberate and emergent", in Asch, D. and Bowman, C. (Eds), *Readings in Strategic Management*, Macmillan, London, pp. 5-19.

Padget, P. (1991), *Accounting in the Construction Industry*, CIMA, London.

Pamulu, M.S., Kajewski, S. and Betts, M. (2007), "Evaluating financial ratios in the construction industry: a case study of indonesian firms'", *Proceedings 1st International Conference of European Asian Civil Engineering Forum (EACEF), Jakarta*, p. E-158.

Samuel, J.M. and Smith, D.J. (1968), "Profits, variability of profits and firms' size", *Economica*, May, pp. 127-39.

Singh, A. and Whittington, J. (1968), *Growth, Profitability and Valuation*, Occasional Paper 7, Cambridge University Press, Cambridge.

Singh, D. and Tiong, R. (2006), "Evaluating the financial health of construction contractors", *Municipal Engineer*, Vol. 159, ME3, pp. 161-6.

SIRCA (n.d.), *SIRCA (Securities Industry Research Centre of Asia-Pacific)*, SIRCA, Department of Education, Science and Training of Australian Government, Sydney, available at: www.sirca.org.au/uni/index.html (accessed 19 June 2008).

Solomon, E. and Pringle, J.J. (1980), *An Introduction to Financial Management*, Goodyear Publishing, Santa Monica, CA.

Wagle, M. (2006), "The meltdown in May pulled down valuations of most stocks", *Business Standard*, 18 September.

Appendix 1. Ratio formulae

Asset management ratios

$$\text{Capital turnover} = \frac{\text{Operating revenue}}{\text{Operating invested capital before goodwill}}$$

$$\text{Inventory turnover} = \frac{\text{Operating revenue}}{\text{Current inventory}}$$

$$\text{Asset turnover} = \frac{\text{Operating revenue}}{\text{Total assets}}$$

$$\text{Property, plant and equipment (PPE) turnover} = \frac{\text{Operating revenue}}{\text{PPE} - \text{Accumulated depreciation}}$$

$$\text{Depreciation to operating revenue} = \frac{\text{Depreciation}}{\text{Operating revenue}}$$

Debt and safety ratios

$$\text{Gross gearing} = \frac{\text{Short-term debt} + \text{Long-term debt}}{\text{Shareholders' equity}}$$

$$\text{Net gearing} = \frac{\text{Short-term debt} + \text{Long-term debt} - \text{cash}}{\text{Shareholders' equity}}$$

$$\text{Financial leverage} = \frac{\text{Total assets}}{\text{Shareholders' equity}}$$

$$\text{Net interest expense cover} = \frac{\text{Earnings before interest and tax}}{\text{Interest expense}}$$

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Current inventory}}{\text{Current liabilities}}$$

$$\text{Gross debt to cash flow} = \frac{\text{Short-term debt} + \text{Long-term debt}}{\text{Gross cash flow}}$$

$$\text{Net debt to cash flow} = \frac{\text{Short-term debt} + \text{Long-term debt} - \text{Cash}}{\text{Gross cash flow}}$$

where Cash flow = NOPLAT + depreciation.

Cash flow ratios

$$\text{Receivables to operating revenue} = \frac{\text{Debtors}}{\text{Operating revenue}}$$

$$\text{Creditors to operating revenue} = \frac{\text{Current creditors}}{\text{Operating revenue}}$$

$$\text{Capital expenditure to operating revenue} = \frac{\text{Cash paid for PPE}}{\text{Operating revenue}}$$

$$\text{Days inventory} = \frac{\text{Current inventory}}{\text{Operating revenue}} \times \text{Days in financial year}$$

$$\text{Days receivables} = \frac{\text{Debtors}}{\text{Operating revenue}} \times \text{Days in financial year}$$

$$\text{Days payables} = \frac{\text{Creditors}}{\text{Operating revenue}} \times \text{Days in financial year}$$

Appendix 2

	June 1998	June 1999	June 2000	June 2001	June 2002	June 2003	June 2004	June 2005	June 2006	June 2007
Capital turnover										
Construction companies	5.46	7.64	9.26	6.92	7.92	13.04	8.95	6.82	7.52	8.63
Blue chip portfolio	3.35	3.42	4.19	4.30	4.99	4.98	5.52	4.13	4.40	4.33
Inventory turnover										
Construction companies	32.85	26.57	28.41	19.40	27.15	32.20	32.44	18.88	17.47	28.07
Blue chip portfolio	19.32	23.94	19.68	19.06	27.74	24.01	27.30	29.27	30.21	23.29
Asset turnover										
Construction companies	1.64	1.84	1.51	1.58	1.66	1.77	1.48	1.36	1.35	1.37
Blue chip portfolio	1.66	1.71	1.76	1.74	1.81	1.86	1.99	1.91	1.71	1.63
PPE turnover										
Construction companies	9.33	10.38	7.32	7.73	9.29	10.29	10.18	8.35	9.94	11.69
Blue chip portfolio	3.63	3.56	3.80	3.91	4.23	4.37	4.76	4.33	4.67	4.41
Depreciation to operating revenue (%)										
Construction companies	1.61	1.87	2.42	2.10	1.87	1.51	1.75	1.53	1.40	1.34
Blue chip portfolio	14.7	7.73	7.34	7.33	7.54	9.44	6.94	5.65	5.94	5.90

