Moderating Variables in Business Research

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Abstract

This paper explains the rationale for introducing the moderating variables in the models built in business research to identify the causal relationships among the variables/constructs. The study is based on search for moderating variables in business related research published during last 35 years (1980 - 2015), available in online databases EBSCO, ProQuest, JSTOR, ScienceDirect, SAGE and Emerald. The study identifies the variables/constructs being majorly used as moderators in business research. The methods used for studying moderation have been identified and multi-group moderation through structural equation modeling (using AMOS) has been recommended and elaborated. The findings and suggestions of the study are likely to be highly useful, for researchers in the field of commerce and business management, in identifying the moderating variables and practically applying multi-group moderation in business research.

Key Words : Moderation, moderating variables, business research, multi-group moderation.

Introduction

The use of moderation in model building and testing has gained a lot of attention of business researchers. This study explores and discusses the important moderators and the modes operandi of their use in business research. Based on extensive review of extant literature available on moderating variables [published during last 35 years (1980 - 2015), available in online databases EBSCO, ProQuest, JSTOR, ScienceDirect, SAGE and Emerald], the study identifies the variables/constructs being majorly used as moderators in business research. The methods used for studying moderation have been discussed and multi-group moderation through structural equation modeling has been recommended and elaborated.

About Moderating Variables

Moderation occurs when the effect of an independent variable on a dependent variable varies according to the level of a third variable, termed a moderator variable, which interacts with the independent variable (Edwards and Lambert, 2007). A variable "z" is a moderator if the relationship between two (or more) other variables, say "x" and "y", is a function of the level of "z" (James and Brett, 1984). Moderating effect occurs when a third variable or construct changes the relationship between two related variables or constructs (Hair et al., 1998). A moderator is an independent variable that affects the strength and/or direction of the connotation between another independent variable and an outcome variable (Lai, 2013).

It is important to make distinction between "Moderating effect" and "Interaction effect". Interaction effects are used to test the model hypotheses that are not inevitably causal in nature. On the other hand, moderation effect is used to test the model hypothesis that is causal in nature, moderation effect is an interaction effect but interaction effect is not necessarily a moderation effect (Wu and Zumbo, 2008).

A moderator variable can be considered when the relationship between a predictor variable and a dependent variable is strong, but most often it is considered when there is an unexpectedly weak or inconsistent relationship between a predictor and a dependent variable (Kim et al., 2001).

Unlike regression which specifies the strength or degree of relationship between predictor and criterion variable, the significance of moderating variables lies in identifying whether the relationship between predictor and criterion variable differs for a particular group or not. For example, if we are studying the relationship between innovation orientation and business performance, and we want to know whether this relationship is same across the groups or is moderated by some variables e.g size of firm (large vs small), type of firm (manufacturing vs service) etc; the moderation will facilitate studying whether the relationship between innovation orientation and business performance is more pronounced in manufacturing or in service organizations.

Moderation analysis provides a way to test whether an intervention has similar effects across groups. It would be important, for example, to demonstrate that intervention effects are obtained for males and females if the program would be disseminated to a whole group containing males and females. Similarly, the consistency of an intervention effect across subgroups provides support for the generalizability of an intervention (Mackinnon, 2011).

Moderating variables should be chosen with strong theoretical support. There must be some logical reason and prior theoretical support for why a particular variable is likely to affect the hypothesized relationships between the constructs. Moderating variable can be at ratio, interval or continuous level or it can be categorical as well, depending upon the type of moderating variable (Kim et al., 2001). However, it should be noted that moderator is not supposed to have any relationship with the constructs under study; unlike mediating variables where the mediator must be related to both the constructs. Mediation refers to an indirect effect of an independent variable on a dependent variable that passes through a mediator variable (Shrout and Bolger, 2002).

Moderators in Business Research

In the business research, a variety of moderating variables are being used. We have systematically identified prominent variables used across the functional areas and strategy research.

The most widely used moderating variables in business research are market turbulence, technological turbulence, competitive intensity, strategy type, strategic orientation, firm age, firm size, industry type, entrepreneurial mindset, organizational culture, organizational structure, environmental dynamism etc. A brief description of these moderators, the research contexts and findings is given below.

