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INDUSTRY STRUCTURE AND RISK POSITIONS FOR WOODEN SINGLE-FAMILY HOUSE FIRMS IN SWEDEN: EVALUATING THEIR POTENTIAL TO ENTER THE MULTI-FAMILY HOUSE SEGMENT

Tobias Schauerte\textsuperscript{1}, Fredrik Lindblad\textsuperscript{2}, Jimmy Johansson\textsuperscript{3}

\textbf{ABSTRACT:} Housing shortage has become a serious issue in Sweden and too little firms are offering solutions for multi-family houses in wood. Possible firms to enter that segment are those currently producing wooden single-family houses. The aim of this paper is to explore the potential of these firms to enter that segment, which is linked to investments in production development, and investigated by mapping the industry structure for sellers, describing the financial situation of the firms and their risk position. Using the Herfindahl-Hirschman index, the Herfindahl-Hershaman number equivalent, Altman’s Z’ value and a risk position model for 51 investigated firms, the results show that the industry is perfect competitive with too many firms involved. Further, the majority of the firms have favourable financial prerequisites and risk positions to invest in production development, in order to produce prefabricated wooden multi-family houses as well.

\textbf{KEYWORDS:} Wooden Houses, Industry Structure, Financial Performance, Risk Position, Product Relatedness

\section{MARKET AND INDUSTRY FOR WOODEN HOUSES IN SWEDEN}

During the past decades, housing shortage in Sweden accumulated to a level implying severe societal problems in general, and combined with continuously rising housing prices, these problems especially occur for younger people with relatively low income, constituting problems related to social welfare. In order to remove that shortage, approximately 40 000 – 60 000 new housing units need to be built in a five year period [1]. However, according to the Swedish national Trade Association for wood and furniture (TMF), only between around 20 000 to 25 000 housing units per annum have been finalized in the past few years [2], i.e. the shortage still increases.

Considering wood as an appropriate construction material for multi-family houses [3], or even as today’s most promising material considering its environmental advantages [a.o.4], more wooden multi-family houses should be built in Sweden. In 2012, the market share for wooden multi-family houses was 10.1 \%, exclusive student dormitories and sheltered housing [4]. This means an increase by 53 \%, compared to the share of 6.6 \% in 2011. Yet, a much higher share of 15 \% up to 20 \% was reported or expected until now [5-8]. Widman [9] even forecasts that wood consequently will outperform competing materials and increase its market share to about 30 \% in 2020.

In order for these numbers to become true, various challenges need to be mastered. Besides technical issues related to the disadvantages of the construction material wood, like, for example, structural acoustic vibrations [10] or stabilizing structures [11], other problems exist that are related to the market structure and firms on that market.

As purchasers and researchers denote, the number of actual firms on the market offering building systems for wooden multi-family houses and taking advantage of the possibilities connected to a higher degree of industrialized building is too low [a.o.12]. Industrialized building is characterized by offsite construction [13], where parts of the house are prefabricated as elements, modules or volumes that finally are assembled onsite. This way of production has been suggested being more beneficial compared to onsite construction, for example in terms of cost savings and improvements in quality, internal and external logistics and working environment [12, 14].
A segment in the Swedish building industry where offsite production and onsite assembly is being applied for a long time is the segment for wooden single-family houses [15]. Wood as construction material traditionally dominates the market for single-family houses with around 85 – 90 % market share [16]. Firms operating in this segment accentuate the potential of wood in prefabrication and industrialized building and should therefore be seen as potential firms entering the market segment of wooden multi-family houses [12]. It could be argued that elements, volumes or modules, prefabricated for single-family houses, as well could be used to assemble multi-family houses. This implies that constructional challenges do not constitute bottlenecks, which is a limitation of this study. In that way, single-family house firms would benefit from economies of scale and scope, using their professional expertise to enter the market segment for multi-family houses and contributing to finding a solution for the Swedish supply shortfalls of housing units.

Thus, the overall aim of this study is to explore the potential of Swedish firms producing wooden single-family houses to enter the market for wooden multi-family houses.

However, this might not be frictionless. To start with, not many firms fully utilize the possibilities and advantages of prefabrication and industrialized building [17, 18]. Production facilities in usage range from manual to semi-automated, even though full-automated solutions exist. This indicates that firms in the Swedish industry for single-family houses are dragging behind other industries in production development, which in turn was suggested to be one explanation for problems related to inefficiency, relatively low productivity and increasing production costs [16, 19].

