A COMPARISON OF THE MARKET ORIENTATION MODEL IN CZECH AND GERMAN HIGH-TECH COMPANIES

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Abstract


A Market orientation belongs to the permanent factors of success and even in the periods of economic instability it helps to keep a company in a good condition. This article aims to compare the Czech and German model of market-orientation of high-tech companies in the manufacturing industry. The overall index of market orientation in the Czech Republic and Germany is almost identical. Subsequently, invariance was tested using the method of Multigroup Confirmatory Factor Analysis. A comparison of absolute terms of the models shows that significant difference among the coefficients exists in the item regarding obtaining information about competitors – i.e. competitor intelligence generation. The research did not demonstrate statistically significant differences between the models. All criteria consistently confirm configural, metric and partial scalar invariance. The only rejected equivalence is scalar invariance. In this study, therefore, no significant differences were demonstrated between the models of market-orientation of Czech and German high-tech companies. There are other studies that deal with the measurement invariance models of market-oriented high-tech companies. Using Czech and German data, this work has helped to clarify that the two versions of the measuring instruments (English and Czech) are indeed equivalent to each other. Based on the research findings, academics and managers are recommended to use both measuring scales indiscriminately as valid tools for determining the index of market orientation in high-tech firms in the manufacturing industry. For now, there is no similar or comparable research in the Czech Republic or Germany. For this reason, it seems appropriate to replicate this research in the future, including discussions with authors who deal with the issue of market orientation.

Keywords: modified market orientation model (MMOM), modified market orientation scale (MMOS), index of market orientation, high-tech sector, invariance analysis, Germany, Czech Republic

INTRODUCTION

Market orientation of companies has been one of the most popular topics of marketer worldwide especially in the past twenty-five years. Yet it appears that most managers have no sufficient knowledge of this model. In earlier research, the emphasis was on finding a suitable model of market orientation in various countries and industry sectors. Numerous studies on the effect of market orientation on innovation and corporate performance also occur. It is mainly innovations that propel high-tech companies in the manufacturing industry to perform. Also the subsequent commercialization of products, in which correct implementation of market orientation plays a significant role, is equally important. The main objective of this paper was to compare the Czech and English shortened versions of market orientation measuring scales MMOS [Modified Market Orientation Scale], which are conceptually and graphically described in the Modified Market Orientation Model (MMOM). A similar study (invariance testing) that would provide an international comparison of the model of market-orientation of high-tech companies...
Market Orientation in Theory

Businesses that value and rely on market information to guide their strategic decision-making are commonly described as market oriented (Mohr et al., 2010). The author of this paper understands market orientation as a process of customer intelligence generation, competitor intelligence generation, intelligence dissemination & integration, and responsiveness to market intelligence. The hypothesis of a four-factor structure of the market-orientation model of high-tech companies (see Fig. 1) has been confirmed in the previous studies, for example by Jangl (2015a, 2015b). The essential idea is based on the company’s ability to obtain relevant market information, to spread such information across various company departments and be able to respond to it. Harrison-Walker (2001) used a similar model of market orientation, which contains the following factors: customer orientation and competitor orientation. Each of them comprises of a four-stage process – acquisition of information, organization-wide sharing of information, a shared interpretation of market information, and utilization of market information.

Kohli and Jaworski (1990) define market orientation as implementation of a marketing concept. Baker and Sinkula (2002) in Karlíček et al. (2014) define market orientation as the degree to which a firm includes information about the external marketing environment into their strategic planning, or as the company’s ability to learn from its environment. Karlíček et al. (2014) further states that market orientation takes into account both, the internal coordination within the organization, and the external environment – the customers (the existing and potential ones), competitors and the environment trends (economic, political, social, technological, legislative, etc.). This fulfills the mission of strategic management – to put resources and expertise into compliance with the opportunities in the markets. This work focuses on two major external market participants – the customers and competitors and the internal interplay of activities within the company.

The aim of Lado and Maydeu-Olivares (2001) research was to determine whether the relation between market orientation and innovation performance may be generalized despite different political and economical environments and cultural context. Lado and Maydeu-Olivares (2001) studied market orientation of insurance companies in the EU. However, no significant differences in market orientation among countries were found. The authors claim they found a significant match between the structure of market orientation factors among the studied countries. In order to measure results in the area of market orientation the authors used an instrument suggested by Lado et al. (1998) which consisted of 30 items. Innovation performance was measured by the help of a four-item scale by Atuahene-Gina (1996), the authors collected 137 responses from the EU and 74 from the USA consisting of top managers and the authors discovered statistically significant positive dependence between market orientation, the innovation degree and innovation performance. In their model Maydeu-Olivares and Lado (2003) determined that innovation performance, as an intermediate variable, considerably increases the influence of market orientation on total business performance; on the contrary, customer loyalty itself does not show any influence on this relationship. Smith et al. (2007) dealt with a comparison of market orientation in Chinese and American firms. The authors used a scale with 29 items that was created from the two best known measuring scales MARKOR and MKTOR.

