KAPANALTI DERGİSİ-2024-Sayı:6
(Journal of Kapanalti-2024- Issue:6)
Doi: 10.62080/kmfed.1544522

THE APPLICATION OF SEM IN STUDIES TO MEASURE EXPORT PERFORMANCE OF FIRMS: A ROAD MAP

FİRMALARIN İHRACAT PERFORMANSINI ÖLÇMEK İÇİN YAPILAN ÇALIŞMALARDA YEM'İN UYGULANMASI: BİR YOL HARİTASI

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ARTICLE INFO

Received
06.09.2024
Revized
23.09.2024
Accepted
03.10.2024
Article Classification:
Research Article

JEL Codes
C15
F23
M16
P45

ABSTRACT

Export performance is a subject that has quite complex relationships by nature. For this reason, it is analysed with the SEM method, which is gaining more and more fame in the research world regarding complex relationships. With this research, the use of SEM in the export performance studies in question was examined based on literature and different applications and views were brought together to create a basic roadmap. In this context, 76 different SEM and export performance-based scientific studies were examined and evaluated from a critical perspective and application maps were created. Afterwards, an ideal and basic application template and roadmap were presented with current suggestions for studies including export performance that want to use SEM in the future.

Keywords: Export Performance, Structural Equation Modeling (SEM)

MAKALE BİLGİSİ

Gönderilme Tarihi
06.09.2024
Revizyon Tarihi
23.09.2024
Kabul Tarihi
03.10.2024
Makale Kategorisi
Araştırma Makalesi

JEL Kodları
C15
F23
M16
P45

ÖZ

İhracat performansı doğası gereği oldukça karmaşık ilişkilere sahip bir konudur. Bu nedenle, karmaşık ilişkiler açısından araştırma dünyasında giderek daha fazla ün kazanan YEM yöntemi ile analiz edilmeye devam edilmektedir. Bu araştırma ile söz konusu ihracat performansı çalışmalarında YEM kullanımı literatüre dayalı olarak incelenmiş ve temel bir yol haritası oluşturmak için farklı uygulamalar ve görüşler bir araya getirilmiştir. Bu bağlamda, 76 farklı YEM ve ihracat performansına dayalı bilimsel çalışma eleştirel bir bakış açısıyla incelenmiş ve değerlendirilmiş ve uygulama temelli yol haritaları keşfedilmiştir. Daha sonra, gelecekte YEM kullanmak isteyen ihracat performansını içeren çalışmalar için güncel önerilerle ideal ve temel bir uygulama şablonu ve yol haritası sunulmuştur.

Anahtar Kelimeler: İhracat Performansı, Yapısal Eşitlik Modeli (YEM)

Atıf (Citation): Öztürk, M. (2024). "The Application of Sem in Studies to Measure Export Performance of Firms: A Road Map", *Kapanaltı Dergisi*, (6): 53-71

Introduction

The usage of Structural Equation Modeling (SEM) has become quite widespread in social sciences in general and international business/trade and export studies in particular. With its nearly century-long history of use, SEM has gained considerable confidence in the analysis of multivariate content and has played an important role in discovering potential direct and indirect relationships (Y. Fan et al., 2016).

When the literature on measuring the export performance of firms is examined (as far as it can be determined), less than 15% of the studies conducted between 1987-1997 used the SEM technique, while more than 30% of the studies conducted between 1998-2005 used SEM, and this rate was over 35% between 2005-2024 (Ozturk, 2024; Sousa et al., 2008; Zou & Stan, 1998). Therefore, with a basic trend observation, it can be predicted that SEM applications will find a much wider place in studies on export performance in the future.

On the other hand, when the literature is examined, it is seen that SEM is a method that develops very rapidly in terms of both export performance and other disciplines and that sometimes researchers work with different scopes and applications that may cause them to criticize each other. For this reason, it can be seen that a roadmap is needed for researchers who will conduct research on export performance directly or in some way with different concepts and subjects to use SEM in the most accurate way and in the most appropriate way for the export performance concept.

For these reasons, without directly criticizing any research or researcher, it was aimed to bring the most up-to-date SEM map that can be used in export performance studies, both in export performance studies and in direct statistics related to SEM or in its use in different disciplines, to the literature with this research.

1. Firm Export Performance (FEP):

With the increasing globalization trend in the 1960s, the importance of exports, perhaps the most primitive and fundamental way of trade between countries, has also increased and export performance has positioned itself as an indispensable subject in the literature with increasing momentum. When one of the most basic definitions of export performance in the literature is examined, it is seen that export performance is defined as the extent to which a firm's objectives, both eco- nomic and strategic, with respect to exporting a product into a foreign market, are achieved through planning and execution of export marketing strategy (Cavusgil & Zou, 1994, p.4). However, this is a company where this design may not include some statistical or new developments when it was designed in 1994. As a matter of fact, this definition has focused on the company's export performance by focusing on its planning and strategies.