Market turbulence is widely used as moderator in business research. It is normally measured on a Likert scale aimed at assessing the extent to which the composition and preferences of an organization's customers tends to change over time. Market turbulence moderates the relationship between market orientation (MO) and business performance. Greater the volatility of customer preferences and their composition; greater the impact of market orientation (Jaworski and Kohli, 993). Pulendran et al. (2000) found a significant impact of market turbulence on the relationship between market orientation (MO) and business performance. However, greater the market turbulence, stronger will be market orientation (MO)-performance relationship. Many other studies found the opposite effects of market turbulence on market orientation (MO) - performance relationship (e.g. Slater and Narver, 1994; Greenley, 1995). However, various other studies did not discover any effect of market turbulence on the relationship between market orientation (MO) and business performance (e.g. Subramanian and Gopalakrishna, 2001; Rose and Shoham, 2002). Pulendran et al. (2003) concluded that when market turbulence is high, improvements in marketing planning quality have an additional positive impact on market orientation. Market turbulence moderates the relationship between market orientation and new product success (O'sullivan and Butler, 2009). The relationship between market orientation and organizational innovation is moderated by market turbulence (Han et al., 1998). Market turbulence does not moderate the relationship between market orientation and business performance (Aziz and Yassin, 2010). Market turbulence moderated the association between total quality management, market orientation and hotel performance (Wang et al., 2012).

Another widely used moderator is technological turbulence - defined as the degree of change associated with product and process technologies in the industry in which a firm embeds (Hanvanich et al, 2006). It is normally measured on a Likert scale. Technological turbulence moderated the relationship between market orientation (MO) and business performance in some studies (e.g. Slater and Narver, 1994; Grewal and Tansuhaj, 2001, Rose and Shoham, 2002; Pulendran et al., 2003, O'sullivan and Butler, 2009). However, it did not moderate market orientation (MO)-performance relationship in other studies (e.g. Pulendran et al., 2000; Harris, 2001, Kirca et al., 2005, Aziz and Yassin, 2010). The relationship between market orientation and organizational innovation is moderated by technological turbulence (Han et al., 1998). Technological turbulence moderated the association between total quality management, market orientation and hotel performance (Wang et al., 2012).

The competitive intensity refers to the extent to which firms within an industry put pressure on one another and limit each other's profit potential. Literature review suggests the use of competitive intensity as a moderator in various studies (e.g. Slater and Narver, 1994; Pulendran et al., 2000; Grewal and Tansuhaj, 2001; Harris, 2001; Subramanian and Gopalakrishna, 2001; Rose and Shoham, 2002; Aziz and Yassin, 2010; Wang et al., 2012; García-Zamora et al., 2013).

In business research, strategy type has been operationalized either on the basis of Miles and Snow's (1978) classification or Porter's (1980) generic strategies. Many strategy researchers have employed strategy type as a moderator in their studies (e.g. Hitt et al, 1982; Homburg et al., 1999; Matsuno et al., 2000, Pelham, 2000). Matsuno et al.(2000) reported that effect of market orientation (MO) on performance deviates across types; and there is more substantial relationship between market orientation (MO) and business performance among firms which employ a prospector strategy or analyzer strategy rather than using the defender or reactor strategy.

Entrepreneurial orientation (EO) is defined as the organization's predisposition to accept entrepreneurial processes, practices, and decision making, characterized by its preference for innovativeness, risk taking, and proactiveness. Entrepreneurial orientation (innovativeness and proactiveness) moderated the relationship between market orientation and business performance (Li et al., 2008, Merlo and Auh, 2009).

