WHAT DO WE REALLY KNOW ABOUT ENTREPRENEURIAL ORIENTATION? USING QUANTITATIVE EMPIRICAL REVIEWS TO ADVANCE ITS CONCEPT AND NOMOLOGICAL NETWORK

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INTRODUCTION

The seminal treatise on archetypes of strategy formulation that characterized entrepreneurship as an organizational attribute and lay the foundation of the entrepreneurial orientation construct (EO), was published in 1978 by Danny Miller and Peter Friesen (Miller & Friesen, 1978). Common across entrepreneurial firms are sustained organizational behavior patterns and managerial styles that reflect in the concurrent exhibition and shared variance among three key dimensions, i.e., innovativeness, proactiveness, and risk-taking (Covin & Slevin, 1989; Miller, 1983). The innovativeness dimension constitutes the "heart" of the EO construct and refers to the ability of a firm to develop and launch new product-market entries (Covin & Miles, 1999). Proactiveness captures the forward-looking stance of a firm, that is, to act upon opportunities and to anticipate future demand ahead of competitors (Lumpkin & Dess, 1996). In contrast to innovativeness and proactiveness that address what entrepreneurial firms do, the risk-taking component is comprised of managerial decision-making styles concerning the dispositions of managers to commit significant resources to high-risk/high-reward projects (Anderson, Eshima, & Hornsby, 2019; Miller, 2011). In the preceding decades, the popularity of EO proliferated quickly, resulting in an incredible volume of scholarship, and established EO as a central strategic orientation in the entrepreneurship and broader management literature (Covin & Wales, 2019; Miller, 2011; Rauch, Wiklund, Lumpkin, & Frese, 2009; Rosenbusch, Rauch, & Bausch, 2013; Simsek, Heavey, & Veiga, 2010; Stam & Elfring, 2008). However, despite over three decades of research and its unbroken popularity, the EO literature still harbors significant ambiguities and is plagued by long-standing conceptual debates that thwart the strides with which the literature is moving forward (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015; Covin & Lumpkin, 2011; Covin & Wales, 2019; Miller, 2011; Wales, 2016).

Research Questions

The first ambiguity pertains to the sheer volume of scholarship that accumulated over the past decades on the performance relationship of EO. While syntheses of the literature suggests a nuanced and robust association between EO and firm performance (Rauch et al., 2009; Rosenbusch et al., 2013; Saeed, Yousafzai, & Engelen, 2014), it is not clear that the literature has made advances in terms of consistency or transparency in variable choices and modeling building considerations (Covin & Wales, 2019; Lumpkin & Dess, 1996; Wales, 2016; Wales, Gupta, & Mousa, 2013). Besides EO's focal relationship with firm performance, the literature is less clear about EO's drivers and more immediate outcomes that may mediate the EO-performance relationship (Covin & Lumpkin, 2011; Wales, 2016). As EO research continues to accumulate, so do the inconsistencies and lack of coherence across studies widen, making it increasingly challenging to keep track of relevant variable choices, essential mechanisms, and the nature of proposed relationships (Covin & Wales, 2019; Miller, 2011). Thus, greater steps may be necessary to get better "in control" of EO research to ensure that future studies are more consistent, transparent, and defensible.

The second debate is concerned with a long-standing conceptual ambiguity that remains at the heart of the EO construct. This debate originates from the potential for component-level differences and variance embedded within the very foundation of the EO construct (Miller, 1983, 2011). Despite repeated calls to "take seriously the differences between the three key components of EO" (Miller, 2011: 888), the literature has been mainly dominated by holistic EO reporting (Wales, Gupta, et al., 2013). Building on Miller's (2011) observation that combining firm behavior (innovativeness and proactiveness) and managerial styles (risk-taking) might confuse situations in which entrepreneurial attitudes of managers do not match firm behavior, the considerations of component-level relationships have garnered renewed attention within EO research. There are emerging perspectives suggesting a

need to examine the role of managerial risk-taking more explicitly and to revisit how it may be measured and captured as a component of EO (Anderson et al., 2015, 2019; Lomberg, Urbig, Stöckmann, Marino, & Dickson, 2017). Hence, new perspectives on component-level effects within EO research are needed to explore what changes could be helpful in future EO research to advance the conversation around managerial risk-taking attitudes.

The third and final issue is a methodological one. Despite the enormous scope and plurality of the EO literature, there is one crucial feature that is common among almost all EO-performance studies, that is, drawing on cross-sectional research designs (Covin & Lumpkin, 2011; Rauch et al., 2009; Saeed et al., 2014). While such observational designs are limited to only suggesting an association between EO and performance (Antonakis, Bendahan, Jacquart, & Lalive, 2010), most EO scholars agree that entrepreneurially orientated firms perform better than conservatively managed firms (Stam & Elfring, 2008). Hence, while there is a large body of research informing us that EO relates to many things, we lack robust knowledge of causal EO relationships (Covin & Wales, 2019). This is unfortunate because understanding whether EO causes a performance advantage is a critical step in building predictive theory (Goldfarb & King, 2016), and provides actionable insights for managers (Ghoshal, 2005). However, addressing this gap is challenging because firms cannot be assigned to an EO condition and thus robs researchers of the single best tool to establish causal relationships, the randomized controlled experiment (Angrist & Pischke, 2008). Considering that EO cannot be manipulated in the laboratory and thus remains observational, researchers must turn to alternative research designs and empirical approaches to recover causal estimates (Angrist & Imbens, 1995) but EO researchers rarely take this step (Covin & Wales, 2019; Rauch et al., 2009; Saeed et al., 2014).

Contribution and Outline

In an overall effort to contribute to the steadily expanding EO literature, this cumulative dissertation aims to pick up on these three pressing concerns in order to help the literature to advance with greater clarity, comprehensive modeling, and more robust research designs. To achieve this, the first paper of this dissertation focuses on the consistency and coherence in variable choices and modeling considerations by conducting a systematic quantitative review of the EO-performance literature. Drawing on the plethora of previous EO studies, the second paper employs a comprehensive meta-analytic structural equation modeling approach (MASEM) to explore the potential for unique component-level relationships among EO's three core dimensions in antecedent to outcome relationships. The third paper draws on these component-level insights and performs a finer-grained replication of the seminal MASEM of Rosenbusch, Rauch, and Bausch (2013) that proposes EO as a full mediator between the task environment and firm performance. The fourth and final paper of this cumulative dissertation illustrates exigent endogeneity concerns inherent in observational EO-performance research and provides guidance on how researchers can move towards establishing causal relationships.

Paper 1: A Midlife "Transparency" Crisis? Entrepreneurial Orientation in its Forties. Prof. Dr. Matthias Baum co-authors this paper. While past meta-analyses have examined questions of whether and when EO is linked to firm performance outcomes, this systematic review aims to consider critical questions regarding the transparency and consistency of model building within past EO research by consolidating previous research. Thereby, the validity and reliability of future performance studies can be improved in order to foster clearer and stronger knowledge accumulation moving forward. To achieve this, the entirety of variables that have been considered in the EO-performance context, how common or rare these are, the nature of their employment within and across proposed models, and

their structural relationships with EO and performance, are evaluated. In addition to that, comprehensive meta-analytic techniques are used to estimate the correlational strength of these variables with both EO and performance. In doing this, it can be assessed which variables are significantly related to EO and/or performance and, thus, their practical relevance inferred. In short, researchers and practitioners are provided with a comprehensive guide to the empirical EO literature, informing them which variables seem to be most relevant and which appear to fall short their expectations, in order to have greater confidence in the prescriptive guidance that emerges from the expanding EO-performance literature.

Paper 2: Revisiting Risk-Taking? Meta-Analytic Insights, Modeling Comparisons, and Component-Level Relationships in Entrepreneurial Orientation Research. Prof. Dr. William Wales and Prof. Dr. Matthias Baum co-authored this paper. This research employs recent advances in MASEM, drawing on a comprehensive database of more than 540 EO studies, spanning 35 years of investigation, to contribute to the entrepreneurship literature by considering new perspectives on component-level effects within EO research. The aim of this study is threefold. First, a traditional aggregate approach to assessing EO is compared with one in which the dimensions are assessed as individual but correlated components (Miller, 2011) and building on that, it is explored whether managerial attitudes toward risk-taking may appropriately be conceived as an antecedent of firms' entrepreneurial behavior (Anderson et al., 2019; Lumpkin & Dess, 1996). Second, the EO construct was constructed to be broad enough to capture various organizations and their processes in different types of firms, e.g., risk-taking in the small firm and proactiveness in an intrapreneurial giant (Miller, 2011). Thus, it is considered whether and how firm size and age, as key organizational characteristics, may influence the manifestation of EO. Third, it is explored as to whether the observed relationships might be non-linear and the potential for non-linearity to explain the exhibition and consequences of risk-taking or entrepreneurial firm behavior. Along these

lines, non-linearity is observed in EO research (Tang, Tang, Marino, Zhang, & Li, 2008; Wales, Patel, Parida, & Kreiser, 2013), but our understanding of such effects remains fragmented at best (Miller, 2011; Wales, 2016).

Paper 3: Revisiting the Mediating Role of Entrepreneurial Orientation in the Task Environment-Performance Relationship: A Finer Grained-Replication. This paper is single-authored. Advancing on Rosenbusch et al. (2013), this research performs a finer-grained replication of their meta-analytic investigation of EO's mediating role in task environment to firm performance relationships. In addition to adapting the aggregate EO model of Rosenbusch et al. (2013), a finer-grained component-level model is proposed in which EO's components are modeled as individual but correlated components (Miller, 2011). Second, overall firm performance is deconstructed into profitability, growth, and non-financial performance. In doing this, the model-specific paths from elements of the task environment to the three components of EO and from EO's components to these salient performance outcomes, can be assessed in order to gain more detailed insights. Finally, older and larger firms are differently affected by their external environment and may manifest EO differently than their younger and smaller counterparts (Anderson & Eshima, 2013; Covin & Slevin, 1989; Damanpour, 1992; Miller, 2011; Rauch et al., 2009; Saeed et al., 2014). Therefore, firm size and age are included as control variables to account for these organizational considerations. In sum, this research helps to answer recent (Anderson et al., 2015) and long-standing (Lumpkin & Dess, 1996) calls to consider insights on EO's component-level influences in antecedent-to-outcome relationships.

Paper 4: The Chicken or the Egg? Causal Inference in Entrepreneurial Orientation-Performance Research. Prof. Dr. Brian Anderson, Prof. Dr. Matthias Baum, Prof. Dr. William Wales, and Prof. Dr. Vishal Gupta co-authored this paper. The purpose of this study is to help EO researchers move from associational to causal research. Starting with a

systematic review of recent EO–performance studies published in top management journals, a causal inference schema is used to evaluate the extent to which EO researchers adopt research designs and statistical tools to better establish a causal claim. Drawing from this review, pressing challenges EO researchers face in establishing a causal effect of EO on performance are then discussed, and simulations are employed to show how two common research designs yield biased estimates under assumptions often found in EO–performance research. The paper concludes by outlining key considerations in designing an EO–performance study meant to estimate a causal effect. In doing so, this research responds to calls for a more robust consideration of causal inference in management research (Antonakis, 2017; Antonakis et al., 2010) and while these discussions are focused on EO, they might be found useful for strategic entrepreneurship and management scholars employing other broad, multidimensional constructs to capture organizational phenomenon (i.e., market orientation).

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A MIDLIFE "TRANSPARENCY" CRISIS? ENTREPRENEURIAL ORIENTATION IN ITS FORTIES

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INTRODUCTION

It has been more than 40 years since Danny Miller and Peter Friesen published their treatise on archetypes of strategy formulation in 1978 (Miller & Friesen, 1978), which provided the foundation for characterizing entrepreneurship as an organizational attribute (Covin & Slevin, 1989; Lumpkin & Dess, 1996; Miller, 1983). In the preceding decades, an incredible volume of scholarship has manifested on the topic, including notable field-level reviews of conceptual directions (Covin & Wales, 2019; Wales, Gupta, Marino, & Shirokova, 2019; Wales, 2016) and systematic meta-analyses of key relationships and contexts such as the EO-performance relationship (Rauch, Wiklund, Lumpkin, & Frese, 2009), mediation of task environment-performance relationships (Rosenbusch, Rauch, & Bausch, 2013), mediation of human/social capital-performance relationships (Miao, Coombs, Qian, & Sirmon, 2017), and cultural and macro-economic contingencies (Saeed, Yousafzai, & Engelen, 2014).

However, a decade after Rauch, Wiklund, Lumpkin, and Frese (2009), the 2015 Greif Research Impact Award winner for the most influential and cited entrepreneurship paper in the world published in 2009, it is not clear that the EO-performance literature has made strides in terms of the consistency or transparency of variable usages. This is a significant problem, and given that notwithstanding the hundreds of studies on the EO-performance link, our current understanding firmly remains a correlational rather than a causal one. In other words, we have a solid understanding that EO has a significant and meaningful correlation with performance, but we lack knowledge if this is truly a causal relationship, or if (unobserved) third-variables at least partially account for the covariation. Thus, greater steps may be necessary to get "in control" of EO research and ensure that future studies are more consistent, transparent, and defensible. This issue reflects a broader trend to question and revisit modeling choices within quantitative management (Aguinis, Ramani, & Alabduljader,

2018) and entrepreneurship (Anderson, Wennberg, & McMullen, 2019) research. However, the relevance of these trends is evident when considering a phenomenon such as EO that has been tested more extensively than almost any other entrepreneurial phenomenon in the literature to date (Covin & Lumpkin, 2011). Therefore, the purpose of this study is to consider and address the question of how we can get better "in control" of EO research by examining how variables are employed, modeled, and controlled within the body of research on the EO-performance link, an area of research that has continued to receive an increasing rate of scholarly attention over the past decades (Covin & Wales, 2019; Rauch et al., 2009; Saeed et al., 2014).