Therefore, in the following years, there were approaches that emphasized that export performance should be evaluated not only with internal firm dynamics but also with a network view, for example by emphasizing that firms are part of a network (Lages et al., 2009). Therefore, understanding and interpreting export performance with an up-to-date and comprehensive definition as “exporting and/or being successful in exports” as stated by Ozturk (2024), would be a sufficient definition for this research.

The measurement of export performance has become another issue that has gained importance since the 1960s. In fact, it is possible to separate export performance and measurement into macro for sector or country-based evaluation and micro for company-based evaluation. Indeed, different criteria and dynamics may come to the fore at macro and micro levels. In his research on measuring firm-based export performance, Tookey (1964), focused on the variables that could affect the firm's export performance (firm type, firm size, firm export policy, marketing channels used in the local market, product adaptation willingness, international marketing strategies, export service diversity and product quality) and the extent to which these variables

could be effective, and accordingly, he presented an export performance evaluation criterion. When we look at the aforementioned research in detail, we see that Tookey has adopted a single main criterion approach that focuses on the long-term profitability of export sales.

In the near future, export performance has started to be considered as one of the main elements of the organization that coincides with the long-term strategies of the business rather than being an indicator measured by a few basic criteria. In fact, Beamish et al. (1993) added to their findings in the research they conducted in the United Kingdom that the success of export performance is related to the use of direct sales distribution, wide product offerings, long-term distributor relationships and a wide geographical market focus, while the export performance of the Canadian company is related to superior product features and diversification of market focus (for SMEs).

In addition, a comprehensive study by Zou et al. (1998) attempted to reveal in detail the determinants of export performance. According to this research, they stated that the basic determinants of export performance can be considered in two parts as internal and external, and that these can be classified as controllable and uncontrollable phenomena. They wrote that the measurement of these determinants of export performance can be done with financial (sales, profit and growth measurements), non-financial (success, satisfaction and goal achievement measurements) and mixed measurements. In the study, controllable internal determinants in the study are export marketing strategies (such as product adaptation and price competitiveness) and management attitudes and perceptions (such as export support and barriers). However, there is no controllable external variable. On the other hand, uncontrollable internal factors are expressed as management characteristics (such as management education and experience) and firm competencies (such as firm experience and size). Finally, uncontrollable external factors include industry characteristics (such as technological intensity and stability), foreign market characteristics (such as market attractiveness and competitive conditions) and domestic market characteristics (such as market conditions and characteristics).

In another study, Beleska-Spasova (2014) has reduced the determinants of export performance to two main classes as internal and external factors with a comprehensive research and study. In this study, internal factors are categorized as (1) management characteristics and perceptions, (2) organizational capabilities (Advanced technology and product/service quality, Export strategy, Marketing mix), (3) knowledge-based factors (export expertise and transfer of knowledge to the outside), (4) relational factors and (5) firm characteristics, while external factors are categorized as export market characteristics (such as legal and political situation) and domestic market characteristics (such as export assistance/consultancy).

Thus, it can be stated that the determinants of export performance and the extent and effectiveness of these elements on export performance may vary depending on firm characteristics, sectoral structures, regional differences, some cultural characteristics and market dynamics. Therefore, the purpose for which export performance is to be measured may affect the criteria, variables and scales to be used in the measurement. What is important is to preserve the main lines of export performance and to harmonize the necessary details in a methodological sense.

2. Research Methodology

This research has a two-stage methodology based on literature and practice. (reviewing fundamental literature and dissecting Structural Equation Model (SEM) applications in Firm Export Performance (FEP)). In other words, within the scope of the research, literature reviews were first conducted for both SEM and FEP separately. Then the techniques used in FEP measurement were examined. Afterwards, the research was tried to be deepened and made meaningful on two basic perspectives. First, the research examined the existing export performance studies with a literature review. Thus, the opportunity to compare studies using

the structural equation model with studies using different techniques was obtained. Secondly, the use of the structural equation model in other disciplines was investigated, and the comparison of the structural equation model applications used in export performance measurement with other disciplines was also made.

In addition, it is possible to use different techniques and tools in the application of Structural Equation Model (SEM). Especially, with the support of developing technology and artificial intelligence applications, it is possible to use different analysis software and applications. Therefore, it has found a place in the research on evaluations and methods regarding which applications and techniques can be used and how. Ultimately, the research followed a methodology based on literature research and analysis.