Model of Market Orientation

The selected model includes four key dimensions: customer intelligence generation, competitor intelligence generation, intelligence dissemination & integration, responsiveness to market intelligence. Market intelligence generally includes useful information about stakeholders and market trends. Kozel et al. (2011) report that the main problem nowadays is not a lack of data but its arrangement so that the data could serve as the basis for the company’s strategic decision-making. Karlíček et al. (2014) highlight three key activities of market orientation that reflect the typical reaction of the organization to its environment (generating relevant market information, its dissemination within the company and its integration in planning and execution of business activities). Mohr et al. (2010); Karlíček et al. (2013) further distinguish between a proactive and reactive market orientation, depending on whether it concentrates on detecting the needs of the current or future customers or examining the current and planned activities in firms using similar technologies, producing competitive products and focusing on the same group of customers.
Customer Intelligence Generation (CUIG)

Kohli and Jaworski (1990) define intelligence generation as obtaining information about "customers' needs and preferences". All customer-oriented companies should aim at understanding customers' expectations, the goal of high-tech firms, especially, is uncovering the so-called hidden customer needs. Active detection and understanding of customer needs helps to achieve higher customer satisfaction, and this approach certainly helps to build and strengthen the lifetime value of a customer. Where to obtain useful customer information? Mohr et al. (2010) for instance mention customer helplines, fairs, regular visits of customers, cooperation with universities, etc.

Competitor Intelligence Generation (COIG)

Continuous data collection and analysis of competitive strategies data is an important external source of information for the management, not only in high-tech companies, a wide range of sources (internal database, CRM, external data from agencies, mystery shopping, etc.) is available for market monitoring, the result is a comprehensive understanding of the current market situation, which may include the price of competing products, strategic plans of the competition, new job openings, names of distributors, managers, etc. Using relevant market knowledge the management can plan and organize key company activities with greater accuracy.

Intelligence Dissemination & Integration (IDI)

According to Mohr et al. (2010) the process of market information dissemination involves sharing or intelligence dissemination across the organization. Integration of information, incl. knowledge-based activities via the information acquired, is closely related to the process of intelligence dissemination. Dostál et al. (2005), Kozel et al. (2011) describe in detail the process of converting data into knowledge. Quality data can be obtained by carrying out a regular quantitative market research. Such data are to be understood, specified and integrated into a broader context and timeframe. An example may be primary demographic and socioeconomic data on the structure of the population and income in a given segment of the population. After a thorough statistical processing, interpretation and comparison with similar data in other regions such data can be seen as information or intelligence. Valuable information is often readily available via information technologies to all companies, and therefore, its value has somewhat decreased. For strategic decision-making and concrete coordinated action it is necessary to understand the broader context of the information obtained. Therefore this information must be transformed into knowledge. Such knowledge is crucial for the company and represents a real competitive advantage in the marketplace. Both formal, and informal meetings, conferences, e-mail and other communication enable sharing and integration of information within the company.

Responsiveness to Market Intelligence (RMI)

Kohli and Jaworski (1990) describe responsiveness as an action taken in response to market intelligence that is generated and disseminated. According to Mohr et al. (2010) it is strategic decisions of the company resulting from the collaboration between individual departments (coordinated action) and contributing to creating an added value between the company and the customer.

MATERIALS AND METHODS

Methodology

The selection of companies was based on the criteria according to CZ-NACE. To obtain the necessary data two company databases were used – Hoppenstedt and Albertina. The analyzed group consisted of responses from 164 Czech and 187 German executives of high-tech companies in the manufacturing industry. The responses were recorded on a seven-point Likert scale. The questionnaire items are shown in appendix. In the Czech settings the Czech version of a measuring scale of market-orientation MMOS with 12 items was used (in Germany, the English version of MMOS was used), the average return rate was around 15% depending on the region, type and size of the company. The market orientation index was calculated as the arithmetic average of all items. The parameters in the model were estimated using the maximum likelihood method. Invariance testing was performed using the method of Multigroup Confirmatory Factor Analysis. The null hypothesis assumes that the surveyed submodels of market orientation in the Czech Republic and Germany do not differ. An alternative hypothesis assumes that the surveyed submodels of market orientation in the Czech Republic and Germany differ. The results were processed in IBM SPSS Statistics 21 and IBM SPSS AMOS 22.

