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To cite this article: Indah Yanti *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **239** 012020

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Modeling of Multigroup Based Structural Equations with Path Analysis Approach (Application in Green Marketing Strategy in Traditional and Modern Food in Indonesia)

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Abstract. The food business is one of the most sought after businesses in Indonesia because it includes long-term business. The factors that affect customer satisfaction there are four namely product quality, price, taste and quality of service. However, in this research will be added promotion variable. Weaknesses Regression analysis is improved by the current commonly used statistical modelling which involves at least one exogenous variable, an endogen intervention variable and a pure endogenous variable is path analysis. This study has originality which will use multigroup modelling based on path analysis. In this research will be used Hypothesis Testing of Linear Parameter Function in order to compare the results between the two groups. Respondents in this research are Brawijaya University Statistics students from 2014 to class of 2017. Evaluation of lane analysis model using the coefficient of determination total and theory trimming. In the modern food group used t-test and for traditional food group used Hypothesis test of linear function parameters (HFLP). Where based on hypothesis testing on both models produce different results. In the modern food group there are 4 variables that (significantly) affect Customer Satisfaction namely Product Quality, Price Compliance, Quality of Taste, and Service Quality.

Keywords: Multigroup, Structural Equation Modelling, Path Analysis, HFLP

1. Introduction

Regression statistical analysis that can be used to find out the causal relationship between exogenous and endogenous variables is regression analysis [1]. However, in a regression analysis, it only has one endogenous variable and several exogenous variables that influence. Weaknesses of the regression analysis are improved by the current statistical modeling that commonly used and involves at least one exogenous variable, one intervening endogenous variable, and the pure endogenous variable is path analysis [2]. Previous research used two groups of modeling separately or indirectly [3]. So that in this research the development of modeling can be done to solve the problem of multigroup equation modeling.



Multigroup equation modeling using path analysis is an approach used to compare two groups, mainly analyzed twice and comparison of model coefficients in both groups [2]. This multigroup solution is identical to puppet regression analysis, by adding a dummy variable worth 0 to group one and dummy variables worth 1 for group two but in the dummy regression equation, there is still a direct influence of the dummy variable [4]. The analysis that can solve the multigroup equation modeling is path analysis which is a technique in multivariate analysis. However, a comparison of the results of comparison tests between groups has not generated. Therefore, additional hypothesis testing for linear function parameters (HFLP) [5] is needed. The food business is one of the businesses that attract many people and is one of the businesses that never dies. Four factors influence consumer satisfaction, namely premium prices (X1), green products (X2), places (intensive distribution channels, X3), promotions (X4), and environmental knowledge (X5) and in this study, promotional variables will be added [6]. In this study, the parameters of multigroup models (i.e., traditional food and modern food) are estimated by path analysis, with modern foods as a group with 0 dummy variable notation and traditional food as group two with dummy variable notation 1.

This study has originality which will use multigroup modeling based on path analysis. Previous research was done by [6] by completing simultaneous two group modeling but still yielding unfavourable results. So in this research will be used Hypothesis Testing of Linear Parameter Function in order to compare the results between the two groups.

2. Literature Review: Application on Green Marketing

Since the last few decades the world community's awareness of the importance of environmental conservation has increased, this increase triggered by concerns about the possibility of threatening environmental disasters, not just health, but even to the survival of humans and their offspring. The evidence shown by scientists and environmentalists, such as the depletion of the ozone layer which directly increases the prevalence of skin cancer and has the potential to disrupt the world's climate and global warming, reinforces the reason for this concern. Not to mention the problem of acid rain, the greenhouse effect, air and water pollution which is already at a dangerous level, fires and deforestation which threatens the amount of oxygen in our atmosphere and flooding in some cities. Even garbage is now a big problem because the amount of garbage is getting bigger and the amount of garbage is difficult to recycle [10].

In such a situation, finally what is called green consumerism finally arises. Green consumerism is a continuation of the global consumerism movement that began with the awareness of consumers of their rights to obtain products that are feasible, safe, and products that are environmentally friendly that are getting stronger. Furthermore, the desired product is not indeed 'green,' but reduces the level of damage caused.

With this awareness, the company applies environmental issues as one of its marketing strategies or what we know as green marketing. Green marketing is also in line with the increasing attention to environmental issues by public regulators can be seen as another indication that environmental awareness is a potential area as a business strategy [11]. In a study conducted by [12], it was said that environmental or green marketing is a new focus in business ventures, namely a strategic marketing approach that began to emerge and became the concern of many parties beginning in the late 20th century [13]. Such conditions require marketers to be careful when decisions taken involve the environment. Attention to environmental issues is evident from the increasing market that cares about the environment [14]. Attention to environmental issues marked by the rise of business people in implementing international standards, better known as ISO-14000.