3. Building Structural Equation Modeling (SEM) for the Research:

The basis of the functioning of social sciences is the testing/analysis of relationship models or hypotheses based on theories using scientific methodologies and the interpretation of the findings (Stevens, 2001). Many different methods have been put forward over time to discover the relationship between variables as a research method in revealing the relationship in question. These methods have developed to be both qualitative, quantitative and mixed in nature. In addition, although the methods in question were occasionally implemented manually or with manual techniques, with advancing technology and developing techniques, they have increasingly begun to be transferred to programming or languages created through computers and related information technologies.

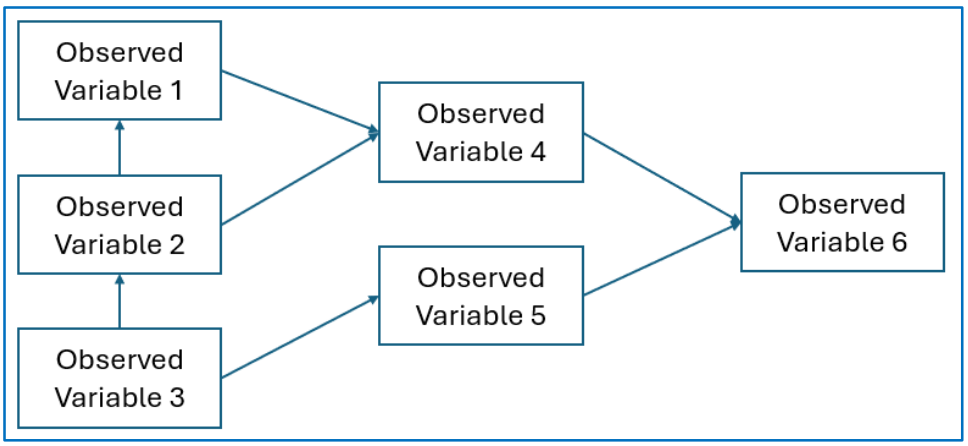
Among these new techniques and methods, Structural Equation Model (SEM) stands out as a method whose importance and use has increased, especially in the 21st century. As a matter of fact, the most important advantage of the model, which is based on multiple regression analysis, is that it enables the emergence of more meaningful and reliable complex relationships compared to classical regression approaches for models with a large number of variables (Ozdamar, 2005; Raats et al., 2005). In this context, comments that single regression analyses are inadequate or weak in explaining complex relationships are among the comments that find a place in the literature (Katipamula et al., 1998). Therefore, when it comes to complex relationships and multivariate models, SEM is considered an important model in order to reveal the mutual relationships in a more meaningful and reliable way.

SEM, which is based on multiple regression analysis, certainly has more advantages and benefits than multiple regression, as well as additional features that increase reliability and validity (Baron & Kenny, 1986). When examined in detail (Byrne, 2016; Raykov & Marcoulides, 2012); First, analyses such as multivariate regression tend to be more explanatory in nature, while structural equation models tend to be more capable of testing and confirming or rejecting hypotheses. Secondly, structural equation modeling allows for more measurement errors to be detected and corrected than other multivariate analysis methods. Thirdly, while multivariate analysis methods focus on observed measurements, it is possible to analyse unobserved or, in other words, latent variables thanks to the structural equation model. Lastly, it is a more powerful, reliable and explanatory model for discovering not only direct but also indirect relationships.

In this context, it is normal to observe that studies that have a multivariate structure and aim to discover complex network relationships tend to use SEM. However, in using SEM, it is appropriate to apply four main different models for different structure applications and process operations (Teo et al., 2013). Sample models and their explanations regarding these four main structural equation models that can be established are as follows.

o *PA Model (Path Analytic Model)*: It is a model that existed in the development process of the structural equation model and emerged during the period when it was not yet capable of measuring latent variables. It is an important building block in reaching today's structural equation modeling (Mitchell, 1992; Teo et al., 2013). Therefore, it is a model in which the relationships between completely measurable variables are measured as in core. However, it is considered a very successful model in measuring observable composite variables (McDonald, 1996). A modeling example for the PA Model is presented in Figure 1.