High-tech sector

In the past many authors such as Baruch (1997), Zakrzewska-Bielańska (2010) or Zeleny (2012) dealt with definitions and exact specification of high-tech sector. According to Mohr et al. (2010, p. 9) high-tech firms can be defined as follows: “high-tech firms are those that are engaged in the design, development and introduction of new products and (or) innovative manufacturing processes through the systematic application of scientific and technical knowledge.” A summary of definitional criteria of high-tech firms was drawn up in details by Králova and Kraft (2008), the most often mentioned characteristic features are
the following: above-average number of employees with a university degree, high science and research costs, products based on advanced technology, high dynamic growth of yields, short lifetime cycle of products, high rate of innovation, etc. Generally, the high-tech branch can be divided into services and manufacturing industry which was the research subject of this study. The exact specification of high-tech industry is described in Table I. The major findings of the selected studies on the nature of the relationship between high-tech sector in Czech Republic and Germany are summarised in Table II.

Mohr et al. (2010) emphasize three activities of high-tech companies: identification of opportunities, product and process innovation, commercialization of the product. Also, in order to avoid volatility in high-tech companies, Mohr et al. (2006) list three sources of marketing myopia in high-tech markets: “our technology is so new that we have no competitors,” “the new technology being commercialized by new competitors will pose a large threat,” “that competitor is in a different industry, and their strategies don’t/ won’t affect my business.”

Invariance testing

In order to compare the research results across the selected groups it is, of course, necessary to make sure that the measurements are comparable. Within mutual comparison of the groups all the structural features in the model are systematically compared by gradually applying constraints or limitations. Weiber and Mühlhaus (2014) describe the individual stages of factorial invariance (see Table III). Model designation and parameter constraints are shown in detail in Figure 1 and Table IV.

Invariance testing also allows for the assessment of validity and reliability of the measuring instrument. Cross-group validity of the measuring instrument is usually checked by going through a series of tests, where the demands for the equivalence of the measuring instrument are increased step by step, as we ask the following questions (see Table III). The last two questions secure equal reliabilities for the items and the complete measuring instrument across groups (Blunch, 2013). If the model with applied constraints shows properties of similar quality (fit) as the same model without them, then the given degree of invariance can be confirmed.

A detailed factor structure of the tested model is shown in the graphical form in Figure 1. The model consists of four latent factors and twelve manifest variables (Jangl, 2015a).
### III: Testing a measuring instrument for cross-group equivalence

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Basis model: the same structure is assumed</td>
<td>Is the model structure the same across groups? That is, is the graphic picture of the measurement model the same across groups?</td>
</tr>
<tr>
<td>Model 2</td>
<td>As model 1 + regression weights are assumed equal</td>
<td>Are the regression weights equal across groups? If so, the manifest variables are measured in the same scale units across groups.</td>
</tr>
<tr>
<td>Model 3</td>
<td>As model 2 + the intercepts are assumed equal</td>
<td>Are the item intercepts equal across groups? If so, the manifest variables are measured on common interval scales.</td>
</tr>
<tr>
<td>Model 4</td>
<td>As model 3 + the factor covariances are assumed equal</td>
<td>Are the factors interrelated in the same way across groups?</td>
</tr>
<tr>
<td>Model 5</td>
<td>As model 4 + factor variances are assumed equal</td>
<td>Do the factors exhibit the same variation across groups?</td>
</tr>
<tr>
<td>Model 6</td>
<td>As model 5 + error variances are assumed equal</td>
<td>Are the error variances and covariances equal across groups?</td>
</tr>
</tbody>
</table>

Source: Own elaboration according Blunch (2013, p. 203)

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1: Factor structure of the model of market orientation MMOM
Source: Own elaboration
### IV: Model designation and parameter constraints

#### MODEL 1 – CONFIGURAL INVARIANCE

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

#### MODEL 2 – METRIC INVARIANCE

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

Regression Intercepts

\[
\begin{align*}
i_{11} &= i_{12} \\
i_{21} &= i_{22} \\
i_{31} &= i_{32} \\
i_{41} &= i_{42} \\
i_{51} &= i_{52} \\
i_{61} &= i_{62} \\
i_{71} &= i_{72} \\
i_{81} &= i_{82} \\
i_{91} &= i_{92} \\
i_{101} &= i_{102} \\
i_{121} &= i_{122}
\end{align*}
\]