ISO-14000 is an environmental management system that can provide guarantees (evidence) to producers and consumers that by applying the system the products produced/consumed are either waste, used products, or services that have gone through a process that pays attention to rules or efforts - environmental management efforts. The International Organization for Standardization (ISO) develops a series of international standards for Eco label (ISO 14020 - ISO 14024). Eco-labeling (eco-labeling) is defined as the activity of labeling in the form of symbols, attributes or other forms of products and services.

This label will guarantee consumers that the products/services they consume have gone through a process that takes into account environmental management rules.

When several companies apply green marketing as the axis of their successful marketing strategies, such as the Body Shop Cosmetics Company and Patagonia sports clothing company [15], then starting from that time green marketing became the main focus of business for various companies. However, there are also many companies that only see green marketing as a minor marketing strategy, even just becoming a niche strategy on the market [16].

But even so, green marketing is considered a failure by several other researchers in contributing further to environmental issues and integrating the potential of competitive advantage with environmental concern as a business strategy [12, 17-19]. If environmental issues (pollution, protection of species, and products that can be recycled) have an essential meaning for consumers in choosing products, and if a company in the market is the only one that offers an environmental marketing mix among its competitors, then the company will have a high strategic competitive advantage [19,20].

In this era of increasingly fierce competition, one way to get customers is to satisfy consumer needs from time to time. Often companies are competing to provide products at low prices assuming consumers only consider prices in purchasing decisions. This assumption is not entirely correct.

Various theories of customer behaviour and marketing state that human needs are not only influenced by their motivation, but also external, such as cultural, social, and economical things. Psychological impulses often influence purchasing decisions and product choices. Products are not designed to meet their functional needs, but also satisfy social and psychological needs.

Green marketing refers to the satisfaction of customer needs, desires, and desires concerning the maintenance and preservation of the environment. Green marketing manipulates four elements of the marketing mix (product, price, promotion, and distribution) to sell products and services offered from the advantages of environmental maintenance advantages that are formed from reducing waste, increasing energy efficiency, and reducing the release of toxic emissions. These advantages are often approached through life-cycle analysis (LCA) that measures the influence of the environment on the product at all stages of the product lifecycle. In this study, we want to model green marketing strategy in the marketing mix by involving 5 exogenous variables, namely premium prices (X_1), green products (X_2), places (intensive distribution channels, X_3), promotions (X_4), and environmental knowledge (X_5), and two endogenous variables of customer choice (satisfaction and loyalty of modern food customers and traditional foods).

3. Research Method

Respondents in this study were 2014 to 2017 (academic year), Department of Statistics, Brawijaya University. The research was conducted by distributing questionnaires with a Likert scale type. Respondents as a research's sample were determined using proportional sampling method with accidental sampling technique and using 110 respondents. The tryout of the research instrument was conducted once to determine the validity and reliability of the questionnaire. Reliability can be tested using Alpha Cronbach's coefficient calculation, with *Alpha Cronbach's* value 0.6, it can be concluded that the instrument is declared reliable [21]. The analysis using Multigroup Equation Modeling (by using dummy variable in path analysis), and test by *Hypothesis Function Linear Parameter (HFLP)*.

3.1. Regression Analysis (Dummy Variable)

Regression analysis is not only quantitative X independent variables that affect Y variables but in research often dealing with variables that are classified or qualitative. It must give a level to the variable to take into account the fact that there is a possibility that the variable influences the response variable [4]. The general regression model with one quantitative variable and one qualitative variable. One concept of dummy variables that is identical to multigroup equation modelling is, Model Dummy Slope:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 D_i X_{1i} + \varepsilon_i \quad (1)$$

3.2. Path Analysis

Path analysis is a method included in the group analysis of relationships between variables and is the development of regression analysis. Path analysis is an extension of multiple linear regression that allows analysis of more complex models [7]. Several steps must be taken to use path analysis [8]:

1. Designing a model based on concepts and theories, based on the relationship of variables in concept and theory can be formed path diagram along with structural model equations.
2. Examination of the assumptions underlying the path analysis, the assumptions used are the same as the regression assumptions, namely the least squares method.
3. Calculate the path coefficient [9]:
 - a) Correlation matrix, if the model is not tiered (linear).
 - b) The relationship coefficient obtained from the OLS (Ordinary Least Square) method calculation.
 - c) Regression coefficient standardized
4. Examination of model validity using total determination coefficient and trimming theory.
5. Analysis output interpretation