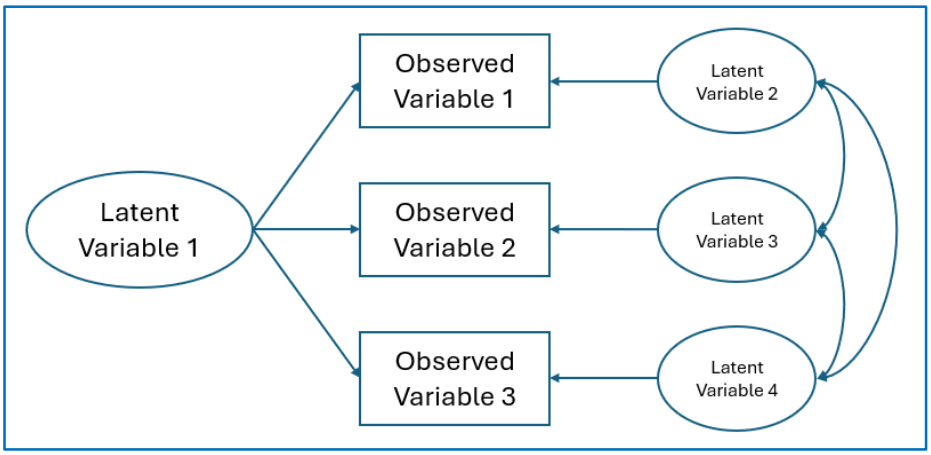
Figure 1: Sample of PA Structural Equation Model



Source: Produced by the author.

o *CFA Model (Confirmatory Factor Analysis Model)*: It has begun to be used in analysing more complex relationships are not established linearly or directly (Teo et al., 2013). Alternative relationships are also evaluated in all versions within the model and significant progress has been made with this model, especially in correcting measurement errors (Kyriazos, 2018). So much so that, although it is not used as the main method in almost every structural equation study in today's literature, it is implemented as a control and model modification tool. A modeling example for the CFA Model is presented in Figure 2.

Figure 2: Sample of CFA Structural Equation Model

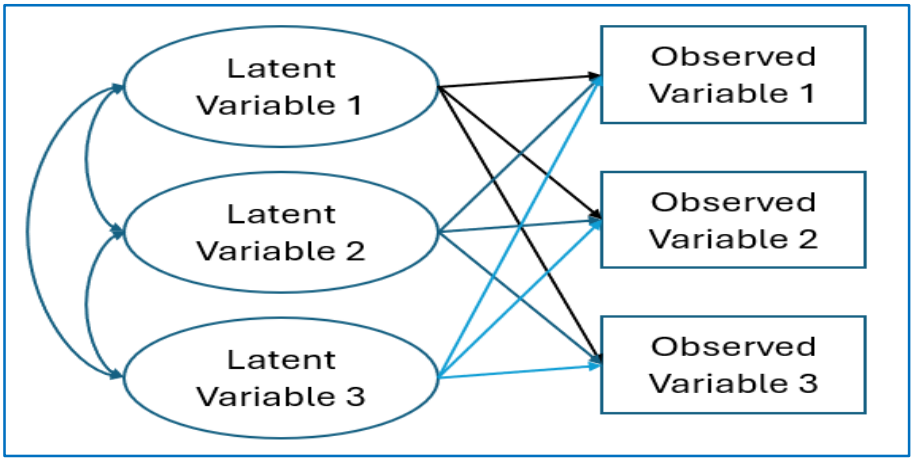


Source: Produced by the author.

o *LC Model (Latent Change Model)*: It is an important SEM construct that allows measurement/analysis, especially by taking into account the differences and changes between

latent variables (McArdle, 2009; Teo et al., 2013). A modeling example for the LC Model is presented in Figure 3.

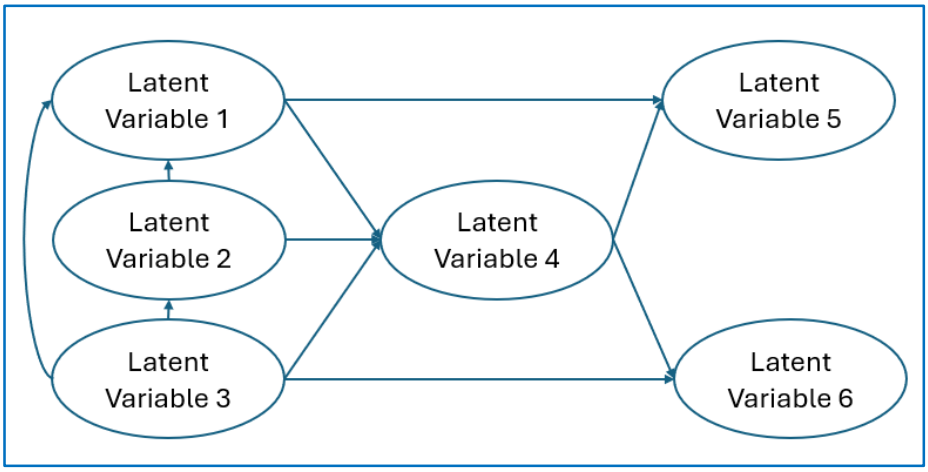
Figure 3: Sample of LC Structural Equation Model



Source: Produced by the author.