#### MODEL 3 – SCALE INVARIANCE

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

Regression Intercepts

\[
\begin{align*}
i_{11} &= i_{12} \\
i_{21} &= i_{22} \\
i_{31} &= i_{32} \\
i_{41} &= i_{42} \\
i_{51} &= i_{52} \\
i_{61} &= i_{62} \\
i_{71} &= i_{72} \\
i_{81} &= i_{82} \\
i_{91} &= i_{92} \\
i_{101} &= i_{102} \\
i_{121} &= i_{122}
\end{align*}
\]

#### MODEL 4 – SCALE INVARIANCE (PARTIAL)

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

Regression Intercepts

\[
\begin{align*}
i_{11} &= i_{12} \\
i_{21} &= i_{22} \\
i_{31} &= i_{32} \\
i_{41} &= i_{42} \\
i_{51} &= i_{52} \\
i_{71} &= i_{72} \\
i_{81} &= i_{82} \\
i_{91} &= i_{92} \\
i_{101} &= i_{102} \\
i_{121} &= i_{122}
\end{align*}
\]

Covariances

\[
\begin{align*}
c_{11} &= c_{12} \\
c_{21} &= c_{22} \\
c_{31} &= c_{32} \\
c_{41} &= c_{42} \\
c_{51} &= c_{52} \\
c_{61} &= c_{62} \\
c_{71} &= c_{72} \\
c_{81} &= c_{82}
\end{align*}
\]

#### MODEL 5 – FACTOR COVARIANCE INVARIANCE

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

Regression Intercepts

\[
\begin{align*}
i_{11} &= i_{12} \\
i_{21} &= i_{22} \\
i_{31} &= i_{32} \\
i_{41} &= i_{42} \\
i_{51} &= i_{52} \\
i_{71} &= i_{72} \\
i_{81} &= i_{82} \\
i_{91} &= i_{92} \\
i_{101} &= i_{102} \\
i_{121} &= i_{122}
\end{align*}
\]

Covariances

\[
\begin{align*}
c_{11} &= c_{12} \\
c_{21} &= c_{22} \\
c_{31} &= c_{32} \\
c_{41} &= c_{42} \\
c_{51} &= c_{52} \\
c_{61} &= c_{62} \\
c_{71} &= c_{72} \\
c_{81} &= c_{82}
\end{align*}
\]

#### MODEL 6 – FACTOR VARIANCE INVARIANCE

Regression weights

\[
\begin{align*}
a_{11} &= a_{12} \\
a_{21} &= a_{22} \\
a_{31} &= a_{32} \\
a_{41} &= a_{42} \\
a_{51} &= a_{52} \\
a_{61} &= a_{62} \\
a_{71} &= a_{72} \\
a_{81} &= a_{82}
\end{align*}
\]

Regression Intercepts

\[
\begin{align*}
i_{11} &= i_{12} \\
i_{21} &= i_{22} \\
i_{31} &= i_{32} \\
i_{41} &= i_{42} \\
i_{51} &= i_{52} \\
i_{71} &= i_{72} \\
i_{81} &= i_{82} \\
i_{91} &= i_{92} \\
i_{101} &= i_{102} \\
i_{121} &= i_{122}
\end{align*}
\]
## Model 7 - Error Variance and Covariance Variance

<table>
<thead>
<tr>
<th>Covariances</th>
<th>vvv1_1=vvv1_2</th>
<th>vvv2_1=vvv2_2</th>
<th>vvv3_1=vvv3_2</th>
<th>vvv4_1=vvv4_2</th>
<th>vvv5_1=vvv5_2</th>
<th>vvv6_1=vvv6_2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Regression Weights

- $a_{1.1} = a_{1.2}$
- $a_{3.1} = a_{3.2}$
- $a_{4.1} = a_{4.2}$
- $a_{5.1} = a_{5.2}$
- $a_{6.1} = a_{6.2}$
- $a_{7.1} = a_{7.2}$
- $a_{8.1} = a_{8.2}$

### Regression Intercepts

- $i_{1.1} = i_{1.2}$
- $i_{3.1} = i_{3.2}$
- $i_{4.1} = i_{4.2}$
- $i_{5.1} = i_{5.2}$
- $i_{7.1} = i_{7.2}$
- $i_{8.1} = i_{8.2}$