3.3. Multigroup Equation Modeling

The analysis of multigroup paths was analyzed twice and a comparison of the path model coefficients in the two groups [2]. The multigroup equation model is identical to dummy regression with group one and group two which are group variables. In the analysis model, the multigroup path with two groups can be made like a dummy variable which is usually denoted by 0 for group one and 1 for group two (in section 2.1), and analyze by path analysis (in section 2.2). In this study we will display a group two research path diagram, namely traditional food with notation one as follows:

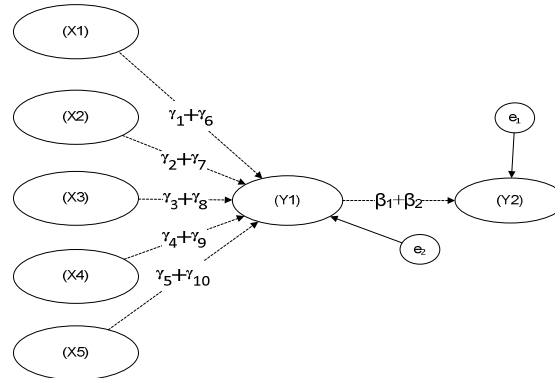


Figure 1. Path Diagram with Group Two Dummy Variables

Whereas:

X_j : exogenous latent variables $j = 1, 2, 3, 4$

Y_m : endogenous latent variables $m = 1, 2, 3, 4$

β : The coefficient of the influence of endogenous latent variables on endogenous latent variables

γ : The coefficient of the influence of exogenous latent variables on endogenous latent variables

e : Error model

3.4. Hypothesis Function Linear Parameter (HFLP)

In solving the problem of multigroup modelling with path analysis, we can compare the model coefficient values. However, in path analysis, it only accommodates testing one group with 0 dummy notation

variables. The linear function hypothesis parameter will be used to complete the two group test with dummy notation variable 1. The second group in the model has a dummy notation variable 1.

The hypothesis of a linear function parameter [5]:

$$H: k' \beta = m \quad (2)$$

The hypothesis of a linear function parameter has a number of equal squares:

$$JK = Y' P_x^\perp Y = (Y - Xk(k'k)^{-1}m)'(1 - X(X'X)^{-1}X')(Y - Xk(k'k)^{-1}m) \quad (3)$$

Then the F test statistics will be carried out

$$F \text{ value} = \frac{\frac{Q/p(k')}{Y' P_x^\perp / P(P_x^\perp)}}{\frac{JK \text{ residue} / (n-p)}{s^2}} = \frac{Q}{s^2} \quad (4)$$

With the Q value obtained using the formula:

$$Q = (k' \hat{\beta} - m)'(k'(X'X)^{-1}k)^{-1}(k' \hat{\beta} - m) \quad (5)$$

4. Result and Discussion

4.1. Estimating Path Analysis Parameters

Analysis of the Multigroup path in this study, estimating the parameters was carried out using the Ordinary Least Square (OLS) method to predict the standardized coefficient. The path coefficients that obtained are formed path analysis equations for groups one and two as follows:

1. The equation for a group of dummy variables is 0

$$Y_1 = 0.34912 X_1 + 0.37632 X_2 + 0.31581 X_3 - 0.0076 X_4 + 0.21092 X_5 \quad (6)$$

$$Y_2 = -0.09745 X_1 + 0.30276 X_2 + 0.08227 X_3 - 0.23579 X_4 + 0.09709 X_5 + 0.66812 Y_1 \quad (7)$$

2. The equation for group two of dummy variables is 1

$$Y_1 = 0.23227 X_1 + 0.27299 X_2 - 0.00093 X_3 - 0.08052 X_4 + 0.41603 X_5 \quad (8)$$

$$Y_2 = 0.07824 X_1 + 0.11250 X_2 - 0.06395 X_3 - 0.07677 X_4 + 0.04021 X_5 + 0.72795 Y_1 \quad (9)$$

4.2. Testing the Hypothesis of Linear Function Parameters

In hypothesis testing for a group of two motivated one dummy variables, it cannot be done by regular testing, but rather by testing hypotheses with the Parameter Linear Function Hypothesis. The following are the results of testing hypotheses for group two as shown in Table 1.