Productivity problems may as well be rooted elsewhere. 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 [20], which equals 60 % and mainly can be regarded as recession-related. Yet, production costs/m² increased from 16 258 SEK in 2001 to 27 042 SEK in 2012 [21], i.e. around 66 %. These figures might reveal serious problems related to productivity. Due to the existing production resources in the industry, a low degree of resource utilization led to rising production costs/m². In order to tackle such problems, firms producing single-family houses could consider engaging in production development, towards a higher degree of automation [18]. This is however connected with investments and risk taking, and as production efficiency is fundamental for a firm’s competitiveness and profitability [22, 23], many firms producing single-family houses might face profitability problems and thus financial problems these days. This becomes probably even more crucial considering the aftermath of the declining sales numbers as described above. Hence, firms’ financial performance becomes an important parameter to investigate. Further, investments and risk taking are interrelated. Risk can be divided into financial risk and operational risk and is found to affect a firm’s readiness to invest, depending on the specific firm’s risk position [24].

Considering the above, this study particular (a) maps the seller structure of the industry for wooden single-family houses in Sweden, (b) describes the financial situation of the Swedish industry for single-family houses in general and (c) investigates the firms’ risk position. These objectives will help to fulfill the overall aim of this study, i.e. exploring the firms’ potential to enter the market for wooden multi-family houses.

## 2 METHODS AND THEIR THEORETICAL BASE

### 2.1 INDUSTRY SELLER STRUCTURE AND CONCENTRATION

The structure of an industry usually is measured by the industry’s concentration, i.e. the degree of concentration of the output of all firms in that industry [25], often referred to as the concentration of firms. This concentration of output can be measured by means of the firms’ market share i.e. the firms’ relative position on the market [22].

One method of quantifying concentration and market share is the Herfindahl-Hirschman index, using the sum of squares of market shares of all firms in the industry, see Equation (1):

\[
H = \sum_{i=1}^{n} s_i^2
\]

where \( s_i \) is the market share of the \( i \)th firm for an industry with \( n \) firms [26]. At a maximum, \( H \) can be 10 000, implying a monopoly structure with only one firm having a market share of 100 %. \( H \) would be \( 100^2 = 10 000 \). A perfectly competitive market, on the other hand, would reveal that \( H \) hypothetically tends towards 0 [26]. An advantage of \( H \) is that it considers the number of firms in an industry and the relative size between them, i.e. the variance equivalent. This makes it possible to calculate how many firms are needed that equally share the market, in order to create the same level of concentration in the industry as it can be found today [27]. This is known as the Herfindahl-Hershamann number equivalent (HNE) [28], see Equation (2):

\[
HNE = \frac{10 000}{H}
\]

The HNE is similar to be interpreted as the well-known Lorenz curve. That curve represents the maximum of economic welfare with an equal distribution of income. Its underlying principles are often used by economists for normative and determining purposes [29]. In the same way, the HNE in this study could show the welfare
maximum with an equal distribution of market share among firms producing wooden single-family houses in Sweden. This could give insights about e.g. optimal resource allocation in this industry. In case there are too many firms with relatively low market share, these firms nonetheless need to use fixed assets, which instead could be used to produce prefabricated elements, volumes or modules for wooden multi-family houses, contributing to a better welfare situation in Sweden as described above.

To calculate firms’ market share, different measures can be used. One possibility is the absolute number of physical units. However, this inherits problems when products are not homogenous [30], which is the case the wooden single-family houses. Even though certain elements, modules and volumes are standardized, most of the prefabricated houses are customized, which makes the finalized houses unique and hardly to be compared directly. Another possibility to measure market share, which at the same time makes not homogenous products comparable, is to use value measures [30]. Therefore, in the current study, turnover was chosen to calculate the firms’ market share and the market concentration for the Swedish industry of wooden single-family houses.

The necessary data for $H$ in Equation (1) was collected from a statistical online database for the latest year available, i.e. 2012.

2.2 FINANCIAL PERFORMANCE: ALTMAN’S $Z’$-VALUE

Most firms and investors are trying to minimize uncertainty for any of their ongoing businesses or investments. This is even more significant for outside investors, trying to assess a new market opportunity or challenge. It is imperative to seek as much information as possible regarding long run viability of the business and risk minimization. Additionally it is crucial for the investment or business opportunity to provide an adequate return of investment in conjunction with the distress or risk taken [31]. As a consequence of the importance of minimizing the effect of financial distress on any business, several financial prediction models have been developed. One of the more frequently recognized models is Altman’s $Z$-score, due to its easy application and ability to predict the environment [32].