- $i_{9.1} = i_{9.2}$
- $i_{10.1} = i_{10.2}$
- $i_{12.1} = i_{12.2}$

### Error Variances

- $v_{1.1} = v_{1.2}$
- $v_{3.1} = v_{3.2}$
- $v_{4.1} = v_{4.2}$
- $v_{5.1} = v_{5.2}$
- $v_{6.1} = v_{6.2}$
- $v_{7.1} = v_{7.2}$
- $v_{8.1} = v_{8.2}$

- $v_{9.1} = v_{9.2}$
- $v_{11.1} = v_{11.2}$
- $v_{12.1} = v_{12.2}$

Source: Own elaboration
STATISTICAL RESULTS

6.1. Analysis of German companies

At first glance no significant differences were found in the descriptive statistics, nor in the covariance matrix between the two groups. Tables V and VII show that the highest rating from the respondents was given to those variables that relate to obtaining customer information, while the managers least believed in themselves in the items related to responsiveness to the obtained market information in the form of coordinated action. Values smaller than 5.0 signal a potential for improvement in the company. It was subsequently tested invariance using Multigroup Confirmatory Factor Analysis method of maximum likelihood.

Verification of invariance

The basic invariance is configural. In case it does not meet this requirement, it is of no use to proceed with applying further constraints. Weiber and Mühlhaus (2014) state that invariance is configural if the following conditions are met, see Table IX:

If configural invariance is supported then each model is tested against its parent model in accordance with Table X. Metrical invariance, scalar invariance, factor covariance invariance, factor variance, error variance and covariance invariance, and possibly partial invariance are tested respectively. The sequence of the models begins from an unrestricted model that corresponds with the independent models between the Czech Republic and Germany. Each submodel has a further constraint added to the parameter group. Such restriction determines that all the parameters in the group are identical between the two models. The results of the model testing, including the results, are described in Table X.

The results of invariance (equivalence) verification are shown in Table X. The column $\chi^2$ indicates the criterion for model and data fit testing. The $\Delta \chi^2$ column builds on the previous one and serves to determine significance ($P$). The criterion $\chi^2$ is used in all parameters of the quality of the model. The models with a lower criterion value seem better. The most important result is the $P$ column, which contains the so-called significance. This can be interpreted as the probability of an error, that the alternative hypothesis will be erroneously accepted when in fact the null hypothesis is valid. In this case, we speak of the probability of false acceptance of validity of the given invariance. The standard threshold for acceptance of the alternative hypothesis is: significance smaller than 5 %.

The Comparative Fit Index (CFI) is used for verification of the model and data fit. All models

| V: Descriptive statistics of market-orientation model of high-tech companies |
|-----------------------------|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                          | CUIG1 | CUIG2 | CUIG3 | COIG1 | COIG2 | COIG3 | IDI1 | IDI2 | IDI3 |
| x                      | 5.70  | 5.93  | 5.61  | 5.05  | 4.98  | 5.45  | 4.98  | 5.31  | 4.79  | 4.85  | 4.72  | 4.35  |
| SD                      | 1.29  | 1.16  | 1.17  | 1.29  | 1.28  | 1.25  | 1.46  | 1.30  | 1.36  | 1.29  | 1.30  | 1.39  |
| Level of MO             | high  | high  | high  | middle| low   | middle| low   | middle| low   | low   | low   | low   |

Note: SD (standard deviation), $\bar{x}$ (mean), MO=Market Orientation < 5 (low level), <5; 5.5> (middle level), > 5.5 (high level)

Source: Own elaboration

<table>
<thead>
<tr>
<th>VI: Variance, correlation and covariance matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>CUIG1</td>
</tr>
<tr>
<td>CUIG2</td>
</tr>
<tr>
<td>CUIG3</td>
</tr>
<tr>
<td>COIG1</td>
</tr>
<tr>
<td>COIG2</td>
</tr>
<tr>
<td>COIG3</td>
</tr>
<tr>
<td>IDI1</td>
</tr>
<tr>
<td>IDI2</td>
</tr>
<tr>
<td>IDI3</td>
</tr>
<tr>
<td>RM11</td>
</tr>
<tr>
<td>RM12</td>
</tr>
<tr>
<td>RM13</td>
</tr>
</tbody>
</table>

Note: Covariances are above the diagonal, correlation coefficients below the diagonal, variances on the diagonal ** $p<0.01$; * $p<0.05$

Source: Own elaboration
show CFI greater than 0.95 indicating a good quality of the models. ΔCFI symbolizes a decline in the CFI indicator against the compared model; values below 0.01 represent an insignificant difference. The decline is larger only in scalar equivalence and the index agrees with the test χ² of the compared model.