There are number of studies which have used firm age as moderator (e.g. Hannan and Freeman, 1984; Ranger-Moore, 1997; Hannan, 1998; Henderson, 1999; Sorensen and Stuart, 2000; Gopalakrishnan and Bierly, 2006; Balasubramanian and Lee, 2008; Carr et al., 2010; Chelliah et al., 2010; Savino and Petruzzelli, 2012; Hui et al., 2013, Vij and Farooq, 2014a). Firm age is normally used as a categorical variable, indicating the length of existence in business. It has been noted by researchers that firm size is a contextual or enabler variable in the use of technologies and that it is common for small manufacturers to lag behind larger manufacturers in implementing new technologies (Kalkan et al., 2011). Firm age moderates the relationship between learning orientation and innovativeness i.e. older firms are more likely to employ knowledge learned and turn it into innovation activities. Younger firms need to establish an efficient mechanism for rapidly internalizing knowledge (Calantone et al., 2002). Firm age does not moderate the relationship between learning orientation and firm innovativeness (Nybakk, 2012). Firm age moderated the relationship between Customer management performance and financial performance. The relationship was more pronounced for younger firms compared to older firms (Ramaswami et al., 2009). Sorensen and Stuart (2000) studied the impact of firm age and have concluded that experienced and old firms render more innovations and are therefore of lower quality and incremental in nature.

Firm size as a moderator has gained the attention of various strategic management researchers (e.g. Hage, 1980; Ettlie and Rubenstaein; 1987; Acs and Audretsch, 1990; Damanpour, 1992; Rothwell and Dodgson; 1994; Swamidass and Kotha, 1998; Stock et al., 2002; Temtime, 2003; Gopalakrishnan and Bierly, 2006; Ramaswami et al., 2009; Corsino et al., 2011; Noor et al., 2012; Varum and Rocha, 2012; Vij and Farooq, 2014b). Firm size is variously measured in terms of number of employees, amount of investment, total assets, or market value of equity. Firm size moderated the relationship between innovation and both financial and operational performance. However, the relationship is more pronounced in large firms than that of smaller firms (García-Zamora et al., 2013). Firm size moderated the relationship between business strategy and performance

(Kannadhasan and Nandagopal, 2011). Firm size moderated the relationship between organization learning, organizational innovation and organizational performance. The impact of organizational learning on organizational innovation and organizational performance is more significant in companies of smaller size. Large companies usually have access to more resources to be invested in organizational innovation. Thus, these organizations may be less dependent on organizational learning processes than smaller companies (Hui et al., 2013). Firm size moderated the association between profitability and leverage. For large firms, the negative impact of profitability on leverage is stronger compared to the small firms (Chen and Chen, 2011). Firm size does not moderate the relationship between information technology competency and market performance. Therefore, larger firms are not able to effectively utilize their information technology competencies to achieve greater market share than smaller firms. Firm size moderated the influence of information technology competency on development performance; smaller firms were better able to achieve development performance than larger firms (Gibb and Haar, 2007). Firm size significantly moderated the relationship between knowledge sharing orientation (KSO) and business performance. As the size of the organization in terms of the number of employees increases, the necessity for having better KSO increases for enhancing business performance. Smaller firms (in terms of investment) need to have better idea sharing propensity, good organizational climate, excellent knowledge sharing culture and top management support for superior business performance (Vij and Farooq, 2014b).

Industry type has also been used as a moderator in business research. Industries are variously categories e.g. manufacturing vs service industries, public vs private industry etc. There are many studies which have included industry type as a moderator (e.g. Hitt et al., 1982; Banerjee, Iyer and Kashyap, 2003; and Ortega, Martinez and Hoyos, 2006, Tang et al., 2007, Tawfik Mady, 2008; Chen and Chen, 2011; Vij and Farooq, 2014b). Hitt et al. (1982) confirmed that industry type moderated the relationship between company performance and functional importance. Industry type moderated the association between profitability and leverage (Chen and Chen, 2011).

Entrepreneurial mindset refers to a specific state of mind which orientates human conduct towards entrepreneurial activities and outcomes. Individuals with entrepreneurial mindsets are often drawn to opportunities, innovation and new value creation. Phipps and Prieto (2012) found that entrepreneurial mindset moderates the relationship between knowledge management and creativity, entrepreneurial mindset benefits the individual by permitting him to take advantage of these opportunities when they develop.

