

ASSESSING CORPORATE ECONOMIC DISTRESS: A STUDY OF THE WOOD CONSTRUCTION INDUSTRY

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Abstract:

Wood buildings are considered as a viable option to support the effort minimizing the current housing shortage in Sweden. Companies trying to develop into this industry are needed to increase the use of prefabricated wooden elements, volumes or modules in an industrialized way. Suitable companies to make this development could be found amongst firms producing wooden single-family houses. These companies currently act on a highly competitive market with many companies offering relatively homogeneous products or services. Therefore, differentiation towards the wooden multi-family house industry could be considered as a long-term strategy, minimizing the economic distress and improving the survival of the company.

The study is aiming at describing the development of economic distress and market concentration ratio in the Swedish industry for wooden single-family houses, for an eleven-year period from 2005 to 2015. The companies could be helped to understand, if and how the market concentration ratio and the economic distress are connected, linking company size to economic stability and efficient resource utilization. This will be conducted by applying Altman's Z'-score model, grouping firms into a risk, a grey or a safe zone, combined with calculating the industry structure by means of the concentration ratio model. The required data were collected from the annual reports of the 51 relevant firms in the industry.

Key words: *wooden single-family houses; industry structure; concentration ratio; economic distress; Z-score model; wooden multi-family houses.*

THE SWEDISH WOOD CONSTRUCTION INDUSTRY

The focus on finding green solutions have been an ambition of the EU, which have come to fruition in their development of the Europe 2020 strategy. The strategic aim is to create smart, sustainable economies for the citizens within the European Union (EU 2011, COM 2020). Hence, they have made recommendations to increase the use of wood in constructions linking it to enhanced focus on sustainable solutions. However, the EU has communicated no formal policies that specify the utilization of wood as a building material, which would be considered particularly crucial for the Swedish economy when increasing the building production during the next five years (FORMAS 2012; NRA 2012).

Sweden has been confronted with a high level of housing shortage during the past decade, which can develop into a problem regarding social unrest and segregation. This problem has been magnified by the continuous long-term increase of house prices in Sweden, which further enhances the problem since younger people with lower incomes have greater difficulties finding suitable accommodation. Furthermore, the general movement of people within Sweden can be restricted, which could have an effect on the general financial development in Sweden. According to the National Board of Housing, Building and Planning (Boverket) is it estimated that approximately 40 000 – 60 000 new housing units per annum are required to be constructed, to change this trend within the next five-year period (Boverket 2012). However, according to the Swedish National Trade Association for Wood and Furniture (TMF), the production during the period 2009 – 2015 was approximately 20 000 – 35 000 housing units per annum (TMF 2016a). Despite this development phase in comparison to the general production requirements of housing units, have an increase during the last years been noticed. Hence, the projected number for 2016 was estimated to between 35 000 – 40 000 housing units (TMF 2016b). However, the increased production of housing units is required to develop further if the projected demand during 2012 until 2025, with over 700 000 housing units shall be

accomplished. The primary part of this development, 74%, is restricted geographically to the three big city areas, Malmö, Gothenburg and Stockholm (Boverkets 2015).

The projected development supports a change from the traditional building materials towards a greater focus on wood solutions. Currently, concrete makes up 89% of the building material used within the Swedish industry producing multi-family houses, whereas wood solutions only constitute close to 9% of the market (TMF 2016a). Therefore, the positive environmental benefits should also be considered when evaluating wood as a suitable construction material for multi-family houses. Thus, enabling the increased development of sustainable building solutions for multi-family houses in Sweden (Nord and Widmark 2010; Schauerte et al. 2014).

Besides the environmental aspects, a benefit utilizing wood in the construction of multi-family houses is the development of onsite assembly methods. The investigated companies are well familiar with this production and assembly process since they have utilized this methodology for a long time (Schauerte 2010). Furthermore, it has also been indicated to be more beneficial regarding cost savings, quality, work environment and logistics than those related to onsite construction (Stehn and Brege 2007; Mahapatra and Gustafsson 2008).

