

1-1-2000

Multidimensionality of Entrepreneurial Firm-level Processes: Do the Dimensions Covary?

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ABSTRACT

Covariance (or not) among the first-order dimensions of firm-level entrepreneurial processes underpins a fundamental and non-trivial difference between the entrepreneurial orientation and entrepreneurial posture constructs. Utilizing a typology developed for multi-dimensional constructs, we operationalized each construct according to its specific conceptualization (relationships among the dimensions) and compared and contrasted each construct in an identical nomological network. Although we found support for both theories, the entrepreneurial orientation construct was more robust in explaining additional variance in growth. Additionally, our findings suggest that the means through which the first-order dimensions are operationalized—latent vs. summates— significantly affect the analysis.

INTRODUCTION

The apparent futility of achieving consensus on a definition of entrepreneurship (Gartner, 1990) has led many researchers to abandon the effort, with the proviso that each writer should specify how the concept is operationalized in a particular study (Brockhaus, 1987). However, certain constructs in the entrepreneurship literature are amenable to empirical clarification. Such is the case for the multidimensional firm-level entrepreneurial construct.

Historically, entrepreneurial processes at the firm level of analysis have been conceptualized as a multidimensional construct composed of three dimensions: innovation, proactiveness, and the propensity for risk-taking. Miller (1983) and Covin and Slevin (1989; 1991) argued that these three dimensions covary, and that the source of this covariance is a latent higher-order (HO) construct, termed entrepreneurial posture. Recently, Lumpkin and Dess (1996) countered that these dimensions are insufficiently comprehensive and the scope of the domain should include additional dimensions. Further, they asserted that these dimensions may vary independently of each other, and thus, should be modeled in some combination which the authors termed entrepreneurial orientation. In sum, all authors would agree that the overall entrepreneurial construct is multidimensional; however, they do disagree as to the relationships among the dimensions and how the dimensions relate to the overall construct.

The specification and agreement of the relationships among the dimensions and how the dimensions relate to the overall construct are central to the field of entrepreneurship not only for future theory building but also in the operationalization of these conceptualizations for theory testing. As Law, Wong, and Mobley (1998) suggested, “only when the interrelations among the dimensions and between a multidimensional construct and its dimensions are specified can

researchers derive overall and parsimonious conclusions about the role of the multidimensional construct in its nomological network.”

This study strives to bring about an understanding not only of the differences in conceptualization but also of the implications of these differences in the following ways. First, we will develop a typology that delineates the possible ways the dimensions may relate to each other and then, how these dimensions may relate to an overall construct. This typology is an extension and synthesis of the work of Law et al. (1998) and Howell and Wilcox (1994) and suggests a systematic approach in classifying, delineating, and operationalizing the different conceptualizations. Second, through a structural equation model of each conceptualization, we will investigate the covariance among the dimensions and explore how well the respective models fit the data. Third, we will assess the explanatory power of the overall construct, however derived, in terms of its relationship to organizational expansion, controlling for size and alliance behavior and finally, examine if the method of operationalizing the first-order (FO) constructs matters.

TYPOLOGY OF MULTIDIMENSIONAL CONSTRUCTS

In any discussion of theoretical conceptualizations involving multiple dimensions, “typologies can be useful as heuristic devices to highlight the relevant theoretical dimensions of a type. In a real sense, they are the premier tools for defining and explicating multidimensional concepts” (Bailey, 1994). The typology explicated in this article for multidimensional constructs is an extension and synthesis of the work of Law et al. (1998) and Howell and Wilcox (1994). We concur with Law et al. (1998) in defining a construct as “multidimensional when it consists of a number of interrelated attributes or dimensions (>1 dimension) and exists in multidimensional domains.” We also concur with the above authors that the nature of a “multidimensional construct differs when different interpretations are attributed to the relations between the overall construct and its dimensions” and among the dimensions as well.

In developing our typology, we suggest three classification rules for delineating a type of overall construct. As noted in [Figure 1](#), the first classification rule asks the question, “Does the overall construct exist at the same level as its dimensions?” (FO dimensions in this typology are latent constructs that are measured by observable indicants). We argue that an overall construct may relate to its dimensions at one of two levels. That is, the overall construct may exist at the same level of its dimensions (i.e., as a profile model) or it may exist at a different level than its dimensions. As neither conceptualization of the entrepreneurial construct in this study would be considered a profile type, we will exclude this type from further discussion.