While past meta-analyses have examined questions of whether and when EO is linked to firm performance outcomes, this review aims to consider critical questions regarding the transparency and consistency of model building within past EO research to consolidate gains and increase the validity and reliability of future performance studies to foster clearer knowledge accumulation. In this vein, our exhaustive review aims to shed light on (a) the typical and less frequent roles of EO and performance within EO performance models, (b) what variables are used within past EO models (e.g., as antecedents, moderators, mediators, etc.), (c) how frequently have these variables been used and have inconsistencies in their application arisen, and finally (d) what variables provide clear indication that they should be considered in future studies of EO-performance relationships?

Within our review, we can chart the entity of variables that have been considered in the EO-performance context, how common or rare these are, the nature of their employment within and across proposed models, and their structural relationships with EO and performance. Furthermore, we draw on comprehensive meta-analytic techniques to determine the estimated correlational strength of variable relationships with both EO and performance.

In doing this, we can assess which variables are significantly related to EO and/or performance and infer, based on their correlational strength, their practical relevance.

Building on that, we put a particular emphasis on control variable applications in the EO performance literature. Control variables are important to rule out distortions that might be introduced by confounding variables, i.e. extraneous variables (Bernerth & Aguinis, 2016; Spector & Brannick, 2011). These "third" variables are likely to affect focal variables e.g. EO and/or performance, and their omission might entail serious omitted variable bias concerns and the potential for "false positives" being introduced into EO's nomological network (Antonakis, Bendahan, Jacquart, & Lalive, 2010). Nevertheless, previous reviews on the usage of control variables in the broader management literature suggest that controls are often employed in a rather careless fashion e.g. without providing an appropriate theoretical justifications for why a control is assumed to relate to focal variables and if these assumptions hold empirically true (Becker, 2005; Bernerth & Aguinis, 2016; Bernerth, Cole, Taylor, & Walker, 2018). Therefore, we specifically evaluate what variables are typically controlled for in the EO-performance context and which of these seem to be critical based on their relationship with EO and/or performance.

In short, we aim to infer which variables seem to be most important in the EO-performance context, and which appear to fall short, to provide both practitioners and scholars with a comprehensive guide to the empirical EO literature and to better help both to have greater confidence in the prescriptive guidance that emerges from the expanding EO-performance literature.

THEORETICAL BACKGROUND

Entrepreneurially oriented firms can be characterized by sustained organizational behavior patterns and managerial styles that are geared towards the concurrent exhibition of

innovativeness, proactiveness, and risk-taking activities in order to gain a competitive advantage and superior financial rewards (Covin & Slevin, 1991; Miller, 1983). Innovativeness refers to a firm's ability to be creative, to support and pursue new ideas, and to engage in experimentation to introduce new products, services, or processes (Lumpkin & Dess, 1996). The proactiveness component reflects a forward-looking stance of firms to anticipate future demand and to identify and seize opportunities ahead of their competitors (Covin & Slevin, 1989). Finally, the risk-taking dimension is comprised of managerial styles concerning the preference and willingness of top managers to commit significant resources to bold and wide-ranging high-risk/high reward projects (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015). In order to gauge what it means to be entrepreneurial, or more specifically, to capture what is common among entrepreneurial firms, Miller (1983) conceptualized EO as the concurrent exhibition of these three core dimensions. This composite conceptualization of EO, together with its measurement instrument, the Miller (1983) / Covin and Slevin (1989) scale (M/CS), emerged as the dominant design of EO in the literature (George & Marino, 2011; Rauch et al., 2009; Wales et al., 2019).

Taking into account EO's origin in the strategy domain, the dominant consideration of firm performance as the ultimate outcome of EO is not surprising (Covin & Lumpkin, 2011; Covin & Wales, 2019). Drawing on the amassing cumulative knowledge on the EO-performance relationship, previous meta-analyses show that higher levels of EO are, on average, positively related to higher levels of firm performance (Rauch et al., 2009; Rosenbusch et al., 2013; Saeed et al., 2014). However, as studies on EO's performance link continued to accumulate, so did the criticism for the neglect of the broader picture required to better understand the role of EO in the organizational context (Covin & Lumpkin, 2011; Covin & Wales, 2019; Wales, 2016). This critique refers to two central modeling issues that are repeatedly pointed out. First, scholars emphasize that EO-performance studies have to

adopt a multi-level configurational perspective in order to be adequate in scope (Covin & Slevin, 1991; Lumpkin & Dess, 1996; Miller, 1983). This means that studies have to equally consider the external environment, e.g., in terms of the task environment and institutional influences (Becherer & Maurer, 1997; Kreiser, Marino, Dickson, & Weaver, 2010; Lumpkin & Dess, 2001), the organizational level, for example, concerning the structure and strategic context (Barringer & Bluedorn, 1999; Covin, Green, & Slevin, 2006; Deutscher, Zapkau, Schwens, Baum, & Kabst, 2016), and individual aspects like personality traits of the upper echelon (Poon, Ainuddin, & Junit, 2006; Simsek, Heavey, & Veiga, 2010; Wales, Patel, & Lumpkin, 2013). Second, researchers are increasingly encouraged to cast a more extensive and finer-grained net on antecedents and consequences of EO. Aside from EO's performance link, much less is known about the actual drivers of EO, how higher levels of EO translate, through more immediate intervening variables, into superior performance levels, and how these linkages might be affected by various moderators (Covin & Wales, 2019; Wales, 2016; Wiklund & Shepherd, 2003, 2011). Although these critiques and calls for more comprehensive modeling considerations certainly have not been disregarded by ensuing EO-performance research, the sheer multitude of variable choices and their applications across studies, culminated in a lack of consistency and coherence (Covin & Wales, 2019; Miller, 2011; Wales, Gupta, & Mousa, 2013).

Taking these aspects into account, the ever-increasing scope and richness of EO-performance research is both a blessing and a curse (Covin & Wales, 2019). While meta-analyses are afforded the opportunity to establish more robust EO-performance linkages, it is getting increasingly challenging to keep track of all the variable choices, mechanisms, and proposed relationships. In respect thereof, every EO-performance study is likely to reveal a piece or fragment of a larger explanatory puzzle to better understand the role of EO in organizations (Wales, Gupta, et al., 2013). Consequently, it is exceedingly difficult for

practitioners and scholars alike, to discern what seems to matter most in the expanding EO-performance context and for future research to produce insights that move beyond marginal utility (Aguinis et al., 2018; Covin & Lumpkin, 2011; Covin & Wales, 2019). Considering the unbroken popularity of EO research and reverberating the fact that the foundational treatise on EO was published more than 40 years ago (Miller & Friesen, 1978), the time is ripe to consolidate how we can get better "in control" of the EO-performance relationship and how to improve the clarity and consistency in future research.

In the spirit of evidence-based management (Frese, Rousseau, & Wiklund, 2014; Rousseau, Manning, & Denyer, 2008), we move forward by conducting an exhaustive quantitative review of all considered variable choices in previous empirical EO-performance research. By examining how variables have been employed, modeled, and controlling for their correlational strength with both EO and performance, we aim to provide both practitioners and scholars with a comprehensive overview of the empirical EO literature and offer guidance towards more consistent variable choices and model building to foster the accumulation of a more coherent body of EO-performance research moving forward.

METHODOLOGY

Literature Search and Selection

To ensure that our assessments are of adequate breadth and scope, we searched three literature databases (Science Direct, EBSCO Business Source Premier, and the Web of Science), for three EO keywords: "entrepreneurial orientation", "strategic posture", and "corporate entrepreneurship". This procedure yielded 694 potentially relevant studies for closer inspection. To this set of studies, we applied the following filter criteria: (a) We excluded qualitative research; (b) We excluded quantitative studies that do not report a correlation table; (c) Studies must report a unidimensional measure of EO that is comprised

of innovativeness, proactiveness, and risk-taking; (d) EO must refer to firm-level entrepreneurial behavior; (e) We excluded studies that did not report a correlation between EO and a measure of overall firm performance, e.g. studies that only report a partial performance account like export performance, are omitted; (f) Studies with unclear sample sizes and studies that draw on non-profit or public administration samples, are excluded. The literature search and screening procedure were completed in January 2019. Overall, we identified 178 studies that contribute 182 unique samples, eligible for further consideration.

Coding Procedure

To reduce potential coding errors and to ensure that all relevant details will be captured, we developed a comprehensive coding sheet. The coding was performed by the first author and ambiguities were resolved through discussion with the second author. The coding rubric, data set, and analysis code used to prepare our qualitative and quantitative assessments are available upon request from the first author.

Entrepreneurial Orientation. The M/CS instrument is the most frequently applied measure of EO, and the literature is dominated by aggregate reportings (George & Marino, 2011; Miller, 2011; Rauch et al., 2009). Therefore, we focus our assessments on composite measures of EO that are composed of innovativeness, proactiveness, and risk-taking. This means that studies have to employ the M/CS scale, a derivative thereof, or an instrument that includes the three core dimensions in a manner consistent with M/CS.

Firm Performance. Firm performance is in itself a multifaceted phenomenon (Combs, Crook, & Shook, 2005; Gupta & Wales, 2017). Due to this, we account for four different performance measures: (a) Profitability refers to financial indicators such as return on investment and return on equity; (b) Growth performance pertains to variables like growth in sales and market share; (c) Non-financial performance captures aspects like customer satisfaction and reputation; and (d) Mixed performance measures that consist of at least two

different performance types. Considering their varying configurations and their fragmented application across studies, we follow the practice employed in previous reviews and compound performance measures into a single overall performance measure per study (Rauch et al., 2009; Rosenbusch et al., 2013).

Variable Roles and Relationships. We coded the role with which each variable is modeled within every study, e.g., as a predictor, mediator, outcome, moderator, or control. The classifications are as follows: (a) If a variable is used as an independent variable, it is a predictor; (b) If it is employed as a dependent variable, it is an outcome variable; (c) If it is introduced as a mechanism linking two variables, it is a mediator; (d) If it is described to strengthen or weaken a relationship between two variables, it is a moderator; and (e) If it is used as an extraneous variable to rule out distortions in focal variables, it is a control variable (Aguinis, Edwards, & Bradley, 2017; Bernerth & Aguinis, 2016). Next, we coded on a per-study basis how all the included variables are proposed to be related to EO and performance. We applied the following procedure: (a) If a variable has a direct relationship with EO/performance that is directional towards EO/performance, then the variable is a predictor of the posited variable; (b) If this relationship is not directional towards EO/performance but reversed, then the variable is an outcome; (c) If the variable moderates the relationship of EO/performance to another variable, we classify it as an outgoing moderator (a potential correlate of EO/performance); (d) If the variable moderates the relationship of another variable to EO/performance, then it is an incoming moderator (a potential predictor of EO/performance); and finally (e) If the variable in question is employed as a control or is only indirectly related to EO/performance, it is coded as having a correlational relationship. Mediation is implied if, e.g. a variable is modeled as an outcome of EO and as a predictor of performance.

Levels of Analysis and Categorization. In order to provide a structured portrayal of previous variable choices in the EO-performance literature, we apply a three-staged classification procedure. First, we iterated through all 182 samples, extracted the respective sample sizes and recorded, for every included variable, its name, definition, measurement, correlation with EO and performance, and level of analysis. Drawing on configurational approaches, we divided the level of analysis into the environmental-, organizational-, and individual-level (Wales, 2016). In the second stage, we drew on the recorded variable definitions to create meaningful groups and sub-groups within these levels. For example, we classified the environmental-level into the formal and informal institutional setting (North, 1990), industry effects, and the task environment (Rosenbusch et al., 2013). The individual-level of the upper echelon is comprised of CEO characteristics, features of managers, and the specifics of the top management team. Due to its richness in scope, the classification of the organizational-level necessitated the creation of numerous groups. In the third and last stage, we scrutinized variables for similarity within these groups because some variables might have been attached with different labels and definitions across studies, but they could still be based on the same, or a sufficiently similar, scale warranting the harmonization of their variable names. Finally, we checked how comprehensively the 182 identified samples are drawing, aside from their inclusion of EO and performance, on these three levels. Among the 182 independent samples, 29 (15%) include all three levels, 70 (38%) focus only on the environmental- and organizational-level, 16 (9%) solely consider the organizational-, and upper echelon-level, one sample combines the environmental- and upper echelon-level, 61 (34%) are solely concerned with the organizational-level, four samples are limited to the upper echelon-level, and one to the environmental-level. An exhaustive list that is sorted by sample affiliation and contains all variable names, their definitions, measurements, groupings, and harmonization codings, is available upon request.

Meta-Analytic Procedure

Meta-analysis is the method of choice to combine and summarize evidence from primary studies to draw general conclusions (Combs, Crook, & Rauch, 2019). We draw on the well established meta-analytic approach of Hedges and colleagues to observe the average correlational strength of focal variables with EO and firm performance (Borenstein, Hedges, Higgins, & Rothstein, 2009). We apply a random-effects model to perform our analysis (Aguinis, Pierce, Bosco, Dalton, & Dalton, 2011), use restricted maximum-likelihood estimators to estimate the variance parameters (Veroniki et al., 2016), and calculate 95% confidence intervals around the summary effects. All analyses are performed with the statistics software R 3.6.1 and the "metafor" meta-analysis package (Viechtbauer, 2010). For a variable to be considered in our meta-analysis, it must be reported in at least three or more samples (Song, Podoynitsyna, van der Bij, & Halman, 2008). In a second step, we scrutinize our initial meta-analytic results for practical relevance. To achieve this, we filter our findings for variables that have been used in a minimum of five studies and have, at least, a small significant correlation ($r \geq 0.10$; $p < 0.10$) with EO and/or performance (Bernerth et al., 2018; Bosco, Aguinis, Singh, Field, & Pierce, 2015; Cohen, 1988).

