

How and When to Use Multivariate Analysis

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Many researchers need practical tips on how and when to use multivariate analysis. This column will try to provide answers to certain commonly occurring questions, and explain the correct use of some useful multivariate analysis techniques. This first instalment will cover the use of exploratory factor analysis.

Three Important Caveats

There are some caveats which are useful when using multivariate analysis techniques. Most researchers think about analysis techniques only after data collection. The first caveat is- think of the techniques *before data collection*, while designing the questionnaire.

The first caveat above is related to the second one. You must know the measurement scale of the data required for doing any multivariate analysis, because if it is not in correct measurement scale, you CANNOT do that particular analysis. If you do it, it may be invalid, or lead to gross errors.

The third caveat is, use interval scale measurement on all variables except demographic variables such as age, gender, income group etc. if possible. Because then, you have the maximum flexibility in using multivariate analysis techniques.

Having got ourselves acquainted with the three caveats above, we can start looking at where when and how to use certain important techniques. We will look at Exploratory Factor Analysis first.

Exploratory Factor Analysis

Why should we use factor analysis? Whenever a large number of variables exist, or when we are building a scale or questionnaire with multiple questions measuring the same underlying data, it is useful to factor analyse the data.

An example of the first kind

Let us assume we have forty variables

identified through brainstorming, which measure different attitudes about a category of products/services- let us assume it is about travel and tourism (a service). Let us assume that a tour operator is doing this study.

If all forty variables are to be used as independent variables for decision making, it is likely to cause confusion and diffuse attention from the major variables. Most likely, some of these variables are likely to be correlated (related to each other), and there may be five or six major FACTORS or underlying variables, which capture the important part of this variance (from all variables). If we use factor analysis, we can find out these factors, which are combinations of correlated variables, and try to give them some names. For example, we may find that in this example, the major factors identified through Factor Analysis are ECONOMY, SAFETY, NOVELTY, RELIABILITY and SURPRISES OFFERED are the five FACTORS that explain most of the variance in the travel. The tour operator can use this to decide on marketing strategy for his tour packages.

An example of the second kind

Let us say a doctoral research scholar is undertaking a study of the variables that influence retailer choice and buying behaviour of customers. He may come up with a list of 33 variables that in his view may be affecting this behaviour/choice. This list of 33 variables can be factor analysed to find if there are only a few major FACTORS that

can explain most of this behaviour, rather than 33 of them. In fact, this kind of study has been done and published by a few researchers including this author. There is a new scale for retail shopper behaviour that has been developed using factor analysis. Even the famous SERVQUAL or the MKTOR scales have been developed by their authors through the use of factor analysis.

Author's study: The following findings are from a study co-authored with Shahaida P, Rajashekar H, and Bhagyalaksmi Venkatesh, published in the Focus journal.

An exploratory factor analysis of 40 items revealed the following six dimensions or factors which Indian retail consumers perceived - *Process of shopping, atmospherics, personal service, merchandise, store policies and value added services.*

The following items (questions) from the original set of questions combined to form **Factor one-** *Goods are easy to find, goods arrangement is attractive, traffic flow within the supermarket is smooth, the billing system is efficient and the store accepts major credit and debit cards.* This factor was given the name **Process of shopping.**

For the second factor, three items were found significant namely, *store has ample parking facility, store front, display windows, height and size of building invoke a positive feeling and physical facilities in the store are aesthetically appealing.* This factor was named **Atmospherics..**

The third factor was labeled as **Personal service.** The items *Sales people are easily identifiable, sales people give personal attention, sales people show eagerness in solving customer problems, sales people are consistently courteous and sales people handle customer complaints satisfactorily* loaded onto this factor.

Products are available in convenient pack sizes, rare brands are available and brands are available at all price ranges loaded on the fourth factor, which was labeled as **Merchandise.** The fifth

factor, labeled as **Store policies** consisted of three items namely *Store is easy to reach, no hidden costs in promotional campaigns and store offers its own credit card.*

The sixth factor, labeled as **Value-added services,** consisted of four items, namely *Operating hours of the store are convenient, store provides door delivery, door delivery is efficient and store has a cafeteria.*

The above exercise resulted in simplifying the understanding of the underlying factors which govern retail consumers' behaviour in an Indian setting. This can be of great utility to a retail store management in improving perception about their store.

Doing Factor Analysis

On a computer using SPSS or a similar package, it is very easy to do factor analysis. Only caveat here is that the variables should be measured on an interval scale.

For more information on how to use factor analysis with numerical examples, please refer to Marketing Research (3rd edition) by this author (publisher: Tata McGraw Hill, New Delhi).

Factor Scores

Factor scores can be generated and saved at the end of factor analysis, which can then be used as proxies for the old variables, for further quantitative analysis. These appear as new columns, one for each extracted factor, in the data file used.

Summary

Factor analysis is a useful technique at the early stages of research to clarify the underlying major variables when the initial set of variables is too large to be useful in decision-making.

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