While the first classification rule determines the level at which the overall construct exists in relationship to its dimensions, the second classification rule delineates the relationships among the dimensions, while the third delineates the relationship between the dimensions and a higher order (HO) construct. The second classification rule asks, “Are the dimensions correlated among themselves?” If the dimensions are correlated, we would argue that the correlations among the constructs are the effect of an underlying HO construct (Bollen & Lennox, 1991). We term this type of overall construct a “reflective construct.”¹ To graphically demonstrate this relationship ([Figure 1](#)) between the dimensions and the HO construct, the direction of the arrows flows “*from the overall construct*” “*to the dimensions.*” Thus, the HO construct is reflected in the FO dimensions.

However, if the dimensions are not correlated, we argue that the dimensions take on two possible roles in forming two additional types of HO constructs. The first role is that the FO constructs may be considered as alternative manifestations of other multiple HO constructs. As neither conceptualization of the entrepreneurial construct takes this view, we will also exclude this type from further discussion. The other role of the dimensions is in the formation of an overall construct. We term this type of HO construct a formative construct because the dimensions determine (exert a causal influence²) on the construct and is formed by some means of aggregation of its underlying dimensions. Thus, this relationship between the dimensions and the HO construct may be graphically represented ([Figure 1](#)) by the direction of the arrows flowing “*from the dimensions*” “*to the overall construct.*” As to whether or not a formative construct exists at a higher level from its dimensions, we suggest that the HO formative construct (composite) contains a set of properties that are necessary and sufficient to define the conceptualization of the overall construct, while each respective dimension is necessary, although not sufficient, in defining the construct. Therefore, because no one FO dimension captures the richness and scope of the overall formative construct, we argue that the composite construct exists at a higher level than its dimensions.³

In sum, with the use of three classification rules, a typology is developed that depicts multiple types of constructs derived from the relationships among the dimensions and how these dimensions relate to an overall HO construct,⁴ only two of which are relevant to this study: a reflective and a formative construct. With this specification, it is now possible to classify the authors’ conceptualizations of firm-level entrepreneurial processes into either of two types of HO constructs. Furthermore, it is now possible to operationalize each conceptualization through covariance modeling and to test how well the models, depicting each conceptualization, fit the data.

ENTREPRENEURIAL PROCESSES

Miller (1983) held that firm-level entrepreneurial processes are captured through three dimensions: innovation, proactiveness, and risk-taking. Covin and Slevin (1989) used a nine-item scale to operationalize these same dimensions and termed the overall process that it measures the “strategic posture” of the firm. In formulating their model, Covin and Slevin (1991) used the same three dimensions as Miller and further suggest that the posture construct “reflects an overall strategic philosophy concerning how the firm should operate on particular behavioral dimensions.” Embedded in the above conceptualization is an implicit assumption that the dimensions covary. Miller (1983: 780) (noted by Covin & Slevin, 1989: 79) addressed the logic and rationale as to why these dimensions should covary:

In general, theorists would not call a firm entrepreneurial if it changed its technology or product-line (innovated . . .) simply by directly imitating competitors while refusing to take any risks. Some proactivity would be essential as well. By the same token, risk-taking firms that are highly leveraged financially are not necessarily entrepreneurial. They must also engage in product-market or technological innovation.

The underlying premise suggests that if a given firm scores high on any one dimension, such as innovation, there is the likelihood that the firm will score high on all of the other dimensions; i.e., the dimensions covary. Furthermore, if a firm scores high in all dimensions, the firm would be considered “entrepreneurial.”