RESULTS

The Roles of EO and Performance

The results of our overall role assessments of EO and performance are presented in Table 1. In line with previous observations and reviews (Covin & Wales, 2019; Miller, 2011; Wales, Gupta, et al., 2013), we find that EO is predominantly modeled as an independent variable (in 68% of the 182 reviewed samples) and performance as the dependent variable. In turn, potential antecedents of EO were only considered in about 20% of the samples, i.e., if EO is modeled as either an outcome or mediator. Moreover, just in about 10% of the assessed

samples is EO employed as moderator or control. Regarding our review of applied performance measures, our findings are largely congruent with those of Gupta and Wales (2017). The EO-performance literature is drawing primarily on mixed performance measures. Identical role overviews were also composed for all the variables that have been previously considered in the EO-performance context but in order to conserve space, these lists are available upon request.

Insert Table 1 about here

How Variables Relate to EO and Performance

Environmental-Level. Table 2 lists all environmental variables that were considered in previous studies and how these relate to both EO and performance. It is noticeable that studies seem to put a stronger emphasis on the inclusion of task environment and industry effects than on the institutional environment. Hereinafter, we will limit our considerations to variables that are included in at least three or more samples. Concerning the formal institutional environment, the rule of law is mostly viewed as an antecedent of EO, and the regulatory environment is either used as an antecedent or as a control variable. Industry effects are almost exclusively included as control variables. Third, informal institutional aspects like individualism, power distance, and uncertainty avoidance tend to be used as moderators or control variables. Last, the four elements of the task environment are commonly controlled for, are less frequently used as moderators of the EO-performance relationship, and rarely as antecedents of EO.

Insert Table 2 about here

Organizational-Level. Due to the vast scope of firm-level variables, we split the reporting of our findings into five segments that are shown in Table 3 to 7. First, turning to

Table 3, we discover that capabilities appear to be rather heterogeneously deployed across studies. These appear to be often considered as additional independent variables alongside EO and as moderators or mediators of the EO-performance relationship. Similarly, moving to strategic orientations next, we observe that these are also commonly modeled as additional independent variables, less often as mediators between EO's performance link, and in rare cases, as antecedents of EO. Variables on organizational culture, structure, and leadership styles, are scarcely considered in the EO-performance context. Next, turning to Table 4, we find variables that can be broadly defined as organizational characteristics and governance aspects. Such variables appear to be almost exclusively viewed as control variables. Besides some deviations, the picture portrayed in Table 5 is somewhat similar. Variables belonging to the innovativeness group capture outcomes of innovation activities such as the frequency with new products are launched and introduced and tend to be modeled as mediators of the EO-performance relationship. Other innovation-related variables like commercialization and R&D aspects seem to be routinely applied as control variables. Networks are, again, rather fragmented and only external ties and the quality of relationships are employed in more than three samples but with various roles. Turning to Table 6, among performance variables that did not meet our coding criteria, past performance is included as a control variable in some studies. Organizational resources are, again, a rather diverse category in terms of variable choices but most are typically used as control variables. Table 7 depicts the final set of organizational variables. Regarding the strategic process, we note that decision-making autonomy, participative strategy making, and strategic flexibility tend to be either modeled as independent variables or as moderators on the EO-performance relationship. Finally, considering the broad strategy category, it seems that most of the many considered variables are employed as control variables.

Insert Table 3, 4, 5, 6, and 7 about here

Upper Echelon-Level. Our findings for this level are presented in Table 8. Some of the personality traits of both CEOs and Managers and the human capital of managers seems to be used as predictors of EO or as moderators on the EO-performance relationship. All remaining variables are almost exclusively considered as controls.

Insert Table 8 about here

Meta-Analytic Results

Before we present our meta-analytic results, it is important to sound a cautionary note. Effect size calculations that are based on a small number of studies may have insufficient statistical power to detect small effects (Valentine, Pigott, & Rothstein, 2010). Hence, our findings should not be interpreted as definite and irrefutable results but as a comprehensive account of previous EO-performance research with the possibility to change as EO research continues to accumulate. Overall, our meta-analysis includes 61 variables and all significant relationships ($p < 0.10$), except the correlation of service industries with firm performance, are positive. 30 of these 61 variables are significantly correlated with both EO and performance, seven are only correlated with EO, three correlate solely with performance, and 21 variables are neither correlated with EO nor performance. Considering that 36 of these 61 variables are located on the level of the firm, it is apparent that it is the level that received the most scholarly attention.

Environmental-Level. The results of our meta-analytic assessment of the environment-level are depicted in Table 9. Regulation, power distance, environmental dynamism, and munificence are related to both EO and performance. High-tech industries, environmental hostility, and environmental complexity only relate to EO. Finally, service

industries seem to be negatively related to performance. Manufacturing industries, individualism, and uncertainty avoidance appear to be unrelated to EO and performance.

Insert Table 9 about here

Organizational-Level. The findings for this level are presented in Table 10. In total, 23 of the 36 variables are significantly related to both EO and performance, and internationalization and strategic controls are only correlated with EO. Moreover, eleven of the 36 organization-level variables are neither correlated with EO nor performance.

Insert Table 10 about here

Upper Echelon-Level. The results for this level are depicted in Table 11. The managerial involvement of the top management team and the social capital of managers are both significantly related to EO and performance. CEO tenure and narcissism are only correlated with performance. Last, the education and experience of managers are solely related to EO and seven variables are neither correlated with EO nor performance.

Insert Table 11 about here

Relevance Considerations. After applying our relevance filter to these meta-analytic results, Table 12 shows that only 23 variables remain. These variables are sorted in descending order of their correlational strength with EO and are attached with labels that depict their most common applications. Most of these variables are significantly correlated with both EO and performance, except for internationalization, environmental complexity, and the size of the top management team that are only related to performance. Only one of these variables, the size of the top management teams, belongs to the upper echelon-level. Four refer to the environmental-level (regulatory environment, environmental dynamism,

complexity, and munificence). Hence, 18 of these 23 variables belong to the organizational-level, and so do nine out of the ten variables with the strongest EO correlation. Among these, strategic orientations, organizational capabilities, and the strategic flexibility of a firm appear to be most relevant. Building on that, we evaluated how commonly these 23 variables are used in conjunction with another in literature. Our findings suggest that no more than five of these are ever jointly considered within a single study. Among the 182 samples in our database, only ten samples include five of these relevant variables, 22 samples draw on four variables, 46 samples employ three, 45 samples consider two variables, 38 samples contain only one of these, and a total of 21 samples do not draw on any of these 23 variables.

Insert Table 12 about here

Control Variable Evaluation. In order to put a special emphasis on control variables, we draw on our variable role codings, filtered out all data points in which a variable was not included as a control, and applied the same meta-analytic procedure. The results are reported in Table 13 and show that a total of 33 (54% of the 61 variables) variables have been considered as control variables. Table 14 shows that, after applying our relevance criteria, only nine (27%) of these 33 controls do remain.

Insert Table 13 and 14 about here

DISCUSSION

In an overall effort to answer long-standing and repeated calls for more robust configurational EO-performance models and greater consistency in variable choices across studies (Covin & Lumpkin, 2011; Covin & Wales, 2019; Miller, 2011; Wales, 2016), the present study draws on a comprehensive collection of 178 studies to consolidate what

variables have been employed, and in which way, in the ever-expanding EO-performance literature. Not only do we map out the fragmented variable landscape of the EO literature to provide practitioners and scholars with a comprehensive guide to the vast empirical EO-performance literature, but we also scrutinize past variable choices for practical utility. In this way, we provide evidence-based model building recommendations in order to increase the validity and reliability of future EO-performance research and foster a more coherent and stronger knowledge accumulation moving forward.

The Role of EO and Performance

We find that most studies model EO as an independent and performance as the dependent variable, and consider a range of moderators on their relationship. However, knowing that higher levels of EO are positively related to superior firm performance is of limited value when it is less clear how EO is manifest and translates into firm performance (Covin & Lumpkin, 2011; Covin & Wales, 2019). In contrast to the plethora of studies with a singular focus on the EO-performance relationship, far fewer studies provide important insight into EO's drivers. Moreover, our review reveals that potential antecedents of EO are often inconsistently modeled across studies e.g. formal and informal institutions, elements of the task environment, capabilities, and other strategic orientations. Hence, there seems to be little consensus in regards to what variables should conceptually be perceived as antecedents of EO. Moreover, after filtering our meta-analytic results for practical relevance, none of the remaining variables is consistently used as an antecedent of EO.

Firm performance is predominantly modeled as an outcome of EO, but in contrast to the heterogeneous considerations of EO's potential antecedents, the previous literature put a stronger emphasis on exploring mediators of the EO-performance relationship (Wales, Gupta, et al., 2013). Our review reveals that marketing and technological capabilities, or respective orientations, are often cast as important mediators or moderators of the EO-performance

relationship. Strategic orientations are the guiding principles that drive firm behavior and emerging configurational approaches suggest that the alignment of different orientations e.g. EO, market orientation (MO), and learning orientation (LO), is advantageous over singular stances (Deutscher et al., 2016; Hakala, 2011). For example, the close monitoring of competitors and latent customer needs of MO may enable entrepreneurial firms to better time new entries to offset competitors and to orient their offerings more towards market demands (Zahra, 2008). In a similar vein, LO might provide firms with valuable information to proactively act upon (Dess & Lumpkin, 2005; Sinkula, Baker, & Noordewier, 1997). Hence, by providing EO with valuable information inflows, other strategic orientations could be more frequently modeled as antecedents of EO but they are also likely to have a direct bearing on the characteristics of new offerings and their potential for commercialization. Capabilities, are complex bundles of deeply embedded routines that constitute a firm's unique competencies (Eisenhardt & Martin, 2000; Winter, 2003). Thus, technological strengths and marketing competencies may help to develop better offerings and lend towards a more successful implementation or commercialization (Matsuno, Zhu, & Rice, 2014; van Waterschoot & Van den Bulte, 1992). Future research may consider such capabilities as moderators on EO's relationship with more immediate outcomes and their subsequent firm performance link. In addition to that, innovativeness is frequently viewed as an immediate outcome of EO e.g. the rate of new products or how well innovations are accepted within the firm, but such measures must be applied with caution and researchers need to ensure that there is no conceptual overlap with EO's innovativeness dimension (Covin & Wales, 2019). Last, organizational learning is also often modeled as a less distal outcome of EO that feeds back into the organization's knowledge base and helps firms to improve their performance (Anderson, Covin, & Slevin, 2009; Cohen & Levinthal, 1990; Real, Roldán, & Leal, 2014; Zhao, Li, Lee, & Bo Chen, 2011).

Level of Analysis and Variable Choices

We want to stress that just because a variable seems to be rarely used, is heterogeneously modeled across studies, or appears to be, based on our meta-analytic findings, not meaningfully related to EO and/or performance, does not imply that it should be disregarded in future research. First, the robustness of inferences increases with the number of available data points, and the more findings are available the easier it is to discuss and resolve observed heterogeneity. Second, some variables may not generalize well to a broader range of contexts and the exploration of such special cases is potentially conducive to our understanding of EO's boundary conditions. Finally, the selection of every variable should be carefully grounded in theory, and if possible, its measurement should be based on well-established scales to facilitate knowledge accumulation (Aguinis et al., 2018; Anderson et al., 2019).

The Environmental-level. Considering that most EO-performance studies draw on single country samples, it is not surprising that variables on the institutional environment received the least attention because formal and informal institutional aspects are typically measured with country-level indicators, e.g., Hofstede's cultural dimensions (Hofstede, 2001) and the world governance indicators (Kaufmann, Kraay, & Mastruzzi, 2010). Industry effects are routinely controlled for within the EO literature but our meta-analytic results suggest that these seem to be less relevant. A possible explanation might be that such simple dummy codings are too coarse to appropriately capture more complex competitive dynamics. The elements of the task environment, on the other hand, seem to be more suited for this task. However, bearing in mind that the task environment was initially proposed as either a predictor of EO (Covin & Slevin, 1991; Rosenbusch et al., 2013) or as a moderator of the EO-performance relationship (Becherer & Maurer, 1997; Lumpkin & Dess, 2001), most studies employ these elements in a agnostic fashion as control variables. Therefore, we

encourage future research to refocus on their intended roles and to link these more explicitly to focal variables e.g. as an antecedent of EO.

The Organizational-Level. The vastness in the scope of considered variables renders the organizational-level to be the most fragmented one. Many variables on this level are only reported in a small number of samples, e.g. leadership styles and organizational culture are only included in one study. Second, various variables are too dissimilar to comparable neighboring variables on the item-level to warrant their aggregation. Therefore, many categories appear to be "cluttered" with a range of variables that are rarely used. On closer inspection, we observed that this is almost exclusively affecting control variables e.g. organizational resources and governance. Moreover, our meta-analytic control variable assessments suggest that among all of these firm-level controls, only firm size, R&D intensity, slack resources, and past performance appear to be of relevance. In contrast to this, we find that especially capabilities (e.g., marketing, technological, HR, and learning-related capabilities), strategic orientations (e.g., MO, technology orientation, and LO), innovativeness, strategic flexibility, and high-quality ties to be of relevance in the EO-performance context. However, their roles are often less clear.

The Upper Echelon-Level. Besides personality traits and self-concepts of members of the upper echelon, almost all other variables are typically employed as control variables. As such, only the size of the top management team and the CEO's tenure seem to be of empirical relevance in the EO-performance context. These observations are primarily in line with findings in neighboring management domains, e.g. managerial characteristics and demographics are routinely applied as control variables in leadership studies and were also found to be mostly unrelated to focal variables (Bernerth et al., 2018). However, personality traits and self-concepts of top managers appear to be promising future research avenues. Previous upper echelon research suggests that top managers with positive self-concepts e.g.

self-efficacy and an internal locus of control, are more inclined to pursue innovative strategic actions proactively and are more confident in taking accompanying risks (Bromiley & Rau, 2016; Hambrick, 2007; Wang, Holmes, Oh, & Zhu, 2016). Hence, such personality traits of top managers could be considered as potential antecedents of EO.