The RMSEA indicator (Root Mean Square Error of Approximation) describes the model and data fit. Models with a value below 0.05 are considered quality models. In this case, all models meet this criterion, but the worst value was detected in the model of scalar equivalence. The RMSEA indicator in each model, except for scalar equivalence, falls within the confidence interval of the parent model. Again, the result is in accordance with the model fit test.

The Akaike Information Criterion (AIC) assesses the model and data fit taking into account the size of the model (the number of parameters) and prefers models with fewer parameters. The smaller the AIC value, the better. As the restricted models have a smaller number of independent parameters, the AIC increases, although the criterion of the model fit is always greater in the restricted models than in the compared model. The only decrease of AIC was again recorded in the scalar equivalence model. The ΔAIC column provides the values of the change in AIC.

The Tucker Lewis index (TLI) shows the model and data fit. Values close to 1 indicate good models.

### VII: Descriptive statistics of market-orientation model of high-tech companies

<table>
<thead>
<tr>
<th></th>
<th>CUIG1</th>
<th>CUIG2</th>
<th>CUIG3</th>
<th>COIG1</th>
<th>COIG2</th>
<th>COIG3</th>
<th>IDI1</th>
<th>IDI2</th>
<th>IDI3</th>
<th>RMI1</th>
<th>RMI2</th>
<th>RMI3</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>5.90</td>
<td>6.08</td>
<td>5.67</td>
<td>4.99</td>
<td>4.97</td>
<td>5.40</td>
<td>5.03</td>
<td>5.43</td>
<td>4.89</td>
<td>4.85</td>
<td>4.77</td>
<td>4.39</td>
</tr>
<tr>
<td>SD</td>
<td>1.02</td>
<td>1.06</td>
<td>1.10</td>
<td>1.38</td>
<td>1.44</td>
<td>1.29</td>
<td>1.46</td>
<td>1.23</td>
<td>1.28</td>
<td>1.30</td>
<td>1.33</td>
<td>1.51</td>
</tr>
<tr>
<td>Level of MO</td>
<td>high</td>
<td>high</td>
<td>high</td>
<td>low</td>
<td>low</td>
<td>middle</td>
<td>middle</td>
<td>middle</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
</tr>
</tbody>
</table>

NOTE: SD (standard deviation), x̄ (mean), MO=Market Orientation < 5 (low level), 5-5.5 (middle level), > 5.5 (high level); Source: Own elaboration