Lumpkin and Dess (1996) offer an alternative position, contending that the dimensions of the entrepreneurial construct vary independently of each other, and thus, should be modeled in some combination, a multidimensional construct that they termed entrepreneurial orientation. They also argue that the above three dimensions do not sufficiently capture the domain of firm-level entrepreneurial processes and propose the addition of aggressiveness and autonomy. However, the authors argue that even though “all five dimensions are central to understanding the entrepreneurial process, they may occur in different combinations, depending on the type of entrepreneurial opportunity a firm pursues.” This suggests that the operationalization of the entrepreneurial orientation construct could

result in twenty plus different combinations of the five dimensions, if a combination includes two to five dimensions. Thus, in reference to the former authors' conceptualization of entrepreneurial posture as three dimensions, these three dimensions would be a subset within the set of all possible combinations proposed by Lumpkin and Dess (1996). The authors also argue that the dimensions are independent and may vary independently of each other. In other words, the dimensions do not covary. The underlying logic of this conceptualization is that, if a firm scores high on any one dimension, this would not necessarily increase the likelihood of the firm exhibiting high scores in any of the other dimensions. Additionally, even though the firm does not exhibit high scores in all dimensions (that is, scoring high in only several dimensions) the firm may be considered as entrepreneurial as a firm that scores high in all of the dimensions as proposed by Miller and Covin and Slevin.

In sum, the authors' theoretical conceptualizations converge with respect to both the independence of the dimensions and the dimensions forming an overall multidimensional firm-level construct. However, they diverge in their specification of how the dimensions relate to each other (e.g., do the dimensions covary or not) and to an overall construct. Through the use of our typology embedded with three decision rules, each conceptualization may be delineated into a distinct but different type of HO construct. Entrepreneurial Posture, which argues that the dimensions covary and the source of this covariance is an HO construct, may be classified as an HO reflective construct; while Entrepreneurial Orientation, which argues that the dimensions do not covary and the overall construct is formed by some combination of the independent dimensions, may be classified as an HO formative construct.

Having laid the foundation for delineating the authors' conceptualization of firm-level entrepreneurial processes into formative or reflective HO constructs, what remains is to test how well the models of the different conceptualizations fit the data. Thus, a series of questions is proposed that outlines a systematic approach to testing the different theories.⁵

Research Question 1: Are the dimensions separate and independent dimensions?

This question is proposed because the possibility exists the dimensions are not separate and distinct and are actually measuring the same phenomenon. The resolution to this question rests on the establishment of discriminant validity between the latent FO constructs through the use of a confirmatory factor analysis (CFA).

Research Question 2: Do the dimensions covary?

As Dess, Lumpkin, and McGee (1999) suggest, this question has been assumed away but is a central issue. We also concur that this question is central not only to the conceptualization but also to the operationalization of the entrepreneurial constructs. This question will also be addressed in a CFA.

Research Question 3: What is the source of this covariance?

The covariance among the dimensions is a key demarcation between the two conceptualizations of entrepreneurial HO constructs. Therefore, we developed a structural model of each construct and inserted each into an identical nomological network. If the dimensions covary, comparing and contrasting the two models may be instrumental in identifying the source of the covariance among the constructs.

Research Question 4: Which model exhibits the most explanatory power?

This question not only asks which model may have the most explanatory power within its own nomological network, but also entertains the notion that regardless of how one defines the construct, the question arises as to whether it is worth the effort to define and measure it. To be of relevance to scholars and practitioners, we operationalized an outcome measure, growth, to test for the explained variance by the HO entrepreneurial construct, however conceptualized, while controlling for alliance activity and size.

Research Question 5: Does the method of operationalizing the constructs matter?

Although the conceptualizations of entrepreneurial processes have revolved around latent constructs, the operationalization of these constructs has usually been through the summation of the indicator variables, which assumes the indicants are perfectly reliable indicators of the underlying construct. However, we felt it is appropriate to test this assumption. Once a model has been selected as the best fitting and most robust, we will operationalize the theoretical constructs as latent constructs and as summates of the indicants to test if differences exist between the two methods in explaining variance in growth, the dependent variable.

CONSTRUCTS, SAMPLE, AND MODELS

Measures of constructs: The main FO dimensions associated with firm-level entrepreneurial processes, according to Miller, Covin and Slevin, and Lumpkin and Dess, are proactiveness, risk-taking, and innovation. The dimensions used for this study are proactiveness, risk-taking, and, instead of innovation, futurity. This latter difference diminishes our ability to match the conceptualization of the work of the above authors; however, as Lumpkin and Dess make clear, no consensus has emerged on precisely which FO dimensions ought to be included. This study substitutes futurity for innovation because the survey instrument used incorporates a variant of a scale developed by Venkatraman (1989), which has largely satisfied the criteria for convergent, discriminant, and predictive validity. Furthermore, futurity was conceptualized and operationalized as one of a set of dimensions, such as aggressiveness, proactiveness, and risk-taking, that formed a multidimensional HO construct termed "strategic orientation." This scale, as adapted by Tan and Litschert (1994), was used.⁶