Towards a Structural Baseline Model

Considering that only about 15% of the reviewed samples do concurrently consider the environmental-, organizational-, and individual-level, we think it is due time for future research to draw more comprehensively on these three levels (Covin & Lumpkin, 2011; Covin & Wales, 2019; Miller, 2011; Wales, 2016). Moreover, we encourage researchers to disregard simple multiple regression models in which EO is modeled as an independent variable that predicts performance in favor of more substantial modeling considerations that allow for a concomitant assessment of EO's antecedents and more immediate outcomes that mediate EO's performance relationship.

We propose, information and knowledge inflows (e.g. provided by other strategic orientations, the absorptive capacity of the firm, and high-quality external linkages), the elements of the task environment, and positive self-concepts of top managers, as potential antecedents of EO. A firm cannot act entrepreneurially if it possesses no knowledge and information to act upon, if managers' avoid taking risks, and if environmental forces are not mandating such actions (Cohen & Levinthal, 1990; Rosenbusch et al., 2013; Wang et al., 2016). Turning to the more immediate outcomes of EO, Lumpkin and Dess (1996) argue that a firm can only be deemed as acting entrepreneurial when there is new entry i.e. "New entry can be accomplished by entering new or established markets with new or existing goods or services" (1996: 136). Thus, while innovation is the "heart of entrepreneurship", it is the subsequent implementation or commercialization of new offerings that constitute what it means to be entrepreneurial (Covin & Miles, 1999; Stevenson & Gumpert, 1985). Hence,

new entry should be more readily considered as a mediator of the EO-performance relationship in future studies. Moreover, learning could also be modeled as an outcome of EO that is likely to feedback into the organizational knowledge base and to improve firm performance (Anderson et al., 2009; Cohen & Levinthal, 1990; Real et al., 2014; Zhao et al., 2011). Potential moderators along these structural relationships might be facets pertaining to the strategic process, organizational structure, network ties, and organizational capabilities that are likely to strengthen the manifestation of EO and the commercialization of new offerings (Barringer & Bluedorn, 1999; Covin et al., 2006; Engelen, Kube, Schmidt, & Flatten, 2014).

This baseline model should then be, of course, adjusted by researchers in accordance with their research question and applied theories. Last, in consideration of the fact that previous EO studies proposed various mediators of the EO-performance relationship (Miller, 2011; Wales, 2016; Wales, Gupta, et al., 2013), it is also apparent that these are rarely if ever, included jointly within a single study. Thus, in order to attenuate omitted variable biases and confounding effects, future studies should more thoroughly consider mechanisms that were shown to be of relevance in previous research (Aguinis et al., 2018; Antonakis et al., 2010).

Control Variable Considerations

Our control variable review reveals that EO-performance studies seem to routinely control for variables that do not appear to be linked, in an empirically meaningful way, to EO and/or performance, e.g., firm age. Thus, future studies should explicitly argue for why the included controls are expected to affect focal variables and these findings should then be returned to and discussed. In that regard, our meta-analytic findings suggest that firm size, R&D intensity, past performance, CEO tenure, and the size of the top management team - and, to some extent, access to capital and slack resources - appear to be robust control variables, though their correlations with EO or performance can be deemed to be as rather

small (Cohen, 1988). Finally, most control variables are measured with more distal approximations of what they are actually intended to capture (Bernerth et al., 2018; Spector & Brannick, 2011). Hence, non-significant findings or small observed correlations could also be induced by inappropriate proxy measures.

LIMITATIONS

As with all systematic reviews, our study has, of course, some limitations. First, we exclusively focus on studies that do report an EO-performance correlation. However, there is also quite an abundant number of EO studies that do not include a performance measure. These studies may consider EO more frequently as an outcome variable and could contribute more evidence on potential predictors of EO. Second, previous meta-analyses suggest that EO might be differently related to different performance types (Rauch et al., 2009; Saeed et al., 2014). Initially, we tried to account for different performance measures, but in the light of skewed reportings and the already somewhat fragmented variable landscape, we had to abandon this intention. Third, we planned to draw on reported theories and applied theoretical lenses across studies in order to resolve heterogeneous accounts in variable applications. However, this turned out to be practically infeasible. Many studies do only implicitly state the theories they rely upon e.g. by citing foundational theory papers or a specific line of argument consistent with certain theories. However, the coding of such implicit theoretical references turned out to be too subjective and judgmental to be meaningful.

CONCLUSION

Drawing on the immense literature of over 40 years of research on the EO-performance relationship, the present study sets forth to answer recent and long-standing calls for greater clarity and consistency in variable choices and more robust modeling (Covin &

Wales, 2019; Miller, 2011; Wales, 2016). We offer evidence-based recommendations to increase the validity and reliability of future studies and to foster a more coherent and stronger knowledge accumulation moving forward. Drawing on a comprehensive database of over 170 EO-performance studies, we provide practitioners and researchers with a comprehensive guide to the most relevant variables and their roles in the EO-performance context. Further, we propose a structural baseline model with antecedent to EO and EO to mediator to performance relationships that may serve as a blueprint for future EO-performance research.

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APPENDIX

Table 1: Entrepreneurial Orientation and Firm Performance Roles Overview

		Performance			
Role	**EO**	**Financial**	**Non-Financial**	**Growth**	**Mixed**
Predictor	124	0	1	1	3
Mediator	25	0	1	0	0
Outcome	12	27	17	38	100
Moderator	17	0	0	1	0
Control	4	5	7	2	7
Outcome & Control	0	1	0	0	0
Predictor & Moderator	0	0	0	1	0

Note: EO = Entrepreneurial Orientation; The level of analysis are the number of independent samples and role combinations exist because some studies report e.g. two performance measures of the same type but with different roles.

Table 2: Relationships of Environmental Variables

		Entrepreneurial Orientation					Performance				
	N	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Formal Institutions											
Regulation	8	3	0	2	0	3	1	2	0	0	5
Rule of Law	3	2	1	0	0	0	1	0	0	0	2
Business Support	2	2	0	0	0	0	1	0	0	0	1
Economic Development	1	0	0	0	0	1	0	0	0	0	1
Industry											
Manufacturing	19	0	0	1	0	18	0	1	0	0	18
Service	19	0	0	0	0	19	0	0	0	0	19
High-Tech	17	0	0	1	0	16	0	1	0	0	16
Retail	2	0	0	0	0	2	0	0	0	0	2
Informal Institutions											
Individualism	5	0	1	2	0	2	0	1	0	0	4
Power Distance	3	0	1	1	0	1	0	1	0	0	2
Uncertainty Avoidance	3	1	1	1	0	0	0	0	0	0	3
Masculinity	2	0	1	1	0	0	0	0	0	0	2
Collectivism	1	1	0	0	0	0	0	0	0	0	1
Future Orientation	1	1	0	0	0	0	0	0	0	0	1
Humane Orientation	1	1	0	0	0	0	0	0	0	0	1
Performance Orientation	1	1	0	0	0	0	0	0	0	0	1
Task Environment											
Environmental Dynamism	65	4	3	13	0	45	1	14	0	0	50
Environmental Hostility	43	1	1	11	0	30	1	12	0	0	30
Environmental Munificence	18	1	0	3	0	14	0	3	0	0	15
Environmental Complexity	10	0	0	2	0	8	0	3	0	0	7

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 3:First Variable Set of Organization-Level Relationships

		Entrepreneurial Orientation					Performance				
	N	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Capabilities											
Organizational Learning	14	2	0	2	5	5	9	4	0	0	1
Marketing Capabilities	11	2	0	2	3	4	3	2	0	0	6
Absorptive Capacity	7	0	0	4	2	1	3	2	0	0	2
HR Capabilities	4	1	0	1	0	2	1	1	0	0	2
Technological Capabilities	3	1	0	0	1	1	1	0	0	0	2
Networking Capability	1	0	0	1	0	0	0	1	0	0	0
Culture											
Adhocracy Culture	1	1	0	0	0	0	0	0	0	0	1
Clan Culture	1	1	0	0	0	0	0	0	0	0	1
Creative Climate	1	0	0	0	0	1	1	0	0	0	0
Hierarchy Culture	1	1	0	0	0	0	0	0	0	0	1
Market Culture	1	1	0	0	0	0	0	0	0	0	1
Leadership											
Ambidextrous Leadership	1	1	0	0	0	0	0	0	0	0	1
Charismatic Leadership	1	0	0	0	0	1	0	1	0	0	0
Transformational Leadership	1	0	0	1	0	0	0	1	0	0	0
Strategic Orientations											
Market Orientation	44	3	0	2	9	30	25	2	0	3	14
Learning Orientation	13	3	0	1	1	8	7	1	0	0	5
Technology Orientation	7	0	0	0	3	4	5	0	0	0	2
Alliance Orientation	1	0	0	0	0	1	0	0	0	0	1
Brand Orientation	1	0	0	0	1	0	0	0	0	0	1
Pioneering Orientation	1	0	0	0	0	1	0	0	0	1	0
Small Business Orientation	1	0	0	0	0	1	1	0	0	0	0
Structure											
Structural Organicity	3	0	1	0	0	2	1	0	0	0	2
Organizational Flexibility	2	0	0	0	0	2	2	0	0	0	0
Organizational Structure	2	0	0	0	0	2	1	0	0	0	1

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 4: Second Variable Set of Organization-Level Relationships

				Entrepreneurial Orientation					Performance				
Category	**Group**	**Variable**	**N**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Characteristics	Employees	Firm Size	111	1	0	0	0	110	0	0	0	0	111
		Foreigners	1	0	0	0	0	1	0	0	0	0	1
		Relative Firm Size	1	0	0	0	0	1	0	0	0	0	1
	Life Cycle	Life Cycle	2	0	0	0	0	2	0	0	0	0	2
		Consolidation Stage	1	0	0	0	0	1	0	0	0	0	1
		Maturity Stage	1	0	0	0	0	1	0	0	0	0	1
	Other	Firm Age	90	1	0	3	0	86	0	3	0	0	87
		Scope	1	0	0	0	0	1	0	0	0	0	1
Governance	Board	Board Size	3	0	0	0	0	3	0	0	0	0	3
		CEO Duality	2	0	0	0	0	2	0	0	0	0	2
		Outside Board Members	2	0	0	0	0	2	0	0	0	0	2
		Board Activities	1	0	0	1	0	0	0	0	0	0	1
		Governance System	1	0	0	0	0	1	1	0	0	0	0
	Other	Generational Involvement	5	2	1	0	0	2	1	0	0	0	4
		CEO Change	2	0	0	0	0	2	0	0	0	0	2
		CEO Compensation	1	0	0	0	0	1	0	0	0	0	1
		Entrenchment	1	0	0	1	0	0	0	1	0	0	0
		Returnee Led	1	0	0	0	0	1	0	0	0	0	1
	Ownership	State Owned	8	0	0	2	0	6	0	2	0	0	6
		Family Firm	6	0	0	2	0	4	0	2	0	0	4
		Public Owned	3	0	0	0	0	3	0	0	0	0	3
		CEO Ownership	2	0	0	1	0	1	0	1	0	0	1
		Foreign Owned	2	0	0	0	0	2	0	0	0	0	2
		Non-Independent	2	0	0	0	0	2	0	0	0	0	2
		Non-State Owned	2	0	0	0	0	2	0	0	0	0	2
		Private Owned	2	0	0	0	0	2	0	0	0	0	2
		Public Firm	2	0	0	0	0	2	0	0	0	0	2
		International Joint Venture	1	1	0	0	0	0	0	0	0	0	1
		Shared Owned	1	0	0	0	0	1	0	0	0	0	1

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 5: Third Variable Set of Organization-Level Relationships

				Entrepreneurial Orientation					Performance				
	Group	**Variable**	**N**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Innovation	**Innovativeness**	Innovativeness	9	0	0	0	7	2	7	0	0	0	2
		Exploitation	2	0	0	0	1	1	2	0	0	0	0
		Exploration	2	0	0	0	1	1	2	0	0	0	0
		Radical Innovation	2	0	0	0	2	0	2	0	0	0	0
		Ambidexterity	1	0	0	0	1	0	1	0	0	0	0
		Incremental Innovation	1	0	0	0	1	0	1	0	0	0	0
	Other	Commercialization	3	0	0	0	1	2	0	1	0	0	2
		Open Innovation	1	0	0	0	0	1	1	0	0	0	0
	R&D	R&D Intensity	12	1	0	0	0	11	0	0	0	0	12
		New Product Development	2	0	0	1	0	1	0	1	0	0	1
		Patent Citations	1	0	0	0	1	0	1	0	0	0	0
		R&D Personnel	1	0	0	0	0	1	0	0	0	0	1
		Speed to Market	1	0	0	0	1	0	0	0	0	0	1
Networks	**Alliances**	Alliance Equity	2	0	0	0	0	2	0	0	0	0	2
		Alliance Competition	1	0	0	0	0	1	0	0	0	0	1
		Alliance Experience	1	0	0	0	0	1	0	0	0	0	1
		Alliance Number	1	0	0	0	1	0	0	0	0	0	1
		Alliance Partner Size	1	0	0	0	0	1	0	0	0	0	1
		Alliance Size	1	0	0	0	0	1	0	0	0	0	1
		Alliance Sustainability	1	0	0	0	1	0	1	0	0	0	0
	Franchise	Franchisor Support	1	1	0	0	0	0	0	0	0	0	1
		Franchise Age	1	0	0	0	0	1	1	0	0	0	0
		Franchise Clause	1	1	0	0	0	0	0	0	0	0	1
		Franchise Size	1	0	0	0	0	1	1	0	0	0	0
	Linkages	Ties	14	2	1	4	2	5	7	3	0	0	4
		Relationship Quality	6	0	0	2	2	2	2	2	0	0	2
		Duration	1	0	0	0	0	1	0	0	0	0	1
	Other	Network Usage	2	0	0	0	0	2	2	0	0	0	0
		Value Co-Creation	2	0	0	0	2	0	2	0	0	0	0
	Structure	Network Centrality	2	0	0	1	0	1	1	1	0	0	0
		Network Diversity	2	2	0	0	0	0	2	0	0	0	0
		Network Size	2	2	0	0	0	0	2	0	0	0	0
		Alliance Contract	1	0	0	0	0	1	0	0	0	0	1
		Supply Chain Flexibility	1	0	0	0	0	1	0	0	0	0	1