Despite these benefits, as displayed by producers of wooden single-family houses, currently, a limited number of companies within the industry for wooden multi-family houses take full advantage of the possibilities associated with a higher degree of prefabrication (Stehn and Brege 2007). This could be an explanation for the problems related to inefficiency, relatively low productivity and increased production costs within the industry (Schauerte et al. 2013). Therefore, companies producing single-family houses are required to deal with these issues if they successfully shall establish themselves producing wooden multi-family house.

The problems associated with diminishing productivity and profitability are not only related to an inefficient production but also to shifting market conditions. According to TMF (2016b), from 2007 to 2012, the number of finalized wooden single-family houses in Sweden decreased from about 12 100 units to 4 800 units per annum. Furthermore, the existing production methodology and structure has also led to increased production costs and a low degree of resource utilization. The production costs/m² have increased from 16 258 SEK in 2001 to 30 988 SEK in 2015 (SCB 2017), i.e. an increase of around 91 % in nominal value, as described in Table 1.

Table 1

<i>Development of production cost/m²</i>					
Year	2001	2002	2003	2004	2005
Production cost/m ²	16 258 kr	16 691 kr	17 966 kr	19 198 kr	19 684 kr
% change (based on 2001)		2,7%	10,5%	18,1%	21,1%
Year	2006	2007	2008	2009	2010
Production cost/m ²	20 484 kr	22 985 kr	25 107 kr	24 745 kr	26 011 kr
% change (based on 2001)	26,0%	41,4%	54,4%	52,2%	60,0%
Year	2011	2012	2013	2014	2015
Production cost/m ²	28 221 kr	27 042 kr	28 747 kr	31 064 kr	30 988 kr
% change (based on 2001)	73,6%	66,3%	76,8%	91,1%	90,6%

For companies producing wooden single-family houses to differentiate the product and develop into the market for multi-family houses is however connected with investments and risk taking. Also, there is a requirement for production efficiency to improve the competitiveness and profitability of the company (Besanko et al. 2013; Bottazzi et al. 2008). However, many producers of wooden single-family houses may face profitability issues, resulting in financial problems, while converting to new production systems accommodating multi-family building solutions.

OBJECTIVE

The main purpose of this study is to investigate if any connection exists between the corporate economic distress and the concentration ratio of Swedish companies producing wooden single-family houses. Here, two objectives are identified. First, by using the latest available economic figures conduct an evaluation of the corporate economic distress over a period of some years, which will reveal insights into existing trends or tendencies. Secondly, an assessment of the market structure by evaluating the

concentration ratio of the companies included in the study, which will provide an understanding of the market diversification.

Hence, it is important to assess the participating companies' potential to make investments over time and if the concentration ratio affects the company ability for investments and long-term efficient resource utilization.

THEORETICAL BASE

Industries are constantly developing and changing in character, which creates challenges that need to be addressed by the companies, determined by the specific situation for that industry. Therefore, having the ability to generate a comprehensive understanding of the industry, based on an in-depth understanding of the market structure, provides necessary support when developing a suitable company strategy. This is commonly measured through the industry concentration, which can be described as the degree of concentration relating to the output of all firms in that industry (Rhoades 1993), or more commonly mentioned as the concentration of companies. The industry concentration can be measured by identifying the companies' relative position on the market, also known as market share (Besanko et al. 2013). One of the most commonly used methods to measure market structure or market concentrations is the company deposit Concentration Ratio (CR_n) (Al-Muharrami and Matthews 2009).

The market structure model identifies the level of concentration on a specific market or industry, by understanding the Concentration Ratios (CR_n) between the companies on the market. The market concentration is calculated by the total sum of turnover for all companies within a market or industry, in combination with the turnover of the company (Matthes and Poetzsch 2002), see Equation (1):

$$CR_n = \sum_{i=1}^n x_i \quad (1)$$

where: the CR_n describes the n largest firms competing on the specific market, generating x_i market share (%) for these companies (Matthes and Poetzsch 2002). The maximum value for CR_n is 100%, which suggests a very dominant market position comparable to a monopoly situation.

The German Federal Cartel Office (2013) have identified three levels of concentration ratios, stating that companies on a market are presumed to be dominant if one company exceeds 33.3%, or if three or fewer firms, reaching a combined market share of 50.0%, or if the market consists of five or fewer firms reaching a combined market share of 66.7%.