Other latent constructs: The other latent constructs used in this study (formal coupling and growth) were operationalized by means of a maximum likelihood exploratory factor analysis. This provided a useful heuristic for constructing multiple-indicator measurement models as a precursor to confirmatory factor analysis (Gerbing & Hamilton, 1996). *Formal coupling* (alliance behavior) was included as a control variable because of its demonstrated affect on organizational growth. Alliance behavior has been a major source of organizational expansion and has been associated with increased innovation within the health care context (Goes & Park, 1997). Moreover, empirical studies have suggested that networks facilitate firm growth (Burt, 1992).

Organizational growth is the study's outcome measure. It may be argued that it would be preferable to use growth in wealth, not organizational expansion. However, the literature is clear in treating growth as an important outcome measure for entrepreneurial firms (Gartner, 1990; Hoy, McDougall, & Dsouza, 1992; Penrose, 1959).

Organizational size: As with many other contexts, the health care industry context is one in which organizational size is correlated with many other variables, including growth. Organizational size is best reflected by the number of full-time-equivalent (FTE) physicians (Kimberly, 1976), and is also used as a control variable in the nomological network.

Sample: The data for this study were obtained from a national survey of health care executives (either physician or non-physician) who were well enough informed to report on their organizations' strategic actions. Of the 3,233 questionnaires distributed, 865 were returned for a response rate of 27%.

The structural models: Because different conceptualizations by the various authors represent two distinct types of overall constructs—formative and reflective—two structural equation models were developed, with each model corresponding to the conceptualization of each set of authors.

The first model, which we term the reflective model, represents the conceptualization of the FO dimensions—proactiveness, futurity, and risk-taking—as independent *but covarying*, with the source of this covariance an underlying HO factor. This type of HO factor may be represented as a reflective construct and denotes the “entrepreneurial posture” construct at the firm level of analysis.

The second model, which we term the formative model, represents the conceptualization of the FO constructs as independent but *do not covary*. Additionally, these dimensions, through some combination (composite), determine an overall HO construct. This type of HO construct may be represented as a formative construct⁷ and denotes the “entrepreneurial orientation” construct at the firm level of analysis. Additionally, in both models—reflective and formative—the HO construct is related to growth to test not only for the magnitude and significance of the path between the individual construct and growth, but also for the degree to which the construct explains additional variance in growth, while controlling for alliance behavior and size.

RESULTS

Data were analyzed using EQS software (Bentler & Wu, 1997) and the models tested were linear covariance structure models.⁸ The means, standard deviations and correlations between all FO constructs (modeled as latent constructs and summated) are presented in [Table 1](#).

The analysis followed a two-step procedure, an approach recommended by Anderson and Gerbing (1988). In the first step, confirmatory factor analysis is used to develop a measurement model that demonstrates an acceptable fit to the data. In step two, the measurement model is modified to represent the theoretical model(s) of interest. The model(s) are then tested as being meaningful, parsimonious, and having a statistically acceptable fit.

The measurement model: Goodness of fit indices for the final measurement model, estimated using the maximum likelihood method, are presented below. The chi-square value for the final measurement model was statistically significant: $\chi^2 = 204.90$, $p < .001$ (138 df, $n = 579$). However, one should be cautious about rejecting the model on the basis of this statistic, which is sensitive to small departures from a multivariate normal distribution⁹ (Hatcher, 1994). Further, the values for the Bentler-Bonnet Non-normed fit index (NNFI) (Bentler & Bonnet, 1980) and the comparative fit index (CFI) (Bentler, 1990) were greater than .9, indicating an acceptable fit. Additional fit indices used to evaluate model fit were the root mean squared residual (RMR) and the root mean-square error of approximation (RMSEA). The RMR index was below .05 and may be associated with better fitting models (Joreskog & Sorbom, 1984). RMSEA is a measure of model discrepancy per degree of freedom, which incorporates a measure of parsimony into the measure of (lack of) fit. The model displayed an RMSEA value below .05, with a 90% confidence interval (CI) not including the .05 value, indicating a close fit of the model relative to the degrees of freedom (Browne & Cudeck, 1993).