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 6: Fourth Variable Set of Organization-Level Relationships

				Entrepreneurial Orientation					Performance				
	Group	**Variable**	**N**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Performance	**Failure**	Failure	1	0	0	0	0	1	0	0	0	0	1
		Survival Time	1	0	0	0	0	1	0	0	0	0	1
	Financial Performance	New Product Profit Percentage	1	0	0	0	1	0	0	0	0	0	1
	Non-Financial Performance	Efficiency	2	0	0	0	0	2	0	0	0	0	2
		Brand Strength	1	0	0	0	1	0	1	0	0	0	0
		Circulation	1	0	0	0	0	1	0	0	0	0	1
		Customer Equity	1	0	0	0	1	0	1	0	0	0	0
		Product Delivery	1	0	0	0	0	1	1	0	0	0	0
		Satisfaction with Supply Chain Portfolio	1	0	0	0	0	1	0	0	0	0	1
		SME Power	1	0	0	0	0	1	1	0	0	0	0
		Socioeconomic Wealth	1	0	0	1	0	0	0	1	0	0	0
	Other	Past Performance	9	0	0	0	0	9	0	0	0	0	9
		Cost	2	0	0	0	0	2	1	0	0	0	1
		Volatility	2	0	0	0	1	1	0	0	0	1	1
		IPO Value	1	0	0	0	1	0	0	0	0	0	1
		Strategic Performance	1	0	0	0	1	0	0	0	0	0	1
Resources	**Intangible Resources**	Human Capital	8	1	0	1	1	5	3	2	0	0	3
		External Resources	3	0	0	1	1	1	1	1	0	0	1
		Resource Advantage	3	0	0	1	0	2	2	1	0	0	0
		Legitimacy	2	0	0	2	0	0	0	2	0	0	0
		Organizational Commitment	2	0	0	1	0	1	0	1	0	0	1
		Procedural Justice	2	0	1	1	0	0	0	1	0	0	1
		Trust	2	1	0	1	0	0	0	1	0	0	1
		Employee Psychological Safety	1	0	0	1	0	0	0	1	0	0	0
		Goal Congruence	1	1	0	0	0	0	0	0	0	0	1
		Informational Resources	1	0	0	0	0	1	1	0	0	0	0
		Intellectual Property	1	0	0	0	0	1	0	0	0	0	1
		Intellectual Resources	1	0	0	1	0	0	0	0	1	0	0
		Labor Efficiency	1	0	0	0	0	1	0	0	0	0	1
		Organizational Routines	1	0	0	0	0	1	0	0	0	0	1
		Relational Resources	1	0	0	0	0	1	1	0	0	0	0
	Other	Brand Resources	1	0	0	0	1	0	1	0	0	0	0
		Resource Flexibility	1	0	0	1	0	0	0	1	0	0	0
	Tangible Resources	Access to Capital	10	1	1	2	2	4	3	2	0	0	5
		Leverage	6	0	0	0	0	6	0	0	0	0	6
		Slack	5	0	0	1	0	4	0	1	0	0	4
		Assets	3	0	0	0	0	3	0	0	0	0	3
		Financial Resources	2	0	0	0	0	2	2	0	0	0	0
		Physical Resources	1	0	0	0	0	1	1	0	0	0	0
		Resource Commitment	1	0	0	0	0	1	0	0	0	0	1
		Resource Investment	1	0	0	0	0	1	0	0	0	0	1

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 7: Fifth Variable Set of Organization-Level Relationships

				Entrepreneurial Orientation					Performance				
Category	**Group**	**Variable**	**N**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
Strategic Process	Decision Making	Autonomy	4	1	0	2	0	1	0	2	0	0	2
		Participative Strategy	4	0	0	2	1	1	2	2	0	0	0
		Strategic Centralization	2	0	0	0	0	2	2	0	0	0	0
		Effectuation	1	0	0	1	0	0	0	1	0	0	0
		Technocratic Decision-Making	1	0	1	0	0	0	0	0	0	0	1
	Flexibility	Strategic Flexibility	5	0	0	2	0	3	2	1	1	0	1
		Strategic Creativity	1	0	0	0	1	0	0	0	0	0	1
	Other	Strategic Mission	2	0	0	1	0	1	0	1	0	0	1
		Strategic Planning	2	1	0	1	0	0	0	1	0	0	1
		Scanning	1	0	0	0	0	1	0	0	0	0	1
Strategy	Acquisitions	Firm Acquisitions	1	0	0	0	0	1	0	0	0	0	1
		Technology Acquisition	1	0	0	1	0	0	0	1	0	0	0
	Competitive Strategy	Analyzer	1	0	0	1	0	0	0	1	0	0	0
		Defender	1	0	0	1	0	0	0	1	0	0	0
		Prospector	1	0	0	1	0	0	0	1	0	0	0
	Diversification	Diversification	5	0	0	0	0	5	0	0	0	0	5
		Narrow Product Line	1	0	0	0	0	1	1	0	0	0	0
	Entrepreneurship	Corporate Entrepreneurship	1	0	0	0	1	0	1	0	0	0	0
		Initiative Generation	1	0	0	0	1	0	0	0	0	0	1
	Internationalization	Internationalization	5	1	0	0	1	3	0	0	0	0	5
		Geographic Scope	2	0	0	0	0	2	0	0	0	0	2
		Cultural Distance	1	0	0	0	0	1	0	0	0	0	1
	Marketing	Advertising Expenditure	2	0	0	0	0	2	1	0	0	0	1
		Customer Focus	1	0	0	0	0	1	0	0	0	0	1
		Customer Support	1	0	0	0	0	1	1	0	0	0	0
		Innovative Marketing	1	0	0	0	0	1	0	0	0	0	1
		Lower Price	1	0	0	0	0	1	1	0	0	0	0
		Marketing Emphasis	1	0	0	0	0	1	0	0	0	0	1
		Marketing Proactiveness	1	0	0	0	1	0	1	0	0	0	0
		Marketing Synergy	1	0	0	0	0	1	0	0	0	0	1
		Sales Force Size	1	0	0	0	0	1	1	0	0	0	0
		Social Media	1	0	0	0	1	0	1	0	0	0	0
	Other	Sustainability	6	0	0	0	4	2	4	0	0	1	1
		Controls	3	1	0	1	0	1	0	1	0	0	2
		CSR	2	0	0	0	0	2	2	0	0	0	0
		Open Source	1	0	0	0	0	1	0	0	0	0	1
		Risk	1	0	0	0	0	1	0	0	0	0	1

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated.

Table 8: Relationships of Upper Echelon Variables

				Entrepreneurial Orientation					Performance				
	Group	**Variable**	**N**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**	**Pre**	**Mod(in)**	**Mod(out)**	**Out**	**Cor**
CEO	**Demographics**	Age	5	1	0	0	0	4	0	0	0	0	5
		Gender	2	0	0	0	0	2	0	0	0	0	2
		Founder	2	0	0	0	0	2	0	0	0	0	2
	Human Capital	Tenure	8	1	0	1	0	6	0	1	0	0	7
		Background	2	0	0	0	0	2	0	0	0	0	2
		Education	1	0	0	0	0	1	0	0	0	0	1
		Experience	1	0	0	1	0	0	0	1	0	0	0
		Impression Management	1	0	0	0	0	1	0	0	0	0	1
	Personality	Narcissism	3	1	0	2	0	0	1	2	0	0	0
		Core-Self Evaluation	1	1	0	0	0	0	0	0	0	0	1
		Advice Seeking	1	0	0	1	0	0	0	1	0	0	0
		Machiavellianism	1	0	0	1	0	0	0	1	0	0	0
		Overconfidence	1	1	0	0	0	0	0	0	0	0	1
		Psychopathy	1	0	0	1	0	0	0	1	0	0	0
		Self-Deception	1	0	0	0	0	1	0	0	0	0	1
		Self-Enhancing	1	0	0	1	0	0	0	1	0	0	0
		Self-Transcending	1	0	0	1	0	0	0	1	0	0	0
		Values	1	0	0	0	0	1	0	0	0	0	1
Manager	**Demographics**	Age	7	0	0	0	0	7	0	0	0	0	7
		Gender	6	0	0	0	0	6	0	0	0	0	6
		Position	3	0	0	0	0	3	0	0	0	0	3
		Social Class	1	0	0	0	0	1	0	0	0	0	1
	Human Capital	Education	6	1	0	0	0	5	1	0	0	0	5
		Tenure	6	0	0	0	0	6	0	0	0	0	6
		Experience	4	1	0	0	0	3	1	0	0	0	3
		Social Capital	3	1	0	0	1	1	3	0	0	0	0
		Cultural Intelligence	1	0	0	0	0	1	1	0	0	0	0
		Intellectual Capital	1	0	0	0	0	1	1	0	0	0	0
		Political Skill	1	1	0	0	0	0	0	0	0	0	1
	Personality	Need for Achievement	2	1	0	0	0	1	1	0	0	0	1
		Core-Self Evaluation	1	0	0	0	0	1	0	0	0	0	1
		Self-Efficacy	1	1	0	0	0	0	1	0	0	0	0
		Challenge	1	1	0	0	0	0	0	0	0	0	1
		Emotional Intelligence	1	1	0	0	0	0	0	0	0	0	1
		Fatalism	1	0	0	0	0	1	0	0	0	0	1
		Fate	1	1	0	0	0	0	0	0	0	0	1
		Locus of Control	1	1	0	0	0	0	1	0	0	0	0
		Necessity	1	1	0	0	0	0	0	0	0	0	1
		Philosophy	1	0	0	1	0	0	0	1	0	0	0
		Proactivity	1	1	0	0	0	0	1	0	0	0	0
		Security	1	1	0	0	0	0	0	0	0	0	1
		Self-interest	1	0	0	0	0	1	1	0	0	0	0
		Stakeholder Salience	1	0	0	0	0	1	1	0	0	0	0
TMT	**Composition**	Size	7	0	0	0	0	7	0	0	0	0	7
		Diversity	3	0	0	0	0	3	0	0	0	0	3
		Age	2	0	0	0	0	2	0	0	0	0	2
		Non-Family Members	2	1	0	0	0	1	0	0	0	0	2
		Family Members	1	0	0	0	0	1	0	0	0	0	1
		Founders	1	0	0	0	0	1	0	0	0	0	1
	Human Capital	Involvement	4	0	0	0	1	3	1	1	0	0	2
		Experience	2	0	0	0	0	2	1	0	0	0	1
		Social Capital	1	0	0	1	0	0	0	1	0	0	0
		Tenure	1	0	0	0	0	1	0	0	0	0	1
		Elaboration	1	0	0	0	0	1	1	0	0	0	0
		Heterogeneity	1	0	0	1	0	0	0	1	0	0	0
	Properties	Shared Vision	2	0	0	1	0	1	1	1	0	0	0
		Self-Efficacy	1	0	0	0	0	1	1	0	0	0	0
		Cohesion	1	0	0	0	0	1	0	0	0	0	1
		Environmental Perception	1	0	0	0	1	0	1	0	0	0	0

Note: N = Number of independent samples that report the respective variable; Pre = predictor; Mod(in) = incoming moderator; Mod(out) = outgoing moderator; Out = outcome; Cor = correlated; TMT = top management team.

Table 9:Environment-Level Meta-Analytic Results

			Entrepreneurial Orientation					Performance				
	N	**k**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**
Formal Institutions												
Regulation	5,363	8	0.28	0.039	0.142	0.01	0.52	0.18	0.060	0.095	-0.01	0.35
Rule of Law	3,165	3	0.57	0.108	0.399	-0.14	0.89	0.30	0.024	0.139	0.04	0.53
Industry												
Manufacturing	16,127	19	-0.01	0.318	0.012	-0.04	0.01	0.01	0.593	0.017	-0.02	0.04
Service	10,036	19	0.01	0.714	0.027	-0.04	0.06	-0.03	0.032	0.015	-0.06	0.00
High-Tech	9,099	17	0.05	0.038	0.023	0.00	0.09	0.01	0.677	0.025	-0.04	0.06
Informal Institutions												
Individualism	2,219	5	0.13	0.107	0.082	-0.03	0.28	0.01	0.893	0.104	-0.19	0.22
Power Distance	1,363	3	0.08	0.022	0.037	0.01	0.16	0.12	0.038	0.059	0.01	0.23
Uncertainty Avoidance	1,676	3	-0.09	0.496	0.133	-0.34	0.17	-0.03	0.794	0.105	-0.23	0.18
Task Environment												
Environmental Dynamism	16,669	65	0.23	0.000	0.025	0.19	0.28	0.07	0.001	0.022	0.03	0.11
Environmental Hostility	8,964	43	0.08	0.011	0.031	0.02	0.14	0.01	0.616	0.027	-0.04	0.07
Environmental Munificence	5,813	18	0.18	0.000	0.038	0.11	0.25	0.16	0.000	0.039	0.09	0.23
Environmental Complexity	1,724	10	0.20	0.000	0.024	0.15	0.25	0.02	0.583	0.044	-0.06	0.11

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound.