There are several different methods available to measure corporate economic distress. However, according to Crouhy et al. (2001), four models are most commonly applied: models based on discriminant analysis, linear probability models, probit models and logit models. The goal of these models is to find ways to predict bankruptcy, which has been the focus of many studies conducted by different authors, such as Edmister (1972), Shumway (2001), Hillegeist et al. (2004) and Elliott et al. (2014). However, recently Altman's Z-score model have been used more extensively by researchers and financial analysts due to its prediction accuracy (Elliott et al. 2014 and Gunathilaka 2014). The Z-score model is based on multiple linear discriminant analysis, which could indicate that a firm will turn bankrupt within two years and the accuracy of these forecasts was varying between 75 % and 90 % (Altman et al. 2014).

Altman's original Z-score model included five variables, which were chosen based on their contribution to prediction accuracy and their inter-correlation (Altman 1968). However, this model was developed for publically listed companies and had to be further developed to allow for private industry companies to be included as well. Adjusting the old model to the new Z'-score, Altman replaced variables towards a more suitable approach for private firms. The resulting model is shown in Equation (2) (Altman 1983):

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.42X_4 + 0.998X_5 \quad (2)$$

where: these five ratios belong to different key economic classifications, i.e. liquidity, profitability, leverage, solvency and activity and can be interpreted as follows:

X_1 : working capital/total assets. Working capital is calculated as current assets minus current liabilities. Total assets include all assets on the balance sheet. This ratio describes company's liquidity related to its size and its ability to meet short-term debts (Al-Rawi et al. 2008).

X_2 : retained earnings/total assets. Measuring retained earnings gives a picture of what actions companies have taken regarding its profits. This ratio reflects a company's aggregate profitability over time since research showed that the risk for failure of companies is related to the age of the company (Dun & Bradstreet 1994, Eidleman 1995).

X_3 : EBIT/total assets. EBIT measures profitability or earnings before interests and taxes. This ratio reflects a firm's earning power of its assets excluding the one-time effect of interest and taxation (Muthukumar and Sekar 2014).

X_4 : book value equity/total liabilities. The book value of all assets is measured in relation to the total amount of company debts. If the equity book value of a company is less than its total liabilities, a firm can become insolvent in the short run and bankrupt in the long run (Taurell and Augustsson 2012).

X_5 : sales/total assets. This measures the asset's sales generating capacity, also referred to as the manufacturing capacity of the company's assets (Taurell and Augustsson 2012) or more commonly the management's capability to compete on the market (Muthukumar and Sekar 2014, Altman et al. 2014).

Thereafter, the calculated values for the independent variables X_1 to X_5 are multiplied with the respective discriminant coefficients according to Equation (2). The resulting Z'-score is interpreted according to pre-established cut-off scores or zones, as presented in Fig. 1.

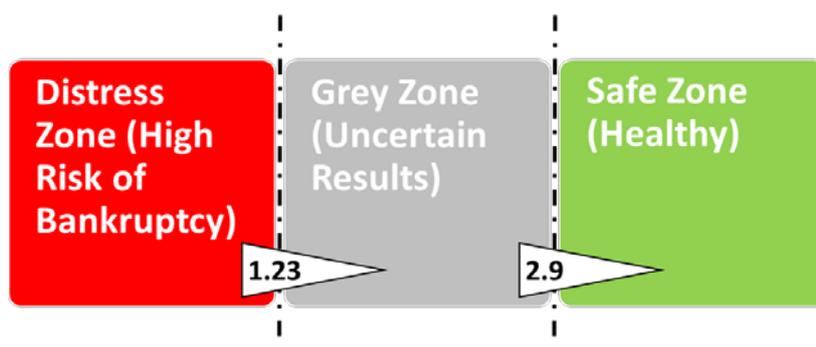


Fig. 1.
Z'-Score Classification Areas and cut-off levels (Altman et al. 2013).