With the measurement model displaying an acceptable fit, a number of tests were conducted to assess the construct's reliability and validity.¹⁰ Standardized factor loadings for the indicator variables ranged from .42 to .69 and t -scores obtained for the coefficients (of factor loadings) ranged from 8.94 to 15.74, indicating that all factor loadings were significant ($p < .001$). This finding provides evidence supporting the convergent validity of the indicators (Anderson & Gerbing, 1988).

Composite reliability is a measure of internal consistency comparable to coefficient alpha (Fornell & Larcker, 1981). However, this measure is superior to Cronbach alpha in that it does not assume equal item loadings (Howell, 1996). All scales demonstrated acceptable levels of reliability with coefficients for the exogenous constructs ranging from .52 to .69 and for the endogenous constructs ranging from .57 to .72.

Discriminant validity is a means of assessing latent factors as being separate and distinct constructs; i.e., not measuring the same underlying dimension. Because the correlations between the latent constructs of proactiveness, futurity, and risk-taking were high, ranging from .57 to .76 respectively ([Table 1](#)), we used an adjusted t -value (Finn, 1974) in performing confidence interval tests ($\alpha = .05$) to assess the discriminant validity between the factors.¹¹ If the interval does not include 1.0, discriminant validity is demonstrated (Anderson & Gerbing, 1988). None of the confidence intervals included 1.0, and thus, the constructs may be interpreted as independent, thereby answering Research Question (RQ) 1.

In sum, our findings generally support the reliability and validity of the constructs and their indicants, in addition to establishing the constructs as independent dimensions. The final measurement model was therefore retained as the basis against which other models may be compared.

The structural models: The reflective model operationalizes entrepreneurial posture as a multidimensional (proactiveness, futurity, and risk-taking) HO reflective construct. The standardized loadings (.767 to .982) and t -tests ($p < .001$) of the three FO constructs provide evidence supporting the convergent validity of the HO factor (Anderson & Gerbing, 1988).¹² Additionally, the composite reliability of the HO factor was .887. In sum, these results initially suggest that the HO factor is a source of the covariance among the latent FO latent constructs.

Having found support for the HO reflective construct, we refocused our analysis on the fit of this theoretical model, as specified in [Figure 2](#). The NNFI and CFI fit indices are both above .89, indicating an acceptable fit. The value of RMR is approximately .023, and the RMSEA is below .05, [CI (90%), .036 to .050], indicating that the theoretical model provided a fit that was not significantly worse than that provided by the measurement model (Howell, 1996). Finally, our findings for the path coefficient between the reflective HO construct and growth is positive and statistically significant, while controlling for formal alliance and medical group size, with a standardized estimate of .224 ($p < .001$). However, the increase in explained variance of growth¹³ was only .031 ([Figure 2](#) and [Table 3](#)).

In summary of the findings for the reflective model, the validities, reliabilities, and fit indices, provide overall support for the theoretical model. Furthermore, the model suggests that the source of the covariance among the FO dimensions may be an HO reflective construct. However, as evidenced by the change in R^2 , the reflective construct was marginal in explaining additional variance in growth.

The formative model operationalizes entrepreneurial orientation as a multidimensional HO formative construct. With the covariance among the dimensions controlled for in the formative model by a general factor,¹⁴ and since EQS produces no statistics for the formative construct because it is endogenous, we turn to the fit of the formative model as specified in [Figure 2](#). The NNFI and CFI fit indices are slightly lower than the reflective model with the NNFI = .887 and the CFI = .903. With the values of RMR = .023 and the RMSEA below .05. [CI (90%), .037 to .050], all fit indices suggest an acceptable fitting model. Finally, our findings for the path coefficient between the formative HO construct and growth is positive and statistically significant while controlling for formal alliance and medical group size with a standardized estimate of .637 ($p < .001$) and change in R^2 of .381 ([Figure 2](#) and [Table 3](#)).

In summary of the findings for the formative model, the validities, reliabilities, and fit indices, provide support for the conceptualization of *entrepreneurial orientation* operationalized as an HO formative construct. What was the most interesting finding was the degree to which the formative construct explained additional variance in growth, with an increase in R^2 over that explained by the control variables of .381.