Table 10: Organization-Level Meta-Analytic Results

			Entrepreneurial Orientation					Performance				
	N	k	r̄	p-val	SE	ci.lb	ci.ub	r̄	p-val	SE	ci.lb	ci.ub
Capabilities												
Absorptive Capacity	1,957	7	0.46	0.004	0.174	0.16	0.69	0.48	0.000	0.119	0.28	0.64
HR Capabilities	802	4	0.33	0.000	0.040	0.26	0.40	0.37	0.000	0.051	0.28	0.46
Organizational Learning	4,240	14	0.36	0.000	0.046	0.28	0.43	0.30	0.000	0.079	0.16	0.44
Marketing Capability	2,436	11	0.34	0.000	0.032	0.28	0.39	0.31	0.000	0.065	0.19	0.42
Technological Capabilities	597	3	0.41	0.000	0.123	0.20	0.59	0.41	0.000	0.041	0.34	0.48
Characteristics												
Firm Size	26,522	110	0.07	0.000	0.015	0.04	0.10	0.12	0.000	0.017	0.09	0.16
Firm Age	22,547	90	0.00	0.968	0.016	-0.03	0.03	0.02	0.373	0.017	-0.02	0.05
Governance												
Board Size	607	3	-0.02	0.595	0.041	-0.10	0.06	-0.01	0.938	0.089	-0.18	0.17
Generational Involvement	3,245	5	0.12	0.224	0.100	-0.07	0.31	0.03	0.369	0.031	-0.03	0.09
State Owned	1,928	8	-0.03	0.247	0.030	-0.09	0.02	-0.07	0.124	0.043	-0.15	0.02
Family Firm	3,875	6	0.00	0.893	0.033	-0.06	0.07	0.06	0.345	0.068	-0.07	0.19
Public Owned	1,081	3	-0.03	0.627	0.059	-0.14	0.09	-0.15	0.214	0.125	-0.38	0.09
Innovation												
Innovativeness	1,935	9	0.42	0.000	0.079	0.29	0.54	0.36	0.000	0.083	0.22	0.49
Commercialization	405	3	0.45	0.000	0.089	0.30	0.58	0.35	0.005	0.132	0.11	0.56
R&D Intensity	3,063	12	0.18	0.000	0.045	0.09	0.27	0.09	0.002	0.029	0.03	0.15
Networks												
Ties	6,807	14	0.18	0.009	0.071	0.05	0.31	0.16	0.010	0.061	0.04	0.27
Relationship Quality	1,859	6	0.25	0.089	0.151	-0.04	0.50	0.17	0.011	0.068	0.04	0.30
Performance												
Past Performance	2,277	9	0.15	0.011	0.061	0.04	0.27	0.35	0.004	0.129	0.11	0.55
Resources												
Human Capital	1,355	8	0.25	0.005	0.092	0.08	0.41	0.22	0.000	0.040	0.15	0.30
External Resources	474	3	0.30	0.320	0.314	-0.29	0.73	0.40	0.164	0.301	-0.17	0.77
Resource Advantage	543	3	0.41	0.000	0.053	0.32	0.49	0.24	0.010	0.097	0.06	0.41
Access to Capital	4,875	10	0.19	0.014	0.077	0.04	0.33	0.26	0.000	0.063	0.15	0.37
Leverage	3,550	6	0.05	0.399	0.063	-0.07	0.17	-0.06	0.413	0.071	-0.19	0.08
Slack	745	5	0.24	0.008	0.090	0.06	0.39	0.29	0.026	0.131	0.04	0.50
Assets	929	3	0.17	0.198	0.136	-0.09	0.41	0.15	0.375	0.174	-0.18	0.46
Strategic Orientation												
Learning Orientation	2,370	13	0.30	0.000	0.040	0.23	0.37	0.30	0.000	0.067	0.17	0.41
Market Orientation	12,258	44	0.42	0.000	0.034	0.36	0.47	0.29	0.000	0.024	0.25	0.33
Technology Orientation	2,594	7	0.59	0.000	0.052	0.52	0.66	0.25	0.000	0.066	0.12	0.36
Strategic Process												
Autonomy	1,289	4	0.03	0.732	0.090	-0.14	0.20	-0.03	0.622	0.058	-0.14	0.08
Participative Strategy	1,068	4	0.29	0.000	0.050	0.20	0.38	0.36	0.005	0.133	0.12	0.56
Flexibility	888	5	0.33	0.000	0.083	0.18	0.47	0.17	0.068	0.097	-0.01	0.35
Strategy												
Diversification	2,784	5	0.02	0.770	0.064	-0.11	0.14	0.04	0.275	0.039	-0.03	0.12
Internationalization	1,052	5	0.23	0.001	0.072	0.09	0.36	0.12	0.175	0.091	-0.06	0.29
Sustainability	1,221	6	0.42	0.000	0.084	0.28	0.55	0.30	0.002	0.101	0.12	0.47
Controls	1,158	3	0.33	0.018	0.143	0.06	0.55	0.04	0.719	0.113	-0.18	0.26
Structure												
Structural Organicity	545	3	0.47	0.000	0.059	0.37	0.55	0.09	0.036	0.043	0.01	0.17

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound.

Table 11: Upper Echelon-Level Meta-Analytic Results

			Entrepreneurial Orientation					Performance				
	N	**k**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**
CEO												
Age	1,207	5	0.01	0.857	0.051	-0.09	0.11	0.03	0.315	0.029	-0.03	0.09
Tenure	1,724	8	0.05	0.118	0.030	-0.01	0.10	0.09	0.002	0.028	0.03	0.14
Narcissism	345	3	0.14	0.125	0.091	-0.04	0.31	0.17	0.002	0.055	0.06	0.27
Manager												
Age	1,384	7	0.02	0.527	0.032	-0.04	0.08	-0.04	0.186	0.028	-0.09	0.02
Gender	1,127	6	0.01	0.742	0.042	-0.07	0.10	-0.02	0.645	0.046	-0.11	0.07
Position	890	3	0.03	0.671	0.066	-0.10	0.16	0.02	0.764	0.062	-0.10	0.14
Education	3,010	6	0.03	0.063	0.018	0.00	0.07	0.01	0.742	0.034	-0.06	0.08
Tenure	1,459	6	0.03	0.184	0.026	-0.02	0.09	0.04	0.185	0.030	-0.02	0.10
Experience	731	4	0.13	0.002	0.043	0.05	0.21	0.00	0.920	0.037	-0.08	0.07
Social Capital	2,275	3	0.29	0.053	0.152	0.00	0.53	0.22	0.000	0.042	0.14	0.30
TMT												
Size	1,644	7	0.11	0.000	0.025	0.06	0.16	0.06	0.138	0.038	-0.02	0.13
Diversity	1,884	3	0.02	0.449	0.023	-0.03	0.06	0.02	0.490	0.026	-0.03	0.07
Involvement	419	4	0.33	0.000	0.075	0.19	0.45	0.22	0.001	0.068	0.09	0.34

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound.

Table 12: Relevance Filtered Variables

				Entrepreneurial Orientation					Performance				
Variable	**N**	**k**	**Rel**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**
Technology Orientation	2,594	7	IV, MED	0.59	0.000	0.052	0.52	0.66	0.25	0.000	0.066	0.12	0.36
Absorptive Capacity	1,957	7	MED; MOD	0.46	0.004	0.174	0.16	0.69	0.48	0.000	0.119	0.28	0.64
Innovativeness	1,935	9	MED	0.42	0.000	0.079	0.29	0.54	0.36	0.000	0.083	0.22	0.49
Sustainability	1,221	6	MED	0.42	0.000	0.084	0.28	0.55	0.30	0.002	0.101	0.12	0.47
Market Orientation	12,258	44	IV; MED	0.42	0.000	0.034	0.36	0.47	0.29	0.000	0.024	0.25	0.33
Organizational Learning	4,240	14	Diverse	0.36	0.000	0.046	0.28	0.43	0.30	0.000	0.079	0.16	0.44
Marketing Capability	2,436	11	MED; MOD	0.34	0.000	0.032	0.28	0.39	0.31	0.000	0.065	0.19	0.42
Strategic Flexibility	888	5	IV; MOD	0.33	0.000	0.083	0.18	0.47	0.17	0.068	0.097	-0.01	0.35
Learning Orientation	2,370	13	IV; PRE	0.30	0.000	0.040	0.23	0.37	0.30	0.000	0.067	0.17	0.41
Regulatory Environment	5,363	8	Diverse	0.28	0.039	0.142	0.01	0.52	0.18	0.060	0.095	-0.01	0.35
Human Capital (Resources)	1,355	8	PRE; MOD	0.25	0.005	0.092	0.08	0.41	0.22	0.000	0.040	0.15	0.30
Relationship Quality	1,859	6	Diverse	0.25	0.089	0.151	-0.04	0.50	0.17	0.011	0.068	0.04	0.30
Slack Resources	745	5	CTR	0.24	0.008	0.090	0.06	0.39	0.29	0.026	0.131	0.04	0.50
Internationalization	1,052	5	Diverse	0.23	0.001	0.072	0.09	0.36	0.12	0.175	0.091	-0.06	0.29
Environmental Dynamism	16,669	65	CTR; MOD	0.23	0.000	0.025	0.19	0.28	0.07	0.001	0.022	0.03	0.11
Environmental Complexity	1,724	10	CTR; MOD	0.20	0.000	0.024	0.15	0.25	0.02	0.583	0.044	-0.06	0.11
Access to Capital	4,875	10	Diverse	0.19	0.014	0.077	0.04	0.33	0.26	0.000	0.063	0.15	0.37
Environmental Munificence	5,813	18	CTR; MOD	0.18	0.000	0.038	0.11	0.25	0.16	0.000	0.039	0.09	0.23
Network Ties	6,807	14	Diverse	0.18	0.009	0.071	0.05	0.31	0.16	0.010	0.061	0.04	0.27
R&D Intensity	3,063	12	CTR	0.18	0.000	0.045	0.09	0.27	0.09	0.002	0.029	0.03	0.15
Past Performance	2,277	9	CTR	0.15	0.011	0.061	0.04	0.27	0.35	0.004	0.129	0.11	0.55
TMT Size	1,644	7	CTR	0.11	0.000	0.025	0.06	0.16	0.06	0.138	0.038	-0.02	0.13
Firm Size	26,522	110	CTR	0.07	0.000	0.015	0.04	0.10	0.12	0.000	0.017	0.09	0.16

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; Rel = most common variable applications; IV = independent variable alongside EO; MED = mediator between EO and performance; MOD = moderator of the EO-performance relationship; PRE = antecedent of EO; CTR = control variable; Diverse = very heterogeneous application.

Table 13: Control Variable Meta-Analytic Results

					Entrepreneurial Orientation					Performance				
Level	**Category**	**Name**	**N**	**k**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**
Environment	Formal Institutions	Regulation	584	3	-0.01	0.860	0.042	-0.09	0.07	-0.06	0.200	0.047	-0.15	0.03
	Industry	Service	10,036	19	0.01	0.714	0.027	-0.04	0.06	-0.03	0.032	0.015	-0.06	0.00
		Manufacturing	13,385	18	-0.02	0.020	0.009	-0.04	0.00	0.01	0.611	0.019	-0.03	0.05
		High-Tech	7,271	16	0.05	0.060	0.025	0.00	0.09	0.00	0.983	0.024	-0.05	0.05
	Task Environment	Environmental Dynamism	10,207	41	0.23	0.000	0.030	0.17	0.29	0.05	0.060	0.029	0.00	0.11
		Environmental Hostility	4,623	24	0.11	0.017	0.047	0.02	0.20	0.00	0.899	0.031	-0.06	0.06
		Environmental Munificence	3,027	13	0.18	0.000	0.049	0.08	0.27	0.12	0.001	0.038	0.05	0.19
		Environmental Complexity	1,357	7	0.20	0.000	0.027	0.15	0.25	0.00	0.943	0.055	-0.10	0.11
Organization	Characteristics	Firm Size	26,150	107	0.07	0.000	0.015	0.04	0.10	0.12	0.000	0.018	0.09	0.16
		Firm Age	21,794	85	0.00	0.947	0.016	-0.03	0.03	0.02	0.376	0.017	-0.02	0.05
	Governance	Board Size	607	3	-0.02	0.595	0.041	-0.10	0.06	-0.01	0.938	0.089	-0.18	0.17
		State Owned	1,614	6	-0.03	0.307	0.027	-0.08	0.03	-0.09	0.065	0.050	-0.19	0.01
		Family Firm	2,761	4	0.03	0.461	0.043	-0.05	0.12	0.02	0.646	0.047	-0.07	0.11
		Public Owned	1,081	3	-0.03	0.627	0.059	-0.14	0.09	-0.15	0.214	0.125	-0.38	0.09
	Innovation	R&D Intensity	2,586	11	0.17	0.000	0.047	0.08	0.25	0.07	0.004	0.025	0.02	0.12
	Performance	Past Performance	2,277	9	0.15	0.011	0.061	0.04	0.27	0.35	0.004	0.129	0.11	0.55
	Resources	Leverage	3,550	6	0.05	0.399	0.063	-0.07	0.17	-0.06	0.413	0.071	-0.19	0.08
		Access to Capital	605	3	0.28	0.219	0.238	-0.17	0.64	0.20	0.102	0.123	-0.04	0.42
		Assets	929	3	0.17	0.198	0.136	-0.09	0.41	0.15	0.375	0.174	-0.18	0.46
		Slack	387	3	0.12	0.243	0.103	-0.08	0.31	0.15	0.412	0.178	-0.20	0.46
	Strategic Orientation	Market Orientation	804	3	0.24	0.008	0.092	0.06	0.40	0.31	0.020	0.140	0.05	0.54
	Strategy	Diversification	2,784	5	0.02	0.770	0.064	-0.11	0.14	0.04	0.275	0.039	-0.03	0.12
		Internationalization	448	3	0.15	0.130	0.103	-0.05	0.34	0.14	0.296	0.139	-0.13	0.39
Upper Echelon	CEO	Age	1,157	4	-0.02	0.748	0.067	-0.15	0.11	0.03	0.299	0.030	-0.03	0.09
		Tenure	1,095	6	0.02	0.666	0.040	-0.06	0.10	0.12	0.000	0.030	0.06	0.17
	Manager	Age	1,384	7	0.02	0.527	0.032	-0.04	0.08	-0.04	0.186	0.028	-0.09	0.02
		Gender	1,127	6	0.01	0.742	0.042	-0.07	0.10	-0.02	0.645	0.046	-0.11	0.07
		Position	890	3	0.03	0.671	0.066	-0.10	0.16	0.02	0.764	0.062	-0.10	0.14
		Tenure	1,459	6	0.03	0.184	0.026	-0.02	0.09	0.04	0.185	0.030	-0.02	0.10
		Education	2,850	5	0.03	0.077	0.019	0.00	0.07	0.00	0.959	0.041	-0.08	0.08
		Experience	411	3	0.16	0.004	0.058	0.05	0.27	-0.01	0.771	0.050	-0.11	0.08
	TMT	Size	1,644	7	0.11	0.000	0.025	0.06	0.16	0.06	0.138	0.038	-0.02	0.13
		Diversity	1,766	3	0.02	0.511	0.028	-0.04	0.07	0.02	0.536	0.025	-0.03	0.07

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound.