Fig. 1 display three classification zones with their respective cut-off scores. If a company present a Z'-score below 1.23 indicates that the company is in the distress zone and probably will face bankruptcy, unless appropriate actions are taken by the management within the company. However, a company that displays a Z'-score between 1.23 and 2.9 find themselves in a grey zone, i.e. a relatively unpredictable situation based on the financial results. Finally, Z'-scores of 2.9 or higher indicate that companies' financial situations can be regarded as healthy. These companies face a situation with minor economic risk and have promising potential for future development (Altman 2001). These categories, as presented in the Z'-score model can function as support during the development of investment strategies or market positioning activities for the individual company.

DATA COLLECTION

The companies included in this study were required to be producers of wooden single-family houses and to be located in Sweden. The selection process was initially initiated through an online statistical database for Swedish wooden single-family houses. The resulting list of companies was further edited by removing companies that were too small regarding employees. As a cut-off level, ten employees were chosen. This resulted in a list of 51 companies. Different ownership models between these companies were not considered.

Since sensitive competitive relationships exist between these companies, disclosing economic positions of the specific companies could be used for competitive actions on the market. Therefore, no names of firms are revealed in this study and the companies are handled as anonymous units of analysis.

For the chosen 51 companies, all necessary economic data to calculate the Z'-score and the CR_n according to Equation (1) and (2) was collected from their balance sheets for the years 2005 to 2015. This eleven-year period was chosen since balance sheets for that period were publically available in an online database at the time.

RESULTS AND DISCUSSION

In order to highlight the development of economic distress and market concentration ratios and their possible interdependencies. The Altman's Z'-score model and concentration ratio approach were used, accomplished by grouping the companies into concentration ratio groups. Firstly, the CR_1 group consisted of companies with the largest market share, the CR_3 group including companies with the three largest market shares and finally the CR_5 group with firms having the five largest market shares. Besides a descriptive analysis, a simple regression analysis based on Fixed Effect model was carried out.

As shown in Fig. 2 the Altman's Z'-score value (total average) of 51 enterprises remains above Altman's High score, except for two years in the middle of the period, the average being 3,6. The last years indicate an increase towards the levels at the beginning of the measured period.

As to Z' scores of CR₁, CR₃ and CR₅ their average value over the period do not significantly differ from the sample average. The overall impression is that they fluctuate around the mean Z' score value, except Z' score of CR₁, which shows a remarkable variation and clearly a decreasing trend, but still remaining within Altman's grey uncertain zone towards the end of the period. The Z' score values for the CR₃ and CR₅ groupings tend to slightly decrease but remain around Altman's High score limit towards the end of the period.

One reason for higher Z' score values of the CR₃ and CR₅ groupings should be, among others, the fact that these (average values) consist of underlying companies' Z' score values. By scrutinizing instead individual Z' scores of, e.g. the five largest companies highlights clearly that the annual amplitudes over the period are quite large and for example the Z' score values of CR₃ and CR₅ (here as single companies' individual values) reach Z' scores within the distress zone in some few occasions; i.e. below Altman's Low score value (Fig. 2). For these five companies their market shares; i.e., concentration ratios have remained relatively stable over the period resulting in the same rank of market shares in-between the companies.

Thus, it turns out that the development of economic distress and market share (market concentration ratio, CR) do not indicate any drastic changes/movements from 2005 to 2015 among companies constituting CR₁, CR₃ and CR₅ groupings and their Z' score values. Possibly one can notice a slightly decreasing trend of Z' scores including some recovery at the end of the period. Also, the enterprises forming CR₁, CR₃ and CR₅ groupings seem to be stationary; i.e. keeping their CR_n ranking, respectively.

In order to further explain eventual relation (dependency) of Z' scores of market shares (concentration ratio concept) a simple regression analysis accomplishing the Fixed Effect model on panel data was carried out. By selecting this approach, the number of observations could be increased for the purposes of regression analysis. The outcome of the regressions was that applying a so-called individual effects model approach the estimated model could explain 27 % (adj. R²) of variation in Z' scores. Regardless of the low explanatory power in the estimated model $Z' = 1.987 + 0.489^{***}CR$ the concentration ratio (CR) turned out to be a significant explanatory variable indicating that a unit change of CR would lead to an average 0,489 increase of Z' score value.