DISCUSSION OF RESULTS

RQ 1 investigates the independence of the dimensions of futurity, proactiveness, and risk-taking, and through our confirmatory factor analysis (CFA), we established the discriminant validity of all latent constructs, thereby demonstrating that the dimensions were, in fact, independent.

Having established that the dimensions are independent, RQs 2 and 3 investigate the covariance (or not) of the dimensions and its source. In our CFA, we found that the dimensions were highly correlated; however, just because high correlations exist among the dimensions, it does not necessarily follow that a causal mechanism is driving the correlations. For example, two explanations for these correlations may be a true halo effect (Nisbett & Wilson, 1977) or simply that there is a degree of systematic error which was not separated out from true score (Pedhazur & Pedhazur-Schmedlkin, 1991). Alternatively, it is possible that these correlations are actually driven by an underlying causal mechanism, such as an HO reflective construct. Therefore, our answer to RQ 2 is that the dimensions are correlated but, as to making a definitive and absolute assessment of its source, it is dubious at best.

Because of the confounding effects of true halo or systematic error, we would suggest approaching RQ 3 from a different perspective. That is, rather than making covariance among the dimensions and its source the central focus, researchers may ask an alternative question: Is it the variance that is common among the FO constructs (reflective), or is it that which is unique (formative) that has the most robust predictive validity? In this vein, a reflective HO construct would therefore be defined as one that captures the variance that is common among the FO dimensions while the formative HO construct (modeled with a general factor) captures the variance that is unique. This respecification still satisfies the underlying assumptions and relationships among and between the dimensions as conceptualized by both sets of authors.

RQ 4 asks which conceptualization of the authors best fits the data and is a better predictor of organizational growth. Although both models fit the data relatively well, the reflective construct only marginally explained additional variance in growth (.031). Conversely, the formative construct was more viable in explaining additional variance in growth, with an increase of .381 in R^2 . To synthesize our findings, rephrased in terms of our preceding discussion, one could argue that the variance that is unique, rather than that which is common to the dimensions, was the most robust in explaining additional variance. Therefore in answer to RQ 4, our findings suggest that, although both conceptualizations were supported by model fit, the formative construct has the more explanatory power relative to the reflective construct.

In building theory, it is our opinion the authors have been fairly thorough in the specification of the relationships among the dimensions and between the dimensions and the HO entrepreneurial construct. However, implicit in their conceptualizations is the use of latent constructs. Nevertheless, common practice in operationalizing these constructs is to summate the indicants and then use some type of regression technique. Therefore, to test if this matters, we tested the formative model by operationalizing the constructs by both means—latent constructs (structural model) and summing the indicants (regression model). As reported in [Table 3](#) and [Table 4](#), the explained variance of the two methods is substantially different. The latent-formative model's increase in R^2 was .381 (while controlling for alliance behavior and size) while that of the summated indicants-formative model was only .034/.027. Therefore, in answer to RQ 5, how the constructs are operationalized matters in a non-trivial way.

LIMITATIONS OF STUDY

The most apparent limitations of our study are its cross-sectional nature and the use of secondary data, in that it necessitated the use of the “futurity” rather than the “innovation” dimension in the operationalization of the HO entrepreneurial posture and entrepreneurial orientation constructs. The use of self-report data for all indicants may also be a further limitation in that several problems may be associated with self-report measures such as common method variance (Campbell & Fiske, 1959), a consistency motif, social desirability (Arnold & Feldman, 1981), or halo effect. However, Wagner and Crampton (1993), in a meta-analysis, found “that percept-percept inflation did not have the broad and comprehensive effects envisioned by critics.”

CONTRIBUTIONS

Our study contributes to the field of research in general, as well as specifically to the domain of entrepreneurship. In the development of our typology for multidimensional constructs, we provide a heuristic means to aid in the specification of relationships among and between the dimensions of multi-dimensional constructs. Based on this typology, we were able to delineate, systematically operationalize, and test, in the empirical domain, two fundamental theories conceptualized in the entrepreneurship literature, “entrepreneurial orientation” and “entrepreneurial posture,” at the firm level of analysis.