It is very important for any analytical financial model to accurately absorb the information, and to describe the situation transparently. It is thus of utmost importance to choose financial variables that are easily available and have great degree of importance to the industry. Altman has taken these factors into consideration, choosing variables regarding liquidity, profitability, leverage, solvency and activity, all being of great importance for the analysis of a company’s financial health [32].

The model adopts a multi-variable linear function and picks those variables showing the greatest difference between the two sample groups and the smallest dispersion within each group. This is primarily done through statistical techniques in order to convert multiple variables and to obtain equation [33].

In the $Z$-score, compare Equation 3, five variables were identified to contribute to predicting corporate bankruptcy, following strict methodological procedures, e.g. observing the statistical significance of various alternatives, including the contribution of each variable to prediction accuracy and evaluating the inter-correlation between the variables where $X_1=\text{working capital/total assets}$, $X_2=\text{retained earnings/total assets}$, $X_3=\text{EBIT/total assets}$, $X_4=\text{market value equity/book value of total debt}$ and $X_5=\text{sales/total assets}$ [34].

$$Z =1.2X_1 +1.4X_2 +3.3X_3 +0.6X_4 +0.999X_5$$ (3)

However, the $Z$-score, based on the initial model as described above, had some shortcomings for this study. The initial $Z$-model only took publically listed manufacturing firms into consideration, which eventually led to a revised model adapted towards private firms [32].

The adjustment of the original $Z$-model included a complete re-estimation of all the variables in the model, but more importantly a substitution of $X_4$, that required stock price data not being available by private firms. The new $Z’$-model considered book value instead of market value equity, which was a more suitable measurement for private firms. Furthermore, a complete re-work of the cut off scores was conducted to reflect the new findings towards private firms [35].

Altman’s’ new adaptation of the $Z’$-model, including private firms, described the market situation well for the intended industry in this study.

The result of the revised $Z$-Score model with a new $X_4$ variable is presented in Equation (4):

$$Z’= -0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$ (4)

where $X_1=\text{total capital/total assets}$, $X_2=\text{retained earnings/total assets}$, $X_3=\text{EBIT/total assets}$, $X_4=\text{book value equity/total liabilities}$ and $X_5=\text{sales/total assets}$. The result of the conducted $Z’$-score analysis is interpreted by the use of the pre-calculated classification zones or cut off scores, as described in Figure 3.

![Figure 1: Z’-Score Classification Areas](image)

The model demonstrated in Figure 1 is intended to function as a general classification tool for the applicable firms according to the $Z’$-score. This will create a support
structure in the development of investment strategies, dependent on the firms’ classification. A score below 1.23 indicates that the respective firm is at high risk and is likely to go bankrupt in the near future. A score between 1.23 and 2.9 is considered to be in the grey zone and the financial result of those firms can be regarded as highly uncertain. The highest threshold is 2.9, implying a safe zone where firms can be considered as healthy, having sound potential and limited risk [35].

### 2.3 RISK POSITION: FINANCIAL AND OPERATING RISK

Risk is mostly regarded as negative. In business contexts, investment risk can endanger a firm’s future in case wrong decisions are taken. Therefore, if two investment alternatives have the same return, often the least risk full alternative is chosen [24]. Yet, in today’s literature on management, even risk seeking strategies are explored [36].

Strategy planning is however not only based upon the actual risk of alternative investments [37], but needs to reflect the respective firm’s risk position [24]. Risk positions are suggested to be determined by variations in firms’ profitability, with variations caused by financial risk and operation risk [24], which can be explained as follows.

Profitability, or return on equity \((R_E)\), can be defined as in Equation (3):

\[
R_E = R_T + (R_T - R_S) \cdot \left( \frac{S}{E} \right)
\]

where \(R_T\) = return on total assets, \(R_S\) = average interest rate for depts and \(S/E\) = dept/equity ratio [38]. Equation (3) shows that if return on total assets is larger than the average interest rate for the firm’s depts, return on equity will increase the higher the firm’s dept/equity ratio is [39]. Yet, a rising dept/equity ratio increases the firm’s financial risk [40]. Further, variances in return on total assets and return on equity, \(R_T\) and \(R_E\), are regarded as a measurement for risk and can be determined by using standard deviations, as suggested in Equation (4), assuming the average interest rate for depts being constant [24]:

\[
Var(R_E) = (1 + \frac{S}{E})^2 Var(R_T)
\]

The first factor in Equation (4), \((1+S/E)^2\), points on the firm’s financial risk, as described above. The second factor, \(Var(R_T)\), describes a firm’s operating risk. Return on total assets, \(R_T\), gets affected by e.g. sales and fixed costs. This means that firms with a large amount of fixed costs and firms being sensitive for economic fluctuations will show larger variance in \(R_T\). The latter should be the case for Swedish firms producing wooden single-family houses, since they struggle with declining sales numbers as a result of the economic downturn.