Table 14: Relevance Filtered Control Variables

			Entrepreneurial Orientation					Performance				
Variable	**N**	**k**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**	**r̄**	**p-val**	**SE**	**ci.lb**	**ci.ub**
Environmental Dynamism	10,207	41	0.23	0.000	0.030	0.17	0.29	0.05	0.060	0.029	0.00	0.11
Environmental Hostility	4,623	24	0.11	0.017	0.047	0.02	0.20	0.00	0.899	0.031	-0.06	0.06
Environmental Munificence	3,027	13	0.18	0.000	0.049	0.08	0.27	0.12	0.001	0.038	0.05	0.19
Environmental Complexity	1,357	7	0.20	0.000	0.027	0.15	0.25	0.00	0.943	0.055	-0.10	0.11
Firm Size	26,150	107	0.07	0.000	0.015	0.04	0.10	0.12	0.000	0.018	0.09	0.16
R&D Intensity	2,586	11	0.17	0.000	0.047	0.08	0.25	0.07	0.004	0.025	0.02	0.12
Past Performance	2,277	9	0.15	0.011	0.061	0.04	0.27	0.35	0.004	0.129	0.11	0.55
CEO Tenure	1,095	6	0.02	0.666	0.040	-0.06	0.10	0.12	0.000	0.030	0.06	0.17
TMT Size	1,644	7	0.11	0.000	0.025	0.06	0.16	0.06	0.138	0.038	-0.02	0.13

Note: N = total number of firms; k = number of independent samples; r̄ = inverse variance weighted mean correlation; p-val = p-value of the correlation coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound.

REVISITING RISK-TAKING? META-ANALYTIC INSIGHTS, MODELING COMPARISONS, AND COMPONENT-LEVEL RELATIONSHIPS IN ENTREPRENEURIAL ORIENTATION RESEARCH

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ABSTRACT

Drawing on the largest collection of entrepreneurial orientation (EO) research to date, this study adopts a meta-analytic structural equation modeling (MASEM) approach to examine several distinct modeling approaches of how the components of EO can be related, as predicted by key organizational antecedents, to distinct aspects of firm performance. In doing so, we consider the role of managerial attitudes toward risk-taking in EO research. It is not our intention to challenge the strongly held assumption that risk and entrepreneurship are intertwined, but rather the more weaker held assumption that managerial attitudes toward risk-taking, as presently conceptualized, must always be explicitly captured and modeled as a correlate of firms' entrepreneurial behavior when investigating firms' EO. New approaches are discussed.

INTRODUCTION

Since its conceptualization over three decades ago by Miller (1983), research on entrepreneurial orientation (EO) has gained significant traction, establishing EO as a central strategic orientation in the management and entrepreneurship literature (Covin & Lumpkin, 2011; Covin & Wales, 2019; Rauch, Wiklund, Lumpkin, & Frese, 2009; Rosenbusch, Rauch, & Bausch, 2013; Stam & Elfring, 2008; Wales, 2016). However, in spite of its proliferation and evident popularity, significant conceptual ambiguities remain at the heart of the construct. Much of this ambiguity originates from the potential for component-level differences and variance that is embedded within the very foundation of the EO construct (Miller, 1983, 2011). Despite repeated calls to "take seriously the differences between the components of EO" (Miller, 2011: 888), the literature has been largely dominated by holistic EO research (Wales, Gupta, & Mousa, 2013). Though, emerging perspectives increasingly suggest the need to reconsider this dimensional ambiguity (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015; Lomberg, Urbig, Stöckmann, Marino, & Dickson, 2017).

Specifically, building upon Miller's (2011) observation that combining behavioral and attitudinal components might confuse situations in which entrepreneurial attitudes of managers may not match firm behavior, studies have begun to question the role, conceptualization, and influence of managerial risk-taking within EO research. For instance, Anderson et al. (2015; 2019) argue that EO components reflecting entrepreneurial behavior (i.e. innovativeness and proactiveness) should be separated from attitudinal components (i.e. managerial risk-taking attitudes) instead of being modeled as a unidimensional construct. With reference to this, a recent variance decomposition study suggests that the EO--performance relationship appears to be predominantly driven by the covariation between the two behavioral components, whereas variations in managerial risk-taking, that are not aligned with either of these two, can lead to negative performance outcomes (Lomberg et al., 2017).

Drawing upon these studies as inspiration and building on a comprehensive database of more than 540 EO studies, spanning 35 years of investigation, we use recent advances in meta-analytic structural equation modeling (MASEM) to examine how managerial risk-taking might be treated in EO research (Bergh et al., 2016; Combs, Crook, & Rauch, 2019). In this way, our study provides insight into how managerial risk-taking has, as well as might be, treated and modeled in future EO research. We focus on the Miller (1983) / Covin and Slevin (1989) (hence M/CS) construct given that its three dimensions are generally assessed within EO research (George & Marino, 2011) and have also been included within expanded dimensional conceptualizations of EO (c.f. Lumpkin & Dess, 1996). It is not our intention to challenge the strongly held assumption that risk and entrepreneurship are intertwined (Knight, 1921), but rather to consider the more weakly held assumption (Davis, 1971) that managerial attitudes toward risk-taking, as presently conceptualized, must always be explicitly captured and modeled as a correlate of firms' entrepreneurial behavior when investigating firms' EO.

The aim of our study is threefold. First, we compare a traditional aggregate approach to assessing EO with one in which the dimensions are assessed as individual but correlated components (Miller, 2011). We then break with the dominant empirical status quo and examine a component-level sequential model of EO in which managerial risk-taking is conceived as a principal driver of firms' entrepreneurial new entry behavior (Anderson, Eshima, & Hornsby, 2019; Lumpkin & Dess, 1996). In doing so, we explore whether managerial attitudes toward risk-taking may appropriately be conceived as an antecedent of firms' entrepreneurial behavior. While we approach the comparison of models from a predominantly atheoretic perspective of discovery (Miller, 2007), our model composition choices are rooted within extant theoretical perspectives. In this vein, our proposal and investigation of a component-level antecedent-outcome-based sequential model of EO is

fueled by perspectives on managerial decision-making style and risk preferences as explanations of EO's organizational behavioral stability (Covin & Lumpkin, 2011; Hoskisson, Chirico, Zyung, & Gambeta, 2017), but also by behavioral theories such as the theory of reasoned action (Ajzen & Fishbein, 1977) and upper echelons theory (Hambrick, 2007).

Second, from a modeling perspective, Miller (2011) stresses that the EO construct was constructed to be broad enough to capture various organizations and their processes in different types of firms, e.g. risk-taking in the small firm and proactiveness in an intrapreneurial giant. Thus, within our models, we consider whether and how firm size and age, as key organizational characteristics, may influence the manifestation of EO. Although these organizational characteristics have frequently been included rather agnostically within EO research as control variables, both might be important organizational antecedents that promote (or hinder) the exhibition of EO (Anderson & Eshima, 2013). We consider whether components such as risk-taking are more prominent within smaller or younger firms (Miller, 1983). Sharpening our analysis further, we deconstruct firm performance into profitability, growth and non-financial performance to model and detect finer-grained performance paths (Gupta & Wales, 2017).

A final modeling issue addressed concerns the potential for non-linearity to explain the exhibition and consequences of risk-taking or entrepreneurial firm behavior. Pierce and Aguinis (2013) theorize that a "too much of a good thing effect" (TMGT) is commonplace in managerial relationships and occurs when beneficial effects, after reaching inflection points, unfold diminishing and possibly below-zero returns when taken too far. Along these lines, non-linearity has been observed in EO research (Tang, Tang, Marino, Zhang, & Li, 2008; Wales, Patel, Parida, & Kreiser, 2013), however, our understanding of the TMGT effect

remains fragmented at best (Miller, 2011; Wales, 2016). Thus, for robustness, we consider the evidence as to whether our observed relationships are non-linear.

This research contributes to the entrepreneurship literature by considering new perspectives on component-level effects within EO research. Using the most robust sample of EO studies to date, we observe limited evidence that the current conceptualization of managerial risk-taking attitudes is adding significant explanatory value as a correlate within EO models and discuss what changes could be helpful in future EO research to advance the conversation around risk-taking. Moreover, this research draws attention to understanding the organizational antecedents of EO, illustrates nuanced implications of EO using fine-grained assessments of firm performance, and deepens our understanding of non-linearity within EO research.

Additionally, our findings contribute to the broader management literature by demonstrating why the integration of aggregate and component-level reporting is necessary when investigating organizational phenomena with a deeply embedded theoretic plurality. This research offers support for co-modeling and reporting as essential for greater transparency in management research when investigating a complex organizational phenomenon such as EO (Aguinis, Ramani, & Alabduljader, 2018). Finally, our analysis provides guidance on how MASEM can be applied to reveal new insights within neighboring managerial areas as well (Combs et al., 2019).

COMPONENT-LEVEL EO RESEARCH

Elements of Entrepreneurial Orientation

Covin and Slevin (1989: 77 emphasis added) originally theorized that "Entrepreneurial firms are those in which the top managers have entrepreneurial top management styles, as evidenced by the *firms' strategic decisions* and operating *management*

philosophy". Preceding conceptual research has often emphasized either a firm's strategic behavior (Covin & Slevin, 1991) or its management philosophies (Lumpkin & Dess, 1996), that is, its strategic content or strategic process. Accordingly, theoretic plurality is deeply embedded within the EO literature and two dominant conceptualizations of EO have emerged (Covin & Wales, 2012, 2019). On the one hand, Covin and Slevin (1991) consider EO from the perspective of sustained organizational behavior patterns that are common across entrepreneurial firms and supported by managerial dispositions that promote their exhibition. On the other hand, (Lumpkin & Dess, 1996: 139 emphasis added) conceptualize a firm's EO in terms of a strategic organizational process which is rooted in, and derived from managerial process and posture "[…] analogous to Stevenson and Jarillo's (1990) concept of entrepreneurial management, in that it reflects the organizational processes, methods, and styles that firms use to act entrepreneurially".

To complicate matters further, neither perspective is inherently correct, as both strategic process and content are important elements of an organization's strategic orientation (Covin & Lumpkin, 2011). In this vein, the M/CS construct with its holistic inclusiveness across dimensions and strategic process-content phenomena has undoubtedly become the most frequently employed conceptualization of EO within the literature (Wales, Gupta, et al., 2013). Moreover, the inclusion of innovativeness, proactiveness, and risk-taking has been a common theme or foundation within expanded conceptualizations of EO (e.g. George & Marino, 2011; Lumpkin & Dess, 1996). Innovativeness addresses a firm's ability to develop and launch new product-market entries (Covin & Miles, 1999). Proactiveness captures firms' ability to act quickly upon opportunities before they are fully understood and before competitors have a significant market share (Lumpkin & Dess, 1996). Whereas both innovativeness and proactiveness are primarily conceptualized and operationalized as firm behaviors, risk-taking has been conceived as an attitude among top managers in terms of their

willingness to commit significant resources to bold, high-risk projects (Anderson et al., 2015; Covin & Slevin, 1989).

Thus, while innovation and proactiveness emphasize the strategic content of what entrepreneurial firms do, that is pioneering product-market innovation, risk-taking has traditionally emphasized the strategic process of how firms approach decision-making in a way that presumably supports entrepreneurial behavior (Anderson et al., 2019; Wales, Gupta, Marino, & Shirokova, 2019). Given recent research suggesting that managerial attitudes towards risk-taking and entrepreneurial firm behavior may play different roles in the manifestation of EO (Anderson et al., 2015; Lomberg et al., 2017), we now examine different component-level models to generate deeper insight into whether, when, and how managerial attitudes toward risk-taking matter.

In this vein, Wales et al. (2019) argue that although risk is inseparable from innovation and entrepreneurship, it is not clear that entrepreneurial managers always or necessarily fancy themselves as big risk-takers. As Miller (2011: 874) recalls, he originally "suspected that entrepreneurial processes would manifest differently in different contexts, and so the aforementioned three dimensions were intended to form a collective catchall—one that was broad enough to capture different sorts of processes in different contexts: risk-taking in the small firm, innovation in the high-tech company, and proactiveness in an 'intrapreneurial' giant." Yet, what role has managerial risk-taking ended up playing within this collective catch-all construct? For instance, have younger or smaller firms been typified by higher levels of risk-taking? In what way(s) has risk-taking manifest important consequences for improved firm performance? Are component-level models of EO as (or more) explanatory than their aggregate counterparts?

In the next section, we explore several different modeling approaches conceivable within EO research including a (a) combined aggregate effects model, (b) independent

component-level effects model, (c) managerial attitude/firm behavioral correlational model, and finally (d) a managerial attitude--firm behavior sequential model to direct our MASEM analyses.

EO Model Compositions and Comparison

In this section, to assess EO's component-level relationships, we examine four distinct models, offering insight into their antecedent/outcome relationships. Given our emphasis on considering broad conceptual questions, and operating within norms of previously comprehensive meta-analytic assessments (i.e. Rauch et al., 2009), we offer our expectations regarding these models in summary form, rather than specific hypotheses. Within our models, we consider key organizational antecedents that may promote (or hinder) managerial attitudes toward risk-taking or entrepreneurial firm behavior. In doing so, we expand the EO conversation beyond an exploration of environmental antecedents (Covin & Lumpkin, 2011; Rosenbusch et al., 2013).