### VIII: Variance, correlation and covariance matrix

<table>
<thead>
<tr>
<th>Items</th>
<th>CUIG1</th>
<th>CUIG2</th>
<th>CUIG3</th>
<th>COIG1</th>
<th>COIG2</th>
<th>COIG3</th>
<th>IDI1</th>
<th>IDI2</th>
<th>IDI3</th>
<th>RMI1</th>
<th>RMI2</th>
<th>RMI3</th>
</tr>
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<tbody>
<tr>
<td>CUIG1</td>
<td>1.033</td>
<td>.603</td>
<td>.489</td>
<td>.348</td>
<td>.445</td>
<td>.295</td>
<td>.359</td>
<td>.275</td>
<td>.278</td>
<td>.274</td>
<td>.413</td>
<td>.259</td>
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<tr>
<td>CUIG3</td>
<td>.436**</td>
<td>.591**</td>
<td>1.216</td>
<td>.622</td>
<td>.683</td>
<td>.436</td>
<td>.176</td>
<td>.258</td>
<td>.203</td>
<td>.172</td>
<td>.447</td>
<td>.338</td>
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<tr>
<td>COIG1</td>
<td>.248**</td>
<td>.282**</td>
<td>.191**</td>
<td>.348**</td>
<td>.134**</td>
<td>.134**</td>
<td>.344</td>
<td>.435</td>
<td>.330</td>
<td>.750</td>
<td>.392</td>
<td>.741</td>
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<tr>
<td>COIG2</td>
<td>.304**</td>
<td>.344**</td>
<td>.430**</td>
<td>.701**</td>
<td>2.079</td>
<td>1.284</td>
<td>.320</td>
<td>.357</td>
<td>.352</td>
<td>.695</td>
<td>.607</td>
<td>.908</td>
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<tr>
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<td>.249**</td>
<td>.307**</td>
<td>.636**</td>
<td>.691**</td>
<td>1.660</td>
<td>.115</td>
<td>.079</td>
<td>.190</td>
<td>.495</td>
<td>.451</td>
<td>.672</td>
</tr>
<tr>
<td>IDI1</td>
<td>.239**</td>
<td>.176*</td>
<td>.108</td>
<td>.168*</td>
<td>.150</td>
<td>.217**</td>
<td>.907</td>
<td>1.010</td>
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<td>.590</td>
<td>.608</td>
<td></td>
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<tr>
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<td>.289**</td>
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<td>.255**</td>
<td>.200*</td>
<td>.050</td>
<td>.498**</td>
<td>1.522</td>
<td>1.004</td>
<td>.505</td>
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<td>.335</td>
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<tr>
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<td>.214**</td>
<td>.252**</td>
<td>.144</td>
<td>.187*</td>
<td>.191*</td>
<td>.116</td>
<td>.536**</td>
<td>.637**</td>
<td>1.632</td>
<td>.499</td>
<td>.460</td>
<td>.626</td>
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<td>.201**</td>
<td>.120</td>
<td>.307**</td>
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<td>.296**</td>
<td>.276**</td>
<td>.315**</td>
<td>.301**</td>
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<td>RMI2</td>
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<td>.305**</td>
<td>.323**</td>
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<td>.264**</td>
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<td>.284**</td>
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<td>.540**</td>
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<tr>
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<td>.356**</td>
<td>.418**</td>
<td>.347**</td>
<td>.274**</td>
<td>.181*</td>
<td>.326**</td>
<td>.335**</td>
<td>.441**</td>
<td>2.264</td>
</tr>
</tbody>
</table>

NOTE: Covariances are above the diagonal, correlation coefficients below the diagonal, variances on the diagonal ** p<0.01; * p<0.05; Source: Own elaboration

### IX: Comparison of selected psychometric properties

<table>
<thead>
<tr>
<th>Indicators</th>
<th>CZ</th>
<th>GER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model shows an acceptable fit in each group</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Factor loadings are greater than 0.6; p&lt;0.05 or p&lt;0.10</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Correlation between the factors are less than 1 and are significant</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Discriminant validity of the constructs in each group is determined</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Own elaboration
The index works with criterion of the model fit and the number of parameters. The lowest value of the TLI criterion was detected in the model of scalar equivalence, which also corresponds with the biggest decline against the compared model (ΔTLI).

The only rejected equivalence is therefore scalar equivalence. Other equivalences cannot be rejected. Only full scalar equivalence displays significance less than 5%. Partial scalar equivalence differs from full scalar equivalence in one variable: “We perform evaluation of strong and weak points of major competitors.”

**DISCUSSION**

Anýžová (2014) sees the formulation and translation of the model items and their subsequent interpretation as one of the causes of potential difficulties regarding comparability of the measuring scales. Therefore, invariance in two linguistically different scales was investigated. Within the models, the sequence of submodels was developed comparing differences between the two groups. A more detailed analysis led to the search for specific absolute terms that differ between the groups. The comparison of absolute terms of the models for the Czech Republic and Germany.
shows that the biggest coefficient difference exists in the item: “We perform evaluation of strong and weak points of major competitors." the sequence of submodels, which includes constraints of the absolute terms except for the aforementioned item, shows that all the other submodels are not significantly different. the same information was gathered from the model fit criteria (NFI, IFI, RFI, TLI), the criteria are based on $\chi^2$ and therefore have a similar development.

This is the first survey of the kind, and therefore no other comparable study is available. Still, there are other studies on the measurement of invariance in market orientation. Ward, Girardi and Lewandowska (2006) dealt with a comparison of factor structure of the modified model of market orientation by Narver and Slater. They compared Australian, Dutch and Singaporean companies discovered that there was no statistically significant difference between the studied models. Zhou et al. (2007) compared member and non-member countries of the OECD (Organization for Economic Cooperation and Development). the configural, metric and scalar invariance measurement showed that customer orientation is invariant between member and non-member OECD countries and focus on the competition is partially invariant.