Job autonomy refers to the extent to which a job allows employees discretion, freedom, and independence in the performance of tasks in their job. Job autonomy is used as a moderator in human resource management, entrepreneurship and strategy research. Job autonomy moderates the relationship between proactive personality and job performance (Barrick and Mount, 1993; Fuller et al., 2010). Kim et al. (2009) studied the moderating effect of job autonomy on relationship between emotional competence and work performance. Job autonomy moderated the association between benevolent leadership and creativity (Wang and Cheng, 2010). Job autonomy also moderated the relationships between self leadership behaviors and work outcomes of performance rating, objective work performance and job satisfaction (Ho and Nesbit, 2014).

Organizational culture is generally seen as a set of key values, assumptions, understandings, and norms that is shared by members of an organization and taught to new members as correct. Organizational culture is an important moderator in business research. It is normally measured on Likert scale. Studies have used organizational culture as moderator between organizational commitment and job satisfaction (Yiing and Ahmad, 2009), organizational justice and organizational citizenship behavior (Erkutlu, 2011), leadership styles and quality management practices (Alharbi, 2012, leadership styles and employee affective commitment to change (Ahmad and Gelaidan, 2011), critical success factors and implementation success of ERP projects in India (Chockalingam and Ramayah, 2013), justice and leader member exchange (Erdogan et al., 2006).

Organizational Structure measures organicity i.e. the extent to which organization is structured in organic versus mechanistic manner. It is measured on Likert scale. Various business studies have used organizational structure as moderator e.g. between innovativeness and business performance (Lin et al., 2008), between knowledge management capability and job performance (Lai, 2013), between justice and supervisory support (Ambrose and Schminke, 2003), between entrepreneurial orientation and firm performance (Kreiser and Davis, 2010) and between innovativeness and business performance (Vij and Bedi, 2015).

Perceived organizational support means recognition by the organization of an individual's socio-emotional needs, efforts, commitment and loyalty. It is measured on Likert scale. Perceived organizational support (role clarity, job information, participation in decision-making, colleague support and supervisory relationships) moderated the relationship between workplace bullying and the intention to leave the organization (Rhoades and Eisenberger, 2002; Van Schalkwyk et al., 2011). Perceived organizational support moderates the relationship between organizational stressors and organizational citizenship behavior (Jain et al., 2013).

Environmental dynamism refers to the extent of unpredictable change in an organization's environment. Environmental dynamism significantly moderates the relationship between transformational leadership and new venture performance, and a significant negative moderating effect on the relationship between transactional leadership and new venture performance (Ensley et al., 2006) Environmental dynamism is an important moderator in recent studies e.g. environment dynamism moderated the relationship between emotional capability and firm performance (Akgun et al., 2008), between entrepreneurial orientation and firm performance (Kreiser and Davis, 2010), between innovation strategy and firm performance (Ting et al., 2012), between product and process innovation and new product success (Zamora et al., 2013), between entrepreneurial orientation and resource acquisition (Huang and Wang, 2013), and between innovativeness and business performance (Vij and Bedi, 2015).

Situational strength refers to the idea that various characteristics of situations have the capability to restrict the expression. Situational strength moderated the relationship between job satisfaction and job performance (Bowling et al., 2015). Situational strength moderated the conscientiousness and performance relationship, such that conscientiousness better predicts performance in characteristically weak occupations than in characteristically strong occupations (Meyer et al., 2009).

Some other important moderators in business research are environmental uncertainty (Bstieler, 2005; Boon-itt and Paul, 2008), organizational citizen behavior (Chien, 2013), knowledge integration (Alma'aitah et al., 2013), knowledge management strategy (Ling, 2013), organizational policy (Wickramasinghe and Nisaf, 2013), competitive advantage (Wunnava and Ellis, 2009; Martinette and Leeson, 2009, 2012), locus of control (Sweeney et al., 1991; Kolb and Aiello,1996; Srivastava, 2009, Lefcourt, 2013), organizational competencies (Subramanian et al., 2009), market growth rate (O'sullivan and Butler, 2009), corporate social responsibility (Brik et al., 2011); creative role identity (Wang and Cheng, 2010); critical incidents (Walsh et al., 2008).