Based on the above, a firm’s risk position can be determined by measuring the firm’s financial risk and operation risk and further classifying those results according to the matrix in figure (2) [24].

Firms with risk positions in the four categories A-D in figure 1 are characterized as follows [24]:

- **A:** Firms with low operating risk have only little variation in their earnings, which gives them the possibility to manage a high financial risk, i.e. a high dept/equity ratio.

<table>
<thead>
<tr>
<th>Financial risk</th>
<th>Operating risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>A</td>
</tr>
<tr>
<td>low</td>
<td>B</td>
</tr>
<tr>
<td>low</td>
<td>D</td>
</tr>
<tr>
<td>high</td>
<td>C</td>
</tr>
</tbody>
</table>

**Figure 2: Risk position matrix [24]**

- **B:** The total risk for firms in this segment is generally too high, which often leads to bankruptcy, shutdown or acquisition by other firms.

- **C:** Firms with a high operating risk need to have a higher safety margin to be able to pay for costs of interest, compared to firms in A.

- **D:** Firms in this segment usually have very strong balance sheets, implying a strong but undeveloped potential for growth. Possibly candidates to be taken-over.

To identify the risk positions for the firms in the Swedish industry for wooden single-family houses, data, required by Equation (4) was collected from a statistical online database. The necessary balance sheet information was available for a three year period, 2010 to 2012. Data from these three years was collected and the largest variances between those years determined.

### 3 DATA AND ANALYSIS

#### 3.1 UNIT OF ANALYSIS

Firms included in this study had to be operating in the Swedish industry for single-family houses. Point of departure for the selection process was a statistical online database for wooden single-family houses. The resulting list was further shortened by removing firms that were not active anymore and that were too small in terms of employees. In order to not include all minor carpenters, the corresponding cut-off was determined to 10 employees. The final list of firms contained 51 firms. Ownership issues among these firms were not considered.

Due to sensitive competitive relationships between some of the firms to be analyzed, and the good cooperation between those firms and the authors’ university, no
company names are revealed in this study. Even though the empirical data was collected from an open statistical online database, their analysis might expose critical aspects and results that could be used for competitive actions. Therefore, all firms are treated as anonymous units of analysis.

3.2 INDUSTRY SELLER STRUCTURE AND CONCENTRATION

Table 1 shows the market shares of the investigated firms operating in the Swedish industry for wooden single-family houses in 2012.

According to the Herfindahl-Hirschman index, $H$, the seller concentration rate in the Swedish industry for wooden single-family houses is calculated by the accumulated sum of squares of market shares, compare Equation (1). In this case, $H$ is 518, indicating a non- or low-concentrated supply, strongly tending towards perfect competition [41].

Table 1: Market share $S$ of $i=1$-51 firms

<table>
<thead>
<tr>
<th>Firm no. $(i)$</th>
<th>$S_i$ in % 2012</th>
<th>Firm no. $(i)$ (cont.)</th>
<th>$S_i$ in % 2012 (cont.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.6</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.9</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.3</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1.3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.0</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.7</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3.3</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.4</td>
<td>1.2</td>
<td></td>
</tr>
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<td>10</td>
<td>1.5</td>
<td>2.6</td>
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<td>11</td>
<td>4.1</td>
<td>0.2</td>
<td></td>
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<tr>
<td>12</td>
<td>4.5</td>
<td>4.8</td>
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<tr>
<td>13</td>
<td>6.4</td>
<td>0.4</td>
<td></td>
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<tr>
<td>14</td>
<td>0.4</td>
<td>7.0</td>
<td></td>
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<tr>
<td>15</td>
<td>1.2</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>0.4</td>
<td>0.1</td>
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<td>17</td>
<td>0.4</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>0.1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>0.5</td>
<td>0.7</td>
<td></td>
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<tr>
<td>20</td>
<td>2.3</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>0.3</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>5.0</td>
<td>0.1</td>
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<tr>
<td>23</td>
<td>12.3</td>
<td>0.6</td>
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<tr>
<td>24</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>25</td>
<td>0.2</td>
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<td></td>
</tr>
<tr>
<td>26</td>
<td>0.4</td>
<td></td>
<td></td>
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</tbody>
</table>

In perfect competitive markets, single firms do not have the power to determine prices, since the respective firm’s market share is too small to represent a powerful position. This implies that market prices, in this case for wooden single-family houses, are transparent to both sellers and buyers. Furthermore, products in perfect competitive markets are highly substitutable.