○ *SR Model (Structural Regression Model)*: It was constructed as a model that takes into account the measurement of latent variables, which was noticed as a deficiency in confirmatory factor analysis (Jöreskog et al., 2016; Teo et al., 2013). A modeling example for the SR Model is presented in Figure 4.

Figure 4: Sample of SR Structural Equation Model



Source: Produced by the author.

In using these four models, the research model should be created by selecting the correct SEM sub-model depending on the questions sought to be answered and the hypotheses created, whether the variables that emerge are latent or observed variables, and again according to the structure of the relationship between the variables (such as using linear or mediating relationships). Potentially, there may be revisions and changes in the model established according to the course of the research.

In establishing the right model, it is necessary to evaluate well what kind of variable export performance represents. Indeed, in the literature, financial, non-financial and strategic comprehensive expressions and indicators can be given regarding export performance. The variables in question, which ones will be used as export performance, play a vital role in

selecting the export performance as an observed or latent variable. Export performance, as a result of having these different sub-dimensions in general, finds its place in the model as a latent variable. However, if export performance is accepted in a very narrow sense as only exporting or not exporting, or if it is taken as a criterion only as an export figure, then it has the potential to be an observed variable and in some specific cases (depending on the other dimensions and variables to be used in the model), it may be necessary to accept it as such. Here, it is an inevitable fact for the success of the model that the decision-maker makes the right choice for the research.

4. The Usage of SEM in Studies to Measure Export Performance of Firms:

The use of structural equation modeling is possible and widespread both in measuring the export performance of companies directly and in investigating the relationships of export performance with other dimensions and disciplines. As mentioned, with SEM, the measurement and analysis of complex and intricate relationships can be made more understandable or reliable. However, there are some important points to be considered in the use of SEM in measuring the export performance of companies.

The measurement techniques belonging to SEM, then the export performance and the specific dynamics of the dimensions or components to be measured in addition to export performance should be constructed correctly within the model. In other words, a construction should be made on the literature-based theories in the model to be created and the most accurate SEM method should be selected according to whether the variables are latent or observed (and according to the designed relationship network between them) (Jöreskog et al., 2016; Kyriazos, 2018). The structural equation model that can be used will almost be understood. After that, it should be determined how the structural models will be related to each other in the structural equation model to be established. In other words, the beta structural equation model should be created by considering positions such as linear relationships or mediation roles.

The model should be run by collecting data on the dimensions in question (after obtaining approvals such as validity and reliability) and the model should be updated according to the results obtained. One of the most important points here is to apply the application techniques of basic statistical sciences without skipping or neglecting, despite the different or sometimes incomplete applications in the literature (Ayyıldız & Cengiz, 2006).

Before the established model is put into operation, it is known that in order for a scientific study to be reliable, accurate, objective and valid and to have explanatory features for the universe it claims, the reliability, normality or validity of the research must be tested and approved with the distribution of its data in accordance with the model (Bonett & Wright, 2015; George & Mallery, 2018; Golafshani, 2015). In this context, the results of the research regarding the reliability, normality and validity tests and the approval of its suitability before proceeding to the main analysis (structural equation analysis) of the research must be obtained by performing the following procedures.

4.1. Reliability Analysis of the Research:

As a requirement of the discipline of the research, the concepts and scales included in the study, and the research model (structural equation model), it is seen that two basic reliability measuring analyses should be conducted in the literature. One of these is CA - Cronbach's Alpha Test, and the other is CR - Construct Reliability test (CR is used as both reliability and validity test) (Drost, 2011; Golafshani, 2015). While Cronbach's Alpha value is considered acceptable at a value of 0.700 and above, if this value is extremely high, that is, above 0.950, it is considered as an indication that there are unnecessary questions or dimensions in the scale (Frost, 2022; Panayides, 2013). On the other hand, if the CR value, which expresses the division of the square of the sum of the standardized factor loadings by the square of the sum of the standardized factor loadings and the sum of the error terms, is equal to or higher than 0.700 (in

other words, the total error variance contains less than 30% of the variance of the latent variable), it means that the research has good statistical reliability (The closer this value is to 1, the more reliable the research is considered) (Grewal et al., 2004; Hair et al., 2013).