How to Conduct Moderation Analysis?

There are various methods used for moderation analysis such as subgroup analysis (Sharma et al., 1981, Dijkman et al., 2009), moderated regression analysis (Sharma et al., 1981, Morris et al., 1986, Russell and Bobko, 1992) and hierarchical regression analysis (Dawson, 2014) etc. There are a large number of studies which have conducted multi-group moderation analysis using structural equation modeling (e.g. Little et al., 2007; Azninza et al., 2011; Wagner, 2011; Kock, 2013, Vij and Farooq, 2104a) for identifying moderation.

The main theme of multi-group moderation analysis is to compare path coefficients for identical models which are based on different samples (Kock, 2013). Technically, a model with equality constraints is compared to a model that allows the parameters to vary (Floh and Treiblmaier, 2006). Moderation typically involves testing of structural model estimates. Process generally involves multi-group analysis for testing measurement invariance. Multi-group moderation is tested through chi square difference test which evaluates the differences in the modeled relationships that are statistically significant across groups (Anderson and Gerbing, 1982). The first group model is estimated with path estimates calculated separately for each group. Then a second group model is estimated where the path estimate of interest is constrained to be equal between the groups. Comparison of differences between models with a chi square difference test indicates if the model fit decreased significantly when the estimates were constrained to be equal (Hair et al., 1988).

Let's take an example that moderator variable is denoted by "z", independent variable or predictor variable by "x" and dependent or criterion variable by "y". Secondly, assume that there is a significant positive relationship between "x" and "y". If you are interested in finding moderating effect of "z" on relationship between "x" and "y", we suggest the use of AMOS for conducting multi-group moderation analysis, using the following steps:

Step-I : Take the validated structural equation model in AMOS, which needs to be tested for moderation (Figure 1).

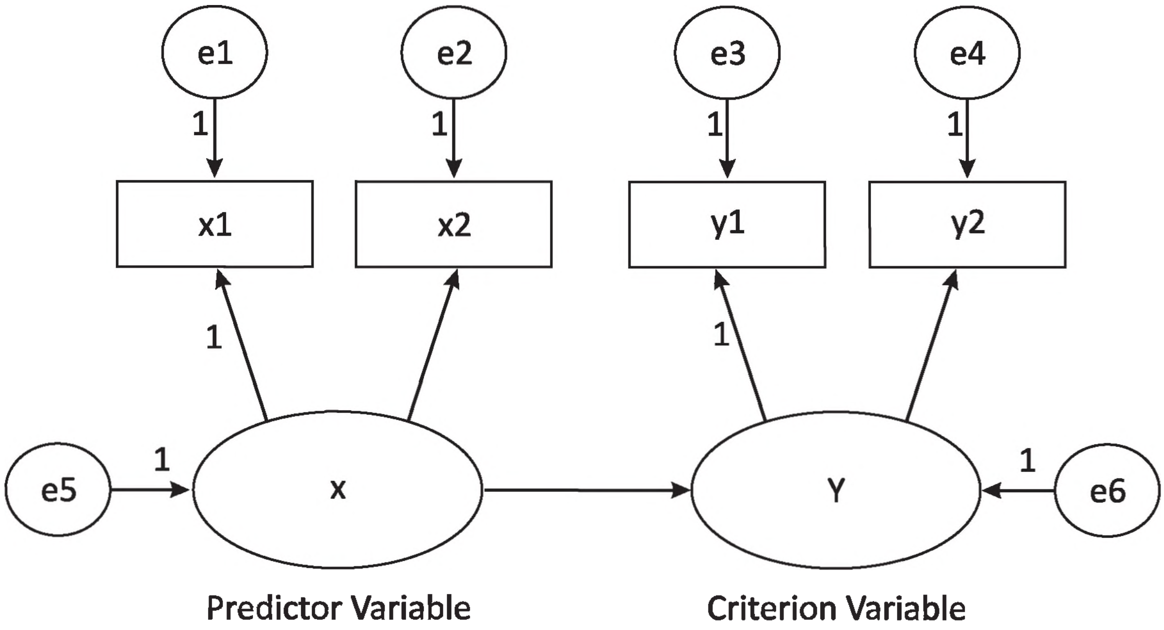

Figure 1: Unconstrained Model

Step-II : You will find an option "Group number 1" in AMOS graphics. You need to specify the categories in the moderating variable "z" to be tested; under "Group number 1", "Group number 2", "Group number 3" and so on (Figure 2).

