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A multi-group analysis of structural invariance: an illustration using the technology acceptance model

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Abstract

Selecting the appropriate mix of functional and/or interface characteristics to achieve user acceptance has proven to be a more challenging and difficult decision than expected. While numerous studies have shown that the technology acceptance model (TAM) is useful for predicting acceptance, estimates of its structural weights are not consistent across studies. Using initial exposure data from 742 users of office suite applications (i.e., spreadsheet, database, word processing, and graphics), our research illustrated the use of multi-group analysis of structural invariance (MASI) to test differences in structural weights across population subgroups for latent variables in TAM. We argue that, for large sample studies containing latent variables, MASI may be a more appropriate test of differences for structural weights/regression coefficients than analysis of covariance. The managerial implications of the results in setting functionality and interface goals and allocating resources to continued development efforts are discussed.

JEL classification: EI0207; GA03; EL03; IB01; GB02; EI0104

Keywords: Structural invariance; Factorial invariance; Confirmatory factor analysis; Perceived usefulness; Perceived ease-of-use; Technology acceptance model

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1. Introduction

More than half the cost of the development of complex software or IS is attributable to decisions made in the upstream stage, where many fuzzy ideas about functional and interface characteristics have to be converted into a requirements specification and design [37]. Effective software development requires the careful allocation of resources to work on functional and/or interface features. Adding functionality will improve user perceptions of the usefulness of the software and enhancing the user interface may make the software easier to use. However, selecting the appropriate mix of functional and/or interface characteristics to achieve user acceptance has proven to be difficult [30,35]. Davis [12] proposed measures of perceived usefulness (PU) and perceived ease of use (PEU) as components of a technology acceptance model (TAM) [13] where intention to use (IU) was used as an indicator of user acceptance.

Knowledge of the relative efficacy (i.e., structural weights) of PU and ease of use in predicting user acceptance for a specific category of an application would be valuable in planning for new development or improvement projects. It could help developers set more appropriate design goals and make better decisions that improve functionality and/or interface characteristics. Better informed planning should improve the initial quality of the system, reduce rework after alpha and beta testing, enhance the payoff from improvement projects, reduce the cost of development, and shorten the development time.

During the alpha and/or beta test phases, users are exposed to the software and their perceptions of its usefulness and ease of use are obtained. Using user response information from these tests, developers plan enhancements of the software's functional and interface characteristics. But, by this time, most of the systems development resources have been spent. Thus, prior knowledge of the efficacy (i.e., structural weights) of PU and PEU for a category of application is critical to improving the effectiveness of the software development effort.

Research on TAM might provide this prior knowledge [15,28,34]. Davis et al. advocated using TAM for predicting the acceptance/purchases of software during early development phases. PU is an end-user's subjective probability that using a specific application will increase his/her job performance. PEU refers to the end-user's expectations that the software is free of effort. IU is important for developers because it is viewed as a major factor influencing software adoption/purchase decisions and, thus, market share. The TAM model is an analytical simplification of how functionality and interface characteristics relate to adoption decisions. In alpha and beta testing, developers desire much more detailed and extensive information on user reactions to specific aspects of the software.

Many studies have been conducted using TAM. However, these studies have reported wide variations in structural weights for both PU and PEU across applications. In aggregate, they are inconclusive and provide limited help to a developer who wishes to know the relative efficacy of usefulness versus ease of use in predicting user acceptance. Thus, developers still have to rely on their own experience or intuition in allocating resources.

This paper illustrates the use of multi-group analysis of structural invariance (MASI) to test for differences in structural weights [9] of PU and PEU in predicting IU across four office suite applications (i.e., spreadsheet, database, word processing, and graphics). While office suite applications are relatively mature, the market is enormous and substantial resources continue to be deployed to enhance their functionality and interface characteristics or redesign these applications for a thin client or Web context.

When latent variables are involved, MASI may provide a more rigorous test of differences in structural weights across groups than analysis of covariance (ANCOVA). The test can answer the question: Do PU and PEU have equivalent structural weights predicting IU across the four office suite applications? Previous research by Doll et al. [16] has tested PU and PEU for measurement invariance. This research extends that study to examine structural weights and test for structural invariance among office suite applications.

2. Literature review

Knowledge of the relative efficacy of PU and PEU in predicting IU for the applications comprising office suite applications can be useful in setting development