The first organizational factor we consider is firm age, which past research suggests plays an ambiguous role in the innovation and entrepreneurship context (Sørensen & Stuart, 2000). On the one hand, adopting a liability of newness view (Stinchcombe, 1965), older firms have a more in-depth market, production, and management experience (Hannan & Freeman, 1984), accumulated knowledge stocks (Cohen & Levinthal, 1990) and more refined competencies and routines (March, 1991). Thus, older firms are more likely to possess specialized resources, enabling these firms to be more efficient and innovative than younger firms (Henderson, 1999; Thornhill & Amit, 2003). On the other hand, from a liability of obsolescence perspective (Barron, West, & Hannan, 1994), the contrary can be the case. A firm's core competencies, routines, capabilities, and structures that are highly tailored towards established innovation domains, may develop in path-dependent ways and become imprinted over time (Leonard-Barton, 1992; Sydow, Schreyögg, & Koch, 2009). Older firms

may often find it exceedingly challenging to break with their histories and overcome inertial forces in the pursuit of new innovation trajectories, which puts them at a disadvantage over less experienced, but more agile younger competitors (Sørensen & Stuart, 2000; Van de Ven, 1986). As such, the relationship between firm age and EO is not clear.

The second organizational factor we consider is firm size. In general, larger firms are associated with access to more complex and diversified resources, which allow them to pursue more projects, take greater risks and to better cope with losses than smaller firms (Damanpour, 1992; Nohria & Gulati, 1996). However, with increasing size, firms also tend to become more complex, formalized and bureaucratic, which might diminish their responsiveness and flexibility (Damanpour, 1992). Thus, the relationship between firm size and EO is also not clear. Given the theorized advantages and disadvantages of firm age and size, as well as the lack of empirical clarity within past research (cf. Anderson & Eshima, 2013), we examine how firm size and age influence the manifestation of EO and do so in aggregate and component-level models.

Moreover, across all four models of EO we also explicitly consider outcome relationships with distinct facets of firm performance. In their review on performance outcomes in the EO literature, (Gupta & Wales, 2017) observe that little attention has been devoted to how performance is assessed e.g. studies often rely on hybrid performance instruments which are mixtures of various indicators of different performance types. Supporting such performance assessments, an early meta-analysis (through 2006) did not find EO to be differently related to various performance types within 53 studies (Rauch et al., 2009). However, a preceding meta-analysis (through part of 2013) observed EO to be more strongly related to growth than profitability based on 177 studies (Saeed, Yousafzai, & Engelen, 2014). This suggests that more specific performance effects may be detectable within larger samples of studies. In addition to that, in terms of performance differences,

albeit growth and profit are viewed to be central outcomes of EO, we concur with past research that non-financial performance aspects, e.g. customer satisfaction or product quality, might also reveal meaningful insights (Lumpkin & Dess, 1996; Rauch et al., 2009; Wales, 2016) and are therefore included within our analyses. Moreover, considering that some studies have indicated risk-taking to exhibit different performance effects than innovativeness or proactiveness (Hughes & Morgan, 2007; Kreiser, Marino, Kuratko, & Weaver, 2013), fine-grained component-level firm performance relationships are also examined.

Aggregate EO Model. We begin with a baseline, the traditional M/CS approach of combining all three dimensions into a first-order reflective construct (Covin & Slevin, 1991). As item-level correlations are typically unavailable in primary studies, we operationalize EO with the three components as its indicators. In general, based upon past research we expect EO to be more positively related to growth and non-financial performance, than to a firm's level of profitability (Saeed et al., 2014). Along these lines, EO is often cast as a "growth orientation" (Wiklund & Shepherd, 2011) and more strongly linked to exploration than exploitation (Abebe & Angriawan, 2014). In terms of organizational determinants, we expect firm age (Anderson & Eshima, 2013; Hill & Rothaermel, 2003) and size (Saeed et al., 2014) to be negatively related to EO. Considering that EO captures an opportunity-seeking orientation, younger and smaller firms seem likely to generally promote higher EO as a means for growth and to compete against larger incumbents (Anderson & Eshima, 2013; Luo, Zhou, & Liu, 2005; Rauch et al., 2009; Saeed et al., 2014). Figure 1 summarizes and depicts the most commonly investigated EO model (Wales, Gupta, et al., 2013), based upon the aggregate conceptualization of M/CS.

Insert Figure 1 about here

Independent Component-Level EO Model. It is reasonable to imagine potential differences in terms of how the dimensions of EO manifest relationships with antecedents and outcomes (Anderson et al., 2015; Lumpkin & Dess, 1996). All three aspects of EO, innovation, proactivity, and risk-taking, require substantial resource investments (Covin & Slevin, 1991; Li & Atuahene-Gima, 2001). Hence, in line with their aggregate effect, we expect the dimensions will be more positively related to certain aspects of performance, such as non-financial and growth, than to profitability. As the first study to investigate the dimensional effects of EO upon specific performance outcomes, we consider whether innovativeness, proactiveness, or risk-taking constitute a dominant driver of firms' non-financial and growth performance, or its profitability (Covin, Green, & Slevin, 2006; Hughes & Morgan, 2007; Rauch et al., 2009). In line with our expectations for the aggregate model, we expect firm age and size to be negatively related to the three components. Nonetheless, differences between the dimensions are possible, i.e. smaller firms might encourage risk-taking and larger firms may tend to be more proactive (Miller, 1983, 2011). To examine such nuanced antecedent-to-component and component-to-outcome relationships, we provide an independent component-level EO model as shown in Figure 2.

Insert Figure 2 about here

Attitudinal/Behavioral EO Model. Despite the centrality of a strategic process/content distinction within the work of Lumpkin and Dess (1996), an examination of EO's components along these lines has been almost non-existent within preceding studies and we aim to correct this oversight. Considering the finding of Lomberg et al. (2017) that the EO--performance relationship appears to be predominantly driven by the shared effect of innovativeness and proactiveness, and the two to be more similar to another than to risk-taking, we next draw on the attitude/behavior distinction advocated by Anderson et al.

(2015). Thus, by modeling innovativeness and proactiveness as a latent behavioral component enables us to explore these aspects in contrast to our independent-component-level model. In doing so, we consider how firm size and age might be differently related to a firm behavioral as opposed to managerial attitudinal (risk-taking) component of EO and how these attitudinal/behavioral components might be differently related to performance outcomes. We expect that systematic differences will manifest within the antecedents and consequences of firms' entrepreneurial decision-making styles and attitudes, and their firm behavior (Anderson et al., 2015). We expect managerial attitudes towards risk-taking and entrepreneurial behavior to diminish, as firms become larger and older. The attitudinal/behavioral split EO model is depicted in Figure 3.

Insert Figure 3 about here

Attitudinal/Behavioral EO Sequential Model. Extending EO modeling approaches, we consider a new possibility, that risk-taking, traditionally conceived as a correlate by M/CS, may influence firm performance indirectly through firm behavior. Thus, considering the mixture of top managerial style and organizational behavior in EO research (Miller, 2011), we propose an integrative structural component-level EO model, in which we model managerial risk-taking as a *predictor* (instead of a correlate) of entrepreneurial behavior and control for differences among the two behavioral components. To motivate this model, we integrate several emerging logics within the EO literature. First, as discussed in their foundational work Lumpkin and Dess (1996) argue that managerial decision-making styles drive a firm's new entry behavior (i.e., innovation in terms of sustained regeneration and proactive market entry (Covin & Wales, 2019). Anderson et al. (2019) expand on this inherent attitude/behavior divide, suggesting that managerial risk-taking proclivities may be expressed through innovative and proactive firm behaviors.

Second, Covin and Lumpkin (2011) offer a temporal stability perspective for the inclusion of managerial attitudes as assurance that entrepreneurial behavior is systematically recurring. Following these logics, we bring together a temporal stability view of EO with the literature on attitude-behavior linkages and managerial risk-taking. According to the literature on attitude-behavior linkages, managers act in accordance with their intentions, which in turn are influenced by attitudes towards the respective behavior (Ajzen & Fishbein, 1977; Madden, Ellen, & Ajzen, 1992). This attitude-behavior mechanism has received broad empirical support across multiple disciplines (e.g. Armitage & Conner, 2001; Kim & Hunter, 1993; Webb & Sheeran, 2006) and informs research on the risk-taking behavior of top managers and its subsequent impact on organizational actions (Hambrick, 2007; Ling, Simsek, Lubatkin, & Veiga, 2008; Liu, Fisher, & Chen, 2018). Taken together and in line with Lumpkin and Dess (1996), a sequential model is presented in Figure 4.

Insert Figure 4 about here

Non-Linearity within EO Relationships. A final modeling consideration is whether there is evidence (or a lack thereof) that relationships between EO components such as risk-taking and organizational antecedents or outcomes may be due to non-linearity (Tang et al., 2008; Wales, Patel, et al., 2013). While such perspectives are often discussed, few, if any, studies have considered how prevalent non-linear effects may be within the EO literature. In a rare non-linear study of EO at the component-level, Kreiser et al. (2013) found innovativeness and proactiveness to have U-shaped performance relationships, theorizing that at moderate levels, firms have to face substantial up-front costs, but may not be able to clearly pull ahead of the competition. Whereas for risk-taking, they find that lower levels of risk-taking outperform medium and higher levels, which can be associated with considerable up-front costs, more costly failures, and firms may spread their resources too thin (Hughes &

Morgan, 2007). This suggests that non-linear effects in antecedent-to-component and component-to-performance relationships may be nuanced and have been overlooked. Thus, the final objective of our study is to uncover whether non-linear relationships have gone unnoticed due to component aggregation.

METHODOLOGY

Literature Search and Selection

We performed a comprehensive literature search for published studies in Science Direct, EBSCO (Business Source Premier) and ISI Web of Science using various EO keywords (e.g. entrepreneurial orientation, strategic posture, and corporate entrepreneurship). We used the following inclusion/exclusion criteria: (a) We excluded qualitative research and studies that do not report required statistical information; (b) EO had to refer to organizational strategy and the number of firms included in the sample had to be clear; (c) Non-profit and public administration samples were excluded; (d) We only included studies which used scales derived from Covin and Slevin (1989), Lumpkin and Dess (2001) to operationalize EO or use a measure of corporate entrepreneurship derived from this literature stream e.g. Zahra (1996); (e) We excluded performance variables solely focused on international or export performance; (f) Studies had to report correlations between variables of interest; (g) If multiple studies used the same sample, we omitted the correlational overlap. The literature search was completed in January 2019 and on completion of the screening process, we identified 544 suitable studies, which contribute 555 independent samples.[2] The distribution of studies, based on year of publication, is depicted in Figure 5.

Insert Figure 5 about here

Coding Procedure

The coding was performed by the first author and a coding sheet was used to incorporate the studies' details and to reduce potential coding errors. Ambiguities were discussed and resolved through discussion among the authors. A list of included studies is available upon request.

Entrepreneurial Orientation. Variables were coded as innovativeness, proactiveness or risk-taking when these were measured with the M/CS scale, Lumpkin and Dess (2001) and with scales that were derived from these or that share significant similarities on the item level e.g. the innovativeness scale of (Hurley & Hult, 1998). We also assessed studies that report EO effects as corporate entrepreneurship and studies that only report aggregate EO, in order to locate additional effect sizes between variables of interest. For the non-linear assessment, we extracted the mean scores of the three components and rescaled all means to reflect a 7-point scale. We also coded the mean scores of aggregate EO measures in order to control for the inverted U-shaped performance effect found in previous studies.

Firm Performance. We classified performance measures as profitability when they were based on e.g. return on sales, return on investment and net income. Second, in order to be classified as growth performance, measures had to refer to growth in e.g. sales, profit, employment or market share. Finally, we classified performance measures as non-financial, when these were neither related to profitability nor growth i.e. customer satisfaction, product quality, market share, sales, and efficiency. We classified measures as mixed when they combined various performance types: 113 studies combine indicators of all three performance types, 43 studies draw on combinations of profitability and non-financial indicators, 45 combine profitability and growth and only ten mix non-financial performance and growth.

Organizational Antecedents. Firm age refers to the number of years since a firm's inception and firm size refers to the total number of employees. When transformations were used on size and age, the mean scores were back-transformed to represent the raw values. Among the samples that report EO component-level correlations with these antecedents and provide mean scores of size or age, the average number of employees across these samples is 449, with a standard deviation of 1,329 employees. As the distribution of raw means for size was skewed, we re-logged the values for our non-linear assessment. The average firm age across these samples is 23 years with a standard deviation of 15 years.

Meta-Analytic Procedure

MASEM is a powerful tool and the method of choice to test the explanatory value between competing frameworks and models which lies beyond the capacity of either traditional meta-analysis or SEM (Bergh et al., 2016; Combs et al., 2019; Viswesvaran & Ones, 1995). We adopt the two-stage structural equation modeling approach (TSSEM) of Cheung (2015a) as it holds several statistical advantages over the approach of Viswesvaran and Ones (1995) (see Cheung, 2015a; Cheung, Sun, & Chan, 2019 for a discussion on this issue). All analyses were performed using the statistics software R 3.5.1, the "metafor" meta-analysis package (Viechtbauer, 2010), the "metaSEM" MASEM package (Cheung, 2015b), and for non-linear assessments the "rms" package (Harrell, 2015). The R code and input used to perform all analyses are available upon request. We use a random-effects model to perform our meta-analysis as the studies were conducted by different researchers in different settings (Aguinis, Pierce, Bosco, Dalton, & Dalton, 2011). If a study reported multiple variables of the same type e.g. innovativeness on the item level or two profitability measures, we computed average correlations.

To control for the accurateness of our findings, we do three things. First, we draw on the meta-analytic approach of Hedges and colleagues (Borenstein, Hedges, Higgins, &

Rothstein, 2009) and controlled the correlations between variables of interest for publication bias by using funnel plot inspection, Egger's test, the trim and fill method (Rothstein, Sutton, & Borenstein, 2005) and checked for influential studies (Viechtbauer & Cheung, 2010). These analyses indicate that publication bias and influential studies might affect some relationships, but their impact should not significantly skew results. Second, to explore the potential uniqueness of the effects of EO's