4.2. Normality Analysis of the Research:

Normality is the name of an approach that assumes that the data are normally distributed in a statistical analysis (Khatun, 2021). Today's parametric analyses, due to their general structure, work and can be used with the precondition of normal distribution of the data, or for data and research that are not normally distributed, analyses can find a place in the literature with alternative solution searches (Rani Das, 2016). When considering the studies in the literature on structural equation model analyses, it is seen that there is no information sharing regarding normality analyses in dozens of studies in different regions and languages, that normality analyses are neglected or ignored, and that many studies are even unaware that the structural equation model they use should meet the requirements of the multivariate normality assumption (Yıldırım, 2023). When the literature on normality analysis is examined in structural equation model applications, it is seen that multivariate normality analysis should be performed (Curran et al., 1996; Finney & DiStefano, 2006; Lee, 2007; Yıldırım, 2023). The normalized multivariate kurtosis value obtained as a result of this analysis should be between 5 and 8 (Bentler, 2005; Curran et al., 1996; Kline, 2023). In addition, the critical ratio for the skewness and kurtosis values for each expression should be between -2 and +2, although there are different opinions in terms of individual normality (George & Mallery, 2018; Hair et al., 2013; Turney, 2022).

In general, it is expected that the data to be used in the structural equation model will show a normal distribution. However, there are cases where SEM can be applied in cases where the data does not show a normal distribution. For this purpose, when performing SEM analysis, distribution options such as Asymptotically Distribution-free Estimation (ADE) can be evaluated instead of Maximum Likelihood Estimation (MLE) as a discrepancy estimation method in the model.

4.3. Validity Analysis of the Research:

It is seen that there are many validity analyses in the literature for export performance studies. However, it is evaluated that the four basic analyses presented will be both necessary and sufficient. One of these values was presented as CR in the previous section. The remaining three tests are as follows.

- *Exploratory Factor Analysis (EFA):* When the studies in the literature are examined, it is seen that many studies have ignored the explanatory factor analysis in studies conducted on previously created scales and models. However, due to factors such as the variable nature and dependence on conditions contained in social sciences, it is considered as a general inference that it is appropriate and necessary to conduct EFA under all circumstances (Larsen & Warne, 2010; Norris & Lecavalier, 2010; Ruscio & Roche, 2012). Within the EFA, the Kaiser-Meyer-Olkin (KMO) values of the research data must be over 0.500 (perfectly between 0.800 - 0.900) and the factor loading for each statement must be over 0.400. In addition, it is important that the statements are separated into factors (sub-dimensions) in accordance with the scales used (the sum of the Initial Eigenvalues (IE) for each factor must be over 1.000) and the Sum of Squared Loadings (SSSL) must be cumulatively over 50% (Fabrigar et al., 1999; Larsen & Warne, 2010; Ruscio & Roche, 2012; Sass & Schmitt, 2010). As a result of EFA, it is also possible to take actions to update the models and scales used in the research (such as removing an expression from the scale).

- *Confirmatory Factor Analysis (CFA):* Confirmatory factor analysis is basically considered a type of structural equation modeling (SEM), or more accurately, a pre-type. CFA is used to understand the extent to which the items in the scale used in the research measure the

targeted features and the features, meanings and connections of the output obtained as a result of the application of the scale and the secondary results of these outputs (Lee, 2007; Şimşek, 2007). When applying CFA, the goodness of fit is confirmed by checking the fit indices and whether these values are within the predicted reference ranges, or if deemed necessary, modifications are applied to ensure model fit with the information obtained from here. Since the values and measurements here are also used in SEM, they are conveyed in the following sections.

- *Average Variance Extracted (AVE):* It is one of the analyses that has dominated the literature and is considered important in testing the validity of the research, and the use of AVE to assess convergent validity is based on a general rule of literature based on "the results cannot be generalized to larger populations in a study where sampling errors are ignored" rather than statistical testing procedures (Shiu et al., 2011). AVE measures the level of variance captured by a construct against the level due to measurement error, and values above 0.700 are considered very good, while a level of 0.500 is acceptable (meaning that the latent construct explains more than 50% of the indicator variance) (Cheung et al., 2023; Fornell & Larcker, 1981).

The calculations and indicators that need to be calculated and checked (optimized if necessary and possible) in order to measure the goodness of fit and validity of the model in question, to update it and ultimately to obtain an acceptable research result in the analysis of both the confirmatory factor and structural equation model are as follows.