Table AI.
Summary of asset management ratios

Appendix 3

Table AII.
Summary of debt and safety ratios

	June 1998	June 1999	June 2000	June 2001	June 2002	June 2003	June 2004	June 2005	June 2006	June 2007
Gross gearing										
Construction companies	68.09	66.37	101.01	71.36	60.87	56.80	65.73	87.94	69.10	72.31
Blue chip portfolio	74.19	84.98	74.41	74.55	64.55	66.55	48.57	59.92	54.09	76.89
Net gearing										
Construction companies	27.28	34.49	63.27	40.98	28.11	23.46	31.71	55.24	24.48	21.76
Blue chip portfolio	57.89	69.64	59.89	57.95	44.54	49.27	36.76	46.51	44.39	64.94
Financial leverage										
Construction companies	3.75	3.54	3.53	3.06	3.23	2.93	2.91	3.18	2.89	3.09
Blue chip portfolio	2.76	3.01	2.84	2.83	2.81	2.71	2.55	2.85	2.81	3.06
Net interest expense cover										
Construction companies	20.59	9.10	11.36	9.76	15.64	10.23	7.65	7.93	15.53	15.48
Blue chip portfolio	7.14	7.71	9.13	12.00	8.39	9.93	12.69	17.86	20.41	13.93
Current ratio										
Construction companies	1.36	1.49	1.38	1.36	1.36	1.37	1.49	1.32	1.32	1.46
Blue chip portfolio	1.09	1.04	0.81	0.88	0.92	1.04	1.04	1.09	0.93	0.89
Quick ratio										
Construction companies	1.12	1.10	0.85	0.84	0.92	0.86	1.06	0.87	0.93	1.07
Blue chip portfolio	0.48	0.44	0.41	0.50	0.53	0.60	0.60	0.67	0.53	0.53
Gross debt to cash flow										
Construction companies	2.83	1.92	4.99	3.35	2.64	2.75	3.07	4.85	3.46	2.99
Blue chip portfolio	2.11	1.98	1.61	1.78	1.67	1.36	1.19	1.33	1.65	2.67
Net debt to cash flow										
Construction companies	1.40	1.07	2.58	1.65	1.28	1.43	1.44	3.56	2.03	1.74
Blue chip portfolio	1.74	1.71	1.34	1.45	1.21	1.03	0.71	0.94	1.15	1.86

Appendix 4

	June 1998	June 1999	June 2000	June 2001	June 2002	June 2003	June 2004	June 2005	June 2006	June 2007
Receivables to operating revenue (%)										
Construction companies	10.98	8.73	15.16	12.87	15.01	11.63	12.05	15.10	13.03	13.30
Blue chip portfolio	5.95	7.06	7.24	8.04	7.15	7.02	6.49	5.72	5.88	7.44
Creditors to operating revenue (%)										
Construction companies	16.33	13.58	19.02	16.57	18.12	20.33	17.52	19.29	21.69	19.32
Blue chip portfolio	11.80	10.64	10.82	10.93	11.60	11.44	10.18	10.31	11.62	14.12
Capital expenditure to operating revenue (%)										
Construction companies	6.75	5.45	5.66	3.10	2.53	2.58	4.97	4.29	3.98	7.50
Blue chip portfolio	12.80	12.14	9.79	13.01	11.09	11.38	10.69	9.88	12.49	12.86
Days inventory										
Construction companies	26.28	33.21	89.43	65.41	56.80	69.60	60.20	90.31	83.85	62.46
Blue chip portfolio	33.47	37.92	37.40	36.13	33.10	33.73	30.89	24.62	25.45	31.14
Days receivables										
Construction companies	40.06	31.87	48.69	46.97	54.78	42.46	43.98	55.13	47.57	48.55
Blue chip portfolio	21.70	25.76	27.52	29.35	26.10	25.64	23.69	20.87	21.46	27.15
Days payables										
Construction companies	59.61	49.56	52.55	60.50	66.15	74.20	63.94	70.43	79.16	70.52
Blue chip portfolio	43.07	38.82	40.87	39.89	42.34	41.77	37.16	37.64	42.40	51.55

Table AIII. Summary of cash flow ratios

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