Still another fixed effect model approach exploring time effects resulted in the equation $Z' = 0.578 + 0.212CR^{**}$ where CR again turned out to be a significant explanatory variable though with somewhat lower significancy compared with the previous one. As well the explanatory power was low, only 11 % of the variation in Z' scores. A combination of individual and time effects model gives the equation $Z' = 2.074 + 0.676^{**}CR$ with an explanatory power of 20 % and the CR being a significant explanatory variable.

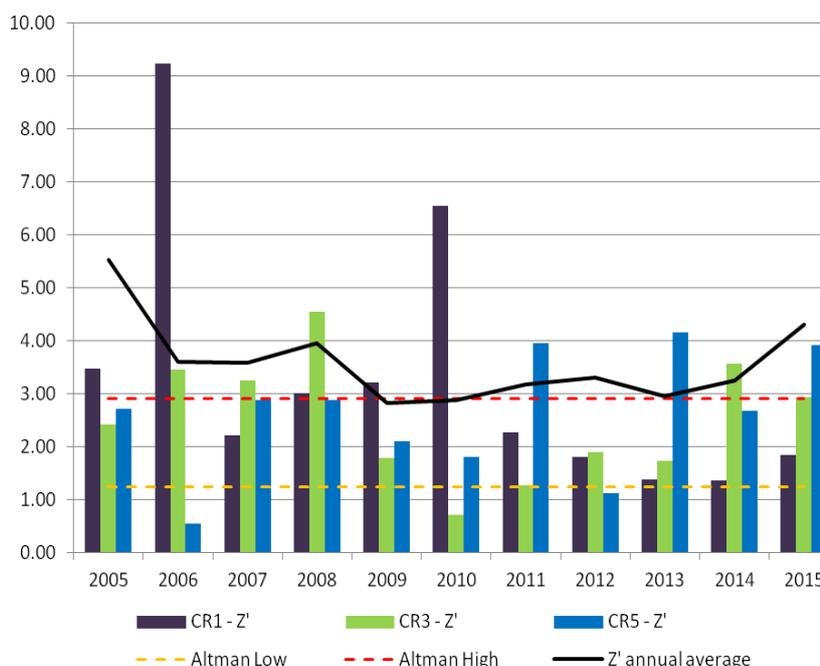


Fig. 2.

Altman's Z' scores for groupings CR₁, CR₃, CR₅ and the average Z' value for the total sample of 51 companies, including Altman High and Low limits.

CONCLUSIONS

The aim of this study was to investigate if any correlation exists between the market concentration ratios of the CR₁₋₅ companies and an economic distress model for the Swedish companies producing wooden single-family houses. This was conducted using economic figures derived from the companies' annual reports over an eleven-year period. Thereby reveal if any existing trends or correlations exist. Also, provide insight regarding company size, and its possible effect on the economic situation. This could have a contributing effect on companies' ability to make suitable investments, market development activities and product development towards the wooden multi-family house industry, in comparison to companies with smaller market shares.

However, the result has not been able to clearly demonstrate any correlation between the concentration ratio model and the economic distress model demonstrated by Altman's Z'-scores. Despite any clear link between the market share of the company and its financial health, significant explanatory values have been established for then various models independently, even if the significant explanatory power have been low. Hence, a reason for the uncertainty demonstrated when reviewing the correlation between the models, and the significance of each model independently could be derived from the recent financial recession. This period has provided a financially uncertain situation for main companies, forcing them to take actions in line with a financially challenging situation i.e. depleting its equity and making limited developments of fixed assets due to general financial constraints.

However, the result shows that those companies with a large market share, as demonstrated by the CR₁₋₅ companies, have greater ability to absorb a long financial recession due to its initial high equity levels and fixed assets, compared to companies with a smaller market share. Therefore, the general financial situation and the strength demonstrated by the market share for the largest five companies included into the study generates a fairly good potential for these companies to invest in production development and product development, supporting an entry to the segment for wooden multi-family houses.

Further research can offer comprehensive information about how the equity and fixed asset levels within companies producing wooden single-family houses can sustain and support long-term financial recession and how these are linked to the companies' ability to provide a stable revenue.

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