Yet, as denoted earlier, wooden single-family houses in Sweden are customized and can therefore be regarded as unique. Buyers compare, however, the individual firm’s ability to customize. Since almost all sellers in the studied industry offer individual customization of their products, that service itself should be considered being homogenous and thus, their offerings become highly substitutable.

Hence, if one seller would increase the price, buyers would tend to buy a less expensive product, since all offered products are perceived as being substitutable. This leads to the fact that, in terms of profit maximization, a single firm only can vary its supply in units, not in prices [42].

One strategic conduct usually done by firms operating on perfect competitive markets is product differentiation. Since products usually can be imitated, firms seek for competitive advantage to protect from imitation by creating imperfect products and thus improve their standing [30, 43]. This opens for product differentiations in terms of a further product development from single- to multi-family houses for the investigated firms.

The Herfindahl-Hershman number equivalent (HNE) reveals that the ideal number of equally sized firms in the Swedish industry for wooden single-family houses related to market share is between 19 and 20. This indicates a relative uneven distribution of resources for welfare purposes, since about 62 % of the firms in the industry could use their fixed assets and professional experience for product differentiation, i.e. producing prefabricated elements, volumes or modules for wooden multi-family houses instead.

3.3 FINANCIAL PERFORMANCE

Table 2 describes the result from Altman’s $Z'$-model for the investigated 51 firms for 2012. For confidential reasons, the numbers of the firms in Table 2 are not consistent with the ones in Table 1. Otherwise, for some firms, data on financial performance could easily be matched with market share and the respective firm being deciphered.

Applying the cut off and classification rules presented in Figure 3, Table 2 reveals that 32 out of the 51 firms score higher than 2.9. This equals 63 % and indicates that they are in the safe zone, financially stable and with no imminent risk of bankruptcy [35]. This makes them financially suitable for various development activities.

Seven firms are classified below 1.23, which is 14 % of the investigated firms. These firms face significant financial problems, possibly indicating an imminent bankruptcy. Due to their strained situation, these firms are not likely to show any interest in investments in production development. The remaining 12 firms, equalling 23 %, are in the grey zone which implies some degree of risk. They could potentially face bankruptcy in the medium-run, if no appropriate action is taken [35]. These firms might need to be investigated one by one and more in detail to judge their strategic actions on medium-term financial planning, and
consequently their potential to invest in production development.

Summing up it can be said that according to the Altman’s Z’ classification, at least 63 %, but most likely even more, of the investigated firms are in a good financial position to invest in their current production facilities.

**Table 2: Altman’s Z’ score of i=1-51 firms**

<table>
<thead>
<tr>
<th>Firm no.</th>
<th>Z’ Value 2012</th>
<th>Firm no. (cont.)</th>
<th>Z’ Value 2012 (cont.)</th>
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<tr>
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<td>24</td>
<td>3,50</td>
<td>50</td>
<td>0,19</td>
</tr>
<tr>
<td>25</td>
<td>3,42</td>
<td>51</td>
<td>-0,29</td>
</tr>
<tr>
<td>26</td>
<td>3,41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.4 RISK POSITION

Figure 3 shows the risk positions of the firms investigated. Data from 49 out of 51 firms could be processed, since two firms did not have the necessary information available to calculate the variances required, compare chapter 2.3.

The results show that 33 out of 49 Swedish firms producing wooden single-family houses have a low financial risk and are classified in D or C. This equals 67 % of the firms and means that these firms potentially can cope with a relatively high degree of dept [24], e.g. for investments in production development, towards a higher degree of automation. 16 firms have a high financial risk, categorized as A and B according to the classification scheme. These firms might have issues investing due to an already relatively high dept/equity ratio.

37 out of 49 firms, i.e. 76 %, even have a low operational risk, corresponding to class A and D. The remaining 12 firms represent 24 % have a high operative risk and are classified into B or C. They are struggling with relatively high variations in their earnings. These variations can lead to insecurity in taking risks. The respective firm can only invest a very limited amount of money since it needs to be certain to earn enough in order to pay the associated interests. This decreases the potential of these 12 firms to invest in production development. Yet, as Figure 3 shows, some of the firms in class C are very close to the boarder to either class D or B, implying that even though these firms might have a limited investment potential, it should be investigated for each firm how the high operational risk would affect an investment that implies a higher dept/equity ratio.