Step-III : Run the unconstrained model and note down the values of chi-square and degrees of freedom.

Step-IV : Constrain the model to be equal between the groups and note down the values of chi-square and degrees of freedom (Figure 3).

Step-V : Now apply the chi-square difference test for model comparison; i.e. compare the values of chi-square and degrees of freedom to check for the significance of differences.

It is important here to note that nowadays many tools are available online to test for the chi-square difference test. We suggest using "Stats tool package"
[available at URL: http://www.kolobkreations.com/Stats%20Tools%20Package.xlsm]

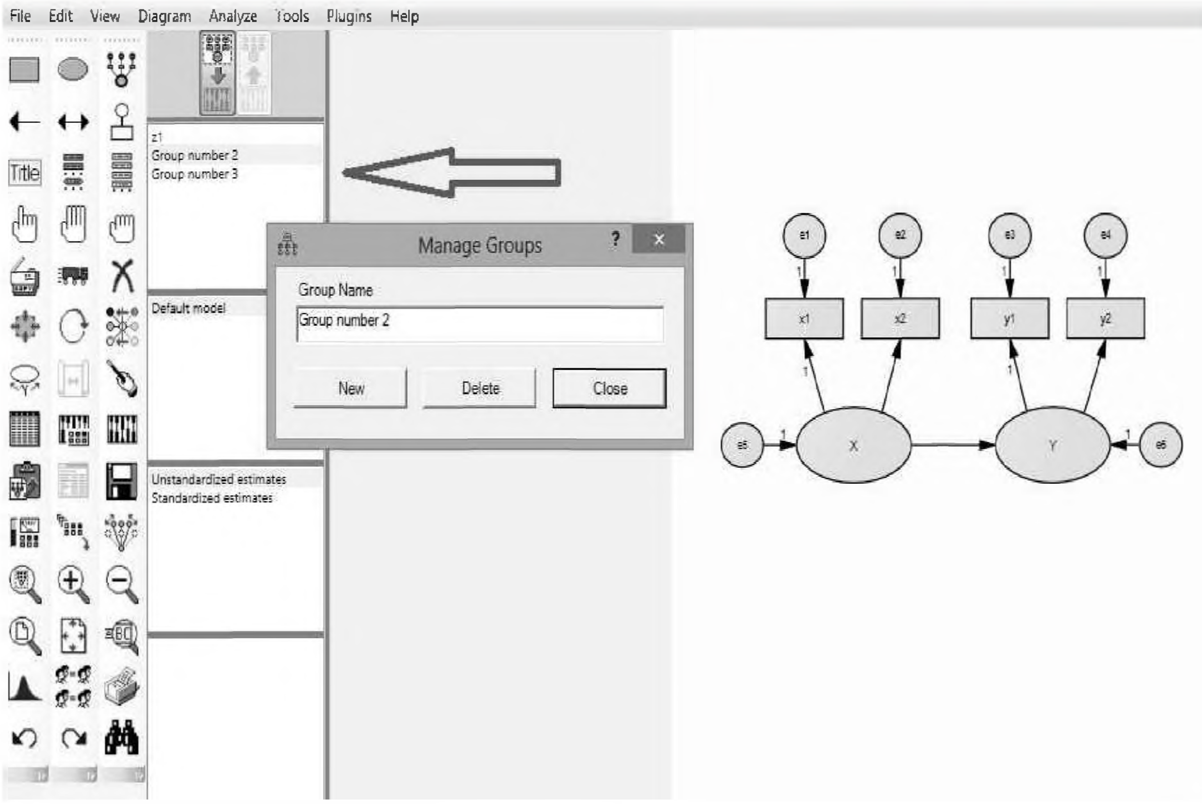

Figure 2: Defining Groups of Moderating Variable

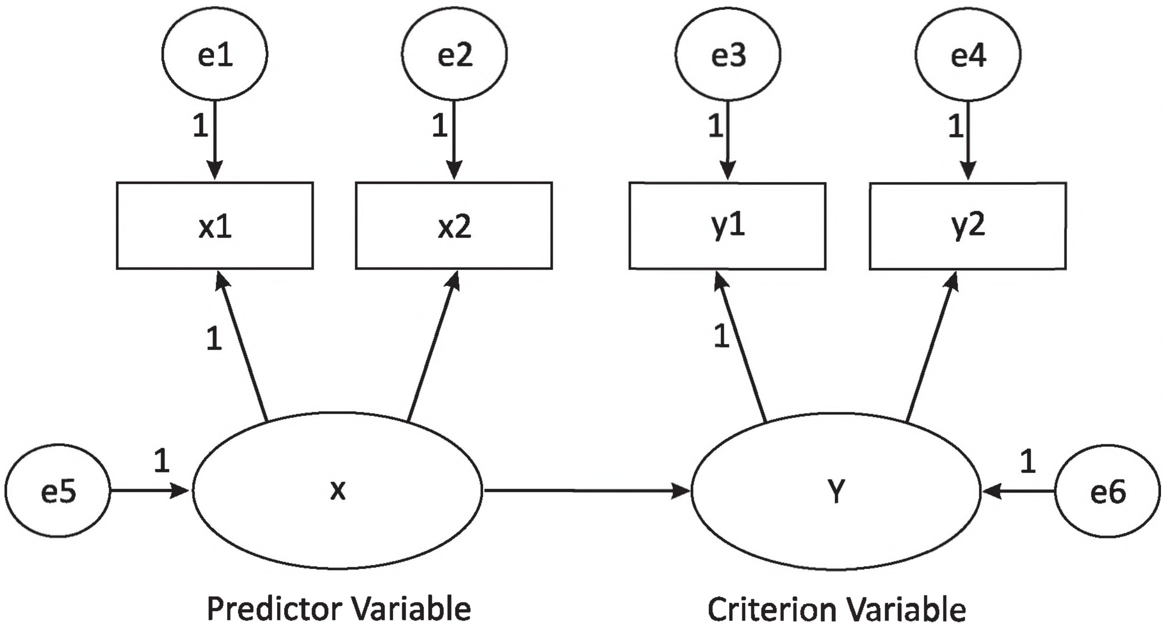

Figure 3: Constrained Model

Step-VI : Enter the values ascertained in Step-III and Step-IV above in "Stats tool package" and check whether the groups are invariant at model level. If yes, there is no moderation. If no, groups are different at the model level and you have to check path differences by going for path by path analysis, if there are multiple paths in the model. Any chi-square more than the threshold [green cells in "Stats tool package"] will be variant for a path by path analysis, at specific level of significance.

Step-VII : If the moderation is found for particular path, you need to check for the values of regression weights for different groups to draw conclusions about how is the moderator "z" affecting the relationship between independent "x" and dependent "y" variable.

You may refer to Vij and Farooq (2014a, 2014b, 2015) for demonstration of how to present and interpret the multi-group moderation analysis in research papers.

Conclusion

Business researchers are interested in building theories and models to understand and decode the relationships amongst various variables related to organizational system. But these relationships are not straightforward. The subgroups (e.g. different segments of customers, different types or levels of employees, different types of industries, different organizational structures etc.) influence the strength and/or the form of the relationship between the criterion and predictor variables. Therefore, theories and models should be built carefully, tested for moderating influence of probable subgroups. Identification of the influence of moderating variables has important implications for business research. Many decision makers rely upon the predicted relationships and invest scarce resources for maximizing the organizational performance. If they are aware that the relationship between two variables is dependent on a third variable, the influence of the moderating variable may be accounted for and decisions can be made more effective and productive. This paper may help the business researchers in identifying the moderating variables and practically incorporating multi-group moderation in their research studies.

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