❖ *CMIN/DF - Relative Chi Square Index (RCSI):* In its simplest form, it is the compatibility test of the data obtained with the created model. The $\chi 2$ goodness-of-fit statistic evaluates the overall fit of the model and, in particular, whether the model explains a significant amount of covariance observed among the items. A significant $\chi 2$ value is considered an indication of poor model fit (Marsh et al., 1988). Although the degree of freedom is an important criterion in the chi-square test, it is seen that its ratio to the chi-square will be a good fit index, with a consensus in the literature (Kelloway, 1998). It should be noted that the main shortcoming of this fit index is its sensitivity to sample size. In a small sample, a poor fit may result in a non-significant $\chi 2$. Similarly, in large samples, a good fit may result in a statistically significant $\chi 2$ (Marsh et al., 1988). Therefore, as reported, in order to make a more comprehensive, meaningful and acceptable comment, the fit index $\chi 2/df$ (CMIN/DF) obtained by dividing the minimum sample discrepancy by the degree of freedom should be examined (This value is calculated by dividing the chi-square value by the degree of freedom) and the ideal frequency for this value is below 5 (The most ideal is below 5 and above 2. On the other hand, although the reference value of >2 is not considered essential for very large sample groups, reaching this value is considered ideal in terms of index fit.) (Kelloway, 1998; Marsh et al., 1988; Marsh & Hocevar, 1985; Schermelleh-Engel & Moosbrugger, 2003).

❖ *Goodness-Of-Fit Index (GFI):* It expresses the variance value explained by the covariance obtained for the calculated population (In other words, it can be formulated as the generalized variance divided by the total generalized variance.) (Byrne, 2016; Hooper et al., 2008; Joreskog & Sorbom, 1984; Raykov & Marcoulides, 2012). The GFI value can be frequency ranged between 0 and 1, which should be above 0.900 for the ideal value, and a value above 0.950 is considered to indicate a very good fit (Hooper et al., 2008; Loehlin & Beaujean, 2017; Schermelleh-Engel & Moosbrugger, 2003; Vieira, 2011).

❖ *Adjusted Goodness-Of-Fit Index (AGFI):* It is used to minimize the risk of incorrect estimation that the GFI test may contain when applied to large sample groups (Hooper et al., 2008; Vieira, 2011). Therefore, it is not appropriate to use it as a reference in studies with low/small samples. It can take a value between 0 and 1 and the ideal value is considered to be above 0.900 (Joreskog & Sorbom, 1984; Raykov & Marcoulides, 2012; Vieira, 2011). However, opinions can be found in the literature that the index will be compatible for values above 0.850.

A negative value indicates a very small/insufficient sample size and a value above 1 indicates that the model is not fully defined.

❖ *Comperative Fix Index (CFI):* It is the value that gives the difference with the null model (absence model) under the assumption that there is no relationship between the variables in the model. Therefore, it is desired for the relevant value to be somewhere close to 1 between 0 and 1, and the acceptable reference value is over 0.900 (Gallagher & Brown, 2013; Kellar & Kelvin, 2012; Schermelleh-Engel & Moosbrugger, 2003).

❖ *Root Mean Square Error of Approximation (RMSEA):* The root mean square error value of the approach founded by Steiger and Lind represents the square root of the approximate means in the model and is a kind of approximate fit value/measure for the main mass (Kellar & Kelvin, 2012; Schumacker & Lomax, 2004; Steiger, 2000, 2016; Yılmaz & Varol, 2015).

❖ *Standardized Root Mean Square Residual (SRMR):* When the literature is examined, it is seen that the unstandardized Root Mean Square Residual (RMR) value is first examined and then the standardized version is evaluated, but when the results of these and the most recent literature applications are examined, it would be appropriate to take only the SRMR value into consideration in terms of checking the goodness of fit of the structural equation model. Basically, it provides a more standardized measure for the values obtained for each observed variable. For SRMR, which can take a value between 0 and 1 like RMR, a value of 0 can be considered excellent and a value of 1 or close to 1 can be considered poor fit, but a value below 0.080 indicates good fit (Çokluk et al., 2010; Iacobucci, 2010; Schermelleh-Engel & Moosbrugger, 2003; Wang & Wang, 2012).

Although there are many parameters in the literature that can measure the goodness of fit of the model other than the above-mentioned CMIN/DF, GFI, AGFI, CFI, RMSEA, SRMR values, it is an established guideline in the literature that the validity and reliability of the model can be accepted as ensured if these six fit indices are measured and the values given by the model comply with the above-mentioned reference ranges (Akyüz, 2018; Barrett, 2000; Browne & Cudeck, 1989; Byrne, 1994, 2016; Çokluk et al., 2010; X. Fan & Sivo, 2007; Gallagher & Brown, 2013; Harrington, 2008; Hooper et al., 2008; Hu & Bentler, 1999; Iacobucci, 2010; Jöreskog, 1969; Joreskog & Sorbom, 1984; Kline, 2023; Marsh et al., 1988; Marsh & Hocevar, 1985; Raykov, 1997; Schermelleh-Engel & Moosbrugger, 2003; Şimşek, 2007; Steiger, 2000; Vieira, 2011; Wang & Wang, 2012; Yılmaz & Varol, 2015). Therefore, for export performance dimensional research using structural equation model, analyses should be made on the basis of the fit indices in question and the established model should be confirmed after the fit control and modification are provided.