![Figure 3: Risk position matrix for Swedish firms producing wooden single-family houses](image)

The 27 firms in class D constitute 55 % of the firms in this study and have a strong balance sheet. They work with a low financial and a low operational risk, i.e. they have a very low dept/equity ratio, might be underdeveloped and have nevertheless a relatively low variation in their earnings [24]. These 27 firms, possibly together with some of the firms from class C, are first hand candidates to invest in production equipment. This could lead to a higher degree of automation associated with the industrialized building of wooden multi-family houses.

### 4 RESULTS AND DISCUSSION

The overall aim of this study was to explore the potential of Swedish firms producing wooden single-family houses to enter the market for wooden multi-family houses. This was done by (a) mapping the seller structure of the industry for wooden single-family houses, (b) describing the financial situation of the firms in that industry and (c) investigating in those firms’ risk position.
The seller structure of the industry can be described as very low, which means that the market is characterized by perfect competition. In case of equally sized firms sharing the market, 19 to 20 instead of 51 firms are required. This raises the issue of uneven distribution of resources for welfare purposes, since 62 % of the firms could use their resources for prefabricated elements, volumes or modules for wooden multi-family houses instead. Yet, it could be argued that the argumentation above is based upon the assumption of today’s supply numbers. This means that an increase of demand for wooden single-family houses would require more resources than currently being utilized. Therefore, further studies might build up scenarios with imaginable demand numbers based upon current market outlooks.

Looking at the firms’ financial performance by means of the Z’ value, 63 % of the firms are in a very good financial shape and 12 % in the grey zone. The latter ones need to be scrutinized more in detail; yet, those all in all between 63 % and 75 % of the firms are conceivable candidates to invest in production development. Furthermore, firms in the higher echelons of the Z’ model could eventually utilize or acquire firms in the distress zone, in order to decrease competition and/or to strengthen their firms offerings. This could generate a positive development in the market towards innovative solutions in order to create a market advantage for the financially stronger companies.

Relating to the investigated risk position of the firms, 55 % of the firms work with both low financial and low operational risk. One supposable explanation for their strong balance sheets might be the lack of updated production technology. Thus, investments in production development potentially will become necessary expenditures for some of the firms. Such investments might, however, not jeopardize those firms financial standing, since they currently show low variances in their earnings, which leads to a relatively high planning reliability regarding amortizations. Consequently, a higher dept/equity ratio could be managed.

Perfect competitive markets imply that prices are beyond control for the involved firms and offerings on the market are highly substitutable. Thus, firms should differentiate by not only further developing existing products, but eventually even looking for new market segments. New business strategies and opportunities can be developed by, e.g., utilizing the potential of economies of scale and scope. For firms involved in this study, economies of scale would mean to use their production facilities to prefabricate elements, volumes and modules not only for single-family but as well for multi-family houses. Economies of scope appear e.g. when firms have cost complementarities, i.e. that producing one product lowers the costs of producing another product, or if products share common inputs [26].

Due to the above it can be stated that the majority of the firms operating on the Swedish market for wooden single-family houses have a rather good potential to invest in production development, towards a higher degree of automation and industrialized building. This would abet entering the segment for wooden multi-family houses, where economies of scale and scope are suggested to contribute to business success.

Further research can bring detailed information about the respective firms’ potential and interest forward. Even though this study shows the potential on an industry level, the individual firm might not be interested in such a development. Many firms in the investigated industry are small or medium sized firms that are family owned. Many of them might be content with the current situation of their firm and do not want to endanger the next family generation’s business conditions. Therefore, resistance to change might be a topic to study.

Furthermore, the relation between structure and performance in the current industry should be investigated. Besides production efficiency, a single firm’s performance, e.g. financial performance in terms of profitability, is affected by the seller structure of the industry. This causal relationship is known as the structure-conduct-performance paradigm, introduced by J.S. Bain in the 1950s [44]. Even though neoclassical theory suggests a positive relationship between structure and performance [45], empirical research led to contradictory findings [46], leaving space for investigations to determine such relationships in industry specific contexts. Such a relation might help to explore the potential of Swedish firms producing wooden single-family houses for investing in production development more in detail.

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