We did find support for both theories as demonstrated by the overall fit of each model to the data. However, we found that the formative construct was more robust and shows promise for scholars and practitioners because of the magnitude and significance of the construct in explaining additional variance in organizational growth while controlling for size and alliance formation.

A final contribution our study makes to the entrepreneurship literature, and possibly research in general, is that how the theoretical constructs are operationalized and what statistical methods are used—matters. Given the exact same model in all respects, except operationalizing the constructs as latent

constructs through the use of structural equation modeling rather than summing the indicants by way of aggregation and using regression techniques, we found a non-trivial difference in explained variance in growth, with the latent model being the most robust.

NOTES

1. This reflective construct is equivalent to the latent construct in Law et al.'s Taxonomy.
2. Causal does not attribute any special significance to the term cause other than the fact that the dimensions determine the latent construct (Bollen & Lennox, 1991).
3. This difference in conceptualization of the level of the construct is a major difference between the typology we suggest and the taxonomy suggested by Law et al.
4. Given these constructs exist at a higher level than their dimensions.
5. This study can be expressed in hypothesis-testing terms. However, this would be excessively cumbersome because, in a structural equation model, each path represents a hypothesis, and a complex one at that, as each is contingent on all the other specifications in the model.
6. A copy of the instrument maybe obtained from the first author.
7. Without theory to guide the actual weights, the paths between the FO factors and the formative construct were set at one. The equal weighting is a conservative as well as an HOListic means to model the construct.
8. Correlations for the indicator and manifest variables may be obtained from the first author.
9. As a cross check, EQS provides a technique for estimating parameters and standard errors that allows for the relaxing of the normality assumption. No significant deviation in reported parameter estimates or significance of these estimates were found in the measurement model or structural models.
10. All standardized loadings of the indicator variables, t-scores, and composite reliabilities for the constructs may be obtained from the first author.
11. Performing a number of significance tests creates the problem of family error rates, with the overall significance level for that series of tests increasing.
12. The larger the factor loadings or coefficients as compared with standard errors and expressed by the corresponding t-values, the stronger the evidence that the measured factors represent the underlying construct (Bollen & Lennox, 1991).
13. Prior to testing the relationship between the HO construct and growth, a null model, containing growth and two control variables, is used to establish a reference point for initial explained variance, R², (Table 3).
14. Note [Appendix](#) for explanation and use of a general factor in the model.

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APPENDIX

After establishing the reliabilites and discriminant validities of the various constructs via confirmatory factor analysis, we then proceeded to model and test the reflective model (entrepreneurial posture (Figure 2) to establish model fit and the degree to which the higher-order (HO) construct explained additional variance in growth. After assessing this model, we then modeled entrepreneurial orientation as a formative HO construct. However, embedded in this conceptualization is the explicit assumption that the FO dimensions do not covary. Therefore, to appropriately operationalize the HO construct, we used a general factor (GF) to partial out the variance that was common among the FO constructs. The result effectively reduced the correlations to zero, thus satisfying the underlying theoretical assumption of non-covariance among the dimensions. Thus, in operationalizing the formative construct, the HO construct is formed from the variance that is “unique” to the underlying first-order dimensions.

Having modeled a GF in the formative model, and to be consistent across our models, we returned to the initial reflective model and retested the reflective model by also including a GF. However, because the underlying conceptualization of the HO construct is reflective rather than formative, we modeled the GF as relating to all indicants within the model rather than to the latent constructs themselves.

As can be observed from Table 4, the path coefficients and additional explained variance in growth for the reflective model without the GF are .106 ($p < .05$) and .031, and with a GF, .133 ($p > .1$) and .025, respectively. For the formative model, the path estimate and explained variance are .104 ($p < .05$) and .024 without the GF, and .103 ($p < .05$) and .381 with the GF, respectively.

Therefore, within the main body of our article, we discussed the results of the formative model using the GF to be consistent with the authors' conceptualization of non-covariance among the dimensions. As for the reflective construct, we discussed the results of the model that did not contain a GF for two reasons. First, the change in additional explained variance was insignificant between the two models (GF and not) and second, without the GF, we are able to increase the degrees of freedom in the overall model which enables not only a more parsimonious model but also more reliable path estimates.