A sample summary table containing the goodness of fit values and reference ranges that will ensure model fit for the indices in question and made suitable for use in research is as follows.

Table 1: Sample Model Goodness of Fit Indices Reference Ranges

Fit Index	Acceptable Value Range	Measured Value	Goodness of Fit Result
CMIN/DF	> 2 and < 5	M1	Index Compatible / Incompatible
GFI	> 0.900	M2	Index Compatible / Incompatible
AGFI	> 0.850	M3	Index Compatible / Incompatible
CFI	> 0.900	M4	Index Compatible / Incompatible
RMSEA	< 0.100	M5	Index Compatible / Incompatible
SRMR	< 0.080	M6	Index Compatible / Incompatible
Sem Goodness Of Fit Result: Model Compatible / Incompatible			

Source: Produced by the author.

5. Application and Results

After the values in the reference ranges for the six different fit indices mentioned above are provided for the research data and model, it is statistically stated that the structural equation model is compatible with the model established with the obtained goodness of fit. After this point, it is necessary to move on to the stage of testing the hypotheses created under the model in order to find answers to the research questions. At this stage, there is another issue that needs to be considered before the hypothesis results are presented.

Although model fit is achieved, making the obtained model more compatible will increase the statistical and scientific power of the research. At this point, it may be possible to make modifications that can increase model fit and bring the fit indices to a healthier reference point. In line with the predictions that can be obtained with modern technology, computer applications and artificial intelligence support, if there are additional covariances that need to be established within the model or with the new paths to be established by finding predictable or unseen relationships between the error coefficients of the dimensions and expressions related to the model, model fit can be increased.

Indeed, due to the complex and different disciplines and dimensions of direct export performance measurements, it can be discovered that there are different linear relationships between the dimensions and expressions in the model. At this point, model goodness and fit can be supported with solutions such as establishing a few covariance relationships in a way that does not harm the model. However, it should not be forgotten that multiple interventions on the model may also cause the model health and validity to be questioned.

After the final modifications are completed, the regression weights of the model that has been adapted and the path relationships between the parameters need to be revealed. According to these results, it is possible to reach an acceptance conclusion for hypotheses related to relationships with a p value below 0.05 and a rejection conclusion for those above. Of course, the most important element here is to reveal the hypotheses that are accepted and rejected, and the extent to which these hypotheses have a place in the model with power and explanatory power needs to be explained with interpretations based on literature-based inference.

6. Discussions and Suggestions for the Future

Structural equation model (SEM) is undoubtedly one of the most important statistical analysis methods and models of our century. In particular, its success in revealing complex and enterprising relationships has increased significantly with the effect of technological developments and model improvements. In this context, the use of SEM has a very important role in revealing and analysing the relationship network in complex models established for research on export and export performance, which frequently takes place as a part of different topics, elements, strategic plans and applications in the literature, in the most optimized way. Therefore, the share of SEM in using studies on export performance as a model and analysis method, as stated above, is increasing day by day.

At this point, considering that a roadmap specific to export performance for SEM, which is used in many different disciplines, is an important support for future research, this roadmap research has been conducted and all stages from the questions and hypotheses revealed based on the need in the literature to the establishment of the model and from there to the modification and analysis of the model step by step and to the conclusion are presented in the article.

However, as it has been determined in almost every application and research examined, one or more different unpredictable or unforeseen relationships can find a place for themselves in model dimensions, expressions or error terms. This essentially indicates that the scales and dimensions developed for the concept of export performance have not yet been fully established or that the established models have not been established to fully include all relationships.

In this context, the need for models and scales to continue to be updated comes to light. In addition, it is important for researchers who will work in the field of export performance to include these current applications and contents in their research. Especially with the reflection of developments in the field of artificial intelligence in the social and human sciences day by day, there is a significant need for artificial intelligence-supported SEM applications that can analyse much newer and more complex relationships in much more depth.

Yazar Katkı Oranı (Author Contributions): Murat ÖZTÜRK (%100)

Yazarın Etik Sorumlulukları (Ethical Responsibilities of Authors): Bu çalışma bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.

Çıkar Çatışması (Conflicts of Interest): Çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

İntihal Denetimi (Plagiarism Checking): Bu çalışma intihal tarama programı kullanılarak intihal taramasından geçirilmiştir.

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