Furthermore, calculation of total market orientation index ($x = 5.20$ in the Czech Republic and $x = 5.14$ in Germany) and its comparison with results of similar measurement was carried out. Smith et al. (2007) used a different measuring scale for measurement of market orientation. Overall company performance calculated in the Czech Republic ($x = 5.13$) and Germany ($x = 5.22$) was slightly higher than in China, and at the same time lower than in the US. Smith et al. (2007) determined the average value in China $x = 5.08$ and in the USA $x = 5.41$. It has to be pointed out that managers from different continents may subjectively perceive the questions a bit differently, the use of Likert scale for evaluation of market orientation is also open to dispute. Since it is a subjective measurement, distortion of values may appear, however, no other method is de facto used in practise. Some authors measured on a five-point scale e.g. Kohli and Jaworski (1990), others such as Slater and Narver (1994) on a seven-point scale. Chalupský et al. (2009) used 52 items in total for measurement of market orientation of firms and the resulting value of index was ($x = 5.2$) using Tomášková’s method. It follows that both ways of measurement show similar results, although they contain different dimensions.

The programme IBM SPSS AMOS version 22 was used to determine the Pearson correlation coefficient between variables (see Table VI and Table VIII). If the data contain extremes or exhibit asymmetry then using the Pearson coefficient may not be appropriate. In such a case for example Spearman coefficient may be used or the data is transformed. the data used in this study are of a subjective character ranging from 1 to 7. Therefore they do not contain extremely remote values and using Pearson coefficient is correct. Generally, there is an impression that subjective measures are inappropriate. There are, however, several good reasons for using them. the reasons in this regard are: (1) managers may be reluctant to disclose actual performance data if they consider it commercially sensitive or confidential, (2) subjective measures may be more appropriate than objective measures for comparing profit performance in cross-industry studies (Dawes, 1999). This is because profit levels might be more appropriate in this situation because managers can take the relative performance of their industry into account when giving their response (i.e. rate the profit performance of the company in relation to that of other companies); (3) performance measures such as profitability may not accurately indicate the underlying financial health of the company. Profitability may vary due to reasons such as the level of investment in R&D or marketing activity that might have long-term effects; and (4) there have been several studies that show a strong correlation between objective and subjective measures (Dess & Robinson, 1984).

Regardless of the measuring tool used, certain disinclination in the majority of managers to cooperate with universities and research institutes can be generally observed. Returnability of questionnaires in this study was about 14% in the Czech Republic and 16% in Germany. Other authors also have similar experience in the area of quantitative research, e.g. Gatignon and Xuereb (1997), who reached 14% returnability of questionnaires, Spanjol et al. (2012) stated the rate of 11.2% and Frambach et al. (2003) about 12.5% in the market orientation research. Similarly, Oudan (2007) reports less than 20% return rate in a quantitative research of market orientation and business performance.
CONCLUSION

In this study, both Czech high-tech firms (x = 5.20) and German high-tech firms (x = 5.14) seem to be medium market orientated. The models between the Czech Republic and Germany are almost identical. The model for the Czech Republic and Germany meets: configural invariance, metrical invariance, partial scalar invariance, factor covariance invariance, factor variance invariance, error variance and covariance invariance (the null hypothesis is accepted). However, the model does not meet: scalar invariance because it differs in a constant of the variable: “We perform evaluation of strong and weak points of major competitors.” The alternative hypothesis is accepted. It can therefore be concluded that scales in both countries are equivalent with the exception of one item.

Acknowledgements

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REFERENCES


### The Modified Market Orientation Scale (MMOS) – English version

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customers Intelligence Generation</strong></td>
<td>We systematically collect and evaluate data about satisfaction or non-satisfaction of customers. We have regular meetings with customers in order to learn their future expectations in time. We permanently strive for a deeper understanding of the hidden needs and requirements of customers.</td>
</tr>
<tr>
<td><strong>Competitors Intelligence Generation</strong></td>
<td>We perform evaluation of strong and weak points of major competitors. We try to predict a future behaviour of competitors. We monitor mutually competing firms in our branch.</td>
</tr>
<tr>
<td><strong>Intelligence Dissemination &amp; Integration</strong></td>
<td>We inform each other about successful and unsuccessful experience with customers across all company departments. In our company we hold a lot of formal and informal talks where we solve present business success, market opportunities or risks. Market information is integrated in this workplace before decisions are made.</td>
</tr>
<tr>
<td><strong>Responsiveness to Market Intelligence</strong></td>
<td>Our reaction to the competitor's price campaign is very short. Principles of market segmentation control development of new products in our firm. We react immediately if the competition launches intensive advertising campaign aimed at our customers.</td>
</tr>
</tbody>
</table>

Source: Own elaboration

Contact information

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