The price of premium (X_1) affects the choice of customers (Y_1 and Y_2) can be accepted. However, the premium price of an environmentally friendly product is positively related to consumer choice on environmentally friendly products. These findings support the results of research from [22] and [23]. Prices include non-product related attributes when representing an essential step in the purchasing process that is indirectly related to the appearance of the product or service function. Price is a significant attribute association because consumers often have strong beliefs about the price and value of a brand and categorize products based on prices in stages for different brands.

Green products (X_2) affect the choice of customers (Y_1 and Y_2) can be accepted. These environmentally friendly products are positively related to consumer choice on these products. The results showed that more environmentally friendly products were chosen by customers [24,25]. The majority of consumers are aware that their buying behavior directly affects various environmental problems. Consumers adapt to this situation by considering environmental issues when shopping and through their buying behavior. The evidence that supports this ecological environment is increasing individuals who

are willing to pay more for environmentally friendly products. Besides, it is often an environmental certification label (e.g., ISO 14000) and symbols that indicate that the product is environmentally friendly, providing support for their purchasing decisions.

Table 1. Results of Group Two Hypothesis Testing

Variable	<i>p-value</i>	Relation
X_1 with Y_1	0.049	Significant
X_2 with Y_1	0.030	Significant
X_3 with Y_1	0.241	Significant
X_4 with Y_1	0.149	Not Significant
X_5 with Y_1	0.109	Not Significant
X_1 with Y_2	0.047	Significant
X_2 with Y_2	0.033	Significant
X_3 with Y_2	0.034	Significant
X_4 with Y_2	0.203	Not Significant
X_5 with Y_2	0.233	Not Significant
Y_1 with Y_2	0.001	Significant

The place (intensive distribution channel, X_3) affects customer choice (Y_1 - Y_2) acceptable. The results of this study indicate that (place) intensive distribution channels influence customers' choices. Previous researchers such as [26] stated that choices, where and when to make products always available, could have a significant influence on customers. Very few customers only want to buy products just because of their friendliness. Sellers who want to achieve success in selling environmentally friendly products should position their products widely in the market so that they can be recognized.

Promotion (X_4) affects the choice of customers (Y_1 and Y_2) that cannot be accepted. The results of this study indicate that promotions do not influence customer choices. These findings support the results of research from [27-29] which states that the influence of providing environmentally friendly information on products varies because information is often inconsistent with one another, so it is no wonder consumers feel confused or doubtful.

Knowledge (X_5) influences customer choice (Y_1 - Y_2) is not acceptable. The results of this study indicate that the higher the level of customer knowledge will affect the choice of the customer. The result is consistent with the research of [30] who reported that there was no significant relationship between knowledge and environmental issues. The choice of product decisions depends more on personal commitment, in other words how much consumers perceive behaviors that support environmental sustainability as being vital for themselves and society at large. Often an individual feels uncomfortable and is not easy to carry out an activity that supports the environment, for example, they feel that recycling is essential for the long-term community. However, they still buy goods with inorganic packaging because of their ease and practicality.

4.3. Model Evaluation

Evaluation of the model on parameter estimation using the OLS method can be done by looking at the Total Determination Coefficient (R^2). The results of the calculation of the Total Determination Coefficient (R^2) are 0.774 which means the value of $0.75 < R^2$; then the model includes a model that is strong in explaining the diversity of data contained in the model.

5. Conclusions and Suggestions

5.1. Conclusions

The total determination coefficient of modern and traditional food models obtained from the study amounted to 77.4%. Therefore, Customer Satisfaction and Customer Loyalty of current food groups and traditional foods are influenced by premium prices (X_1), green products (X_2), places (intensive distribution channels, X_3), promotions (X_4), and environmental knowledge (X_5) while the remaining 22.6% influenced by other variables not explained in the model. In testing the hypothesis on the multigroup path analysis model, traditional food using the Parameter Linear Function Hypothesis (HFLP), there were four significant pathways.

5.2. Suggestions

Based on the results in this study, suggestions that can be given to modern food entrepreneurs to increase Customer Satisfaction, then business owners need to improve Price Compliance with owned modern food businesses so that it will increase the intensity of consumers in purchasing modern food. Whereas for traditional food entrepreneurs, it is necessary to increase Customer Satisfaction, so business owners need to improve the Quality of Service for modern food businesses owned so that it will increase the intensity of consumers in purchasing modern food.

For further research, it is recommended to test hypotheses in the two group studies using the Linear Parameter Function Hypothesis (HFLP). Whereas in the next study it is recommended to use more than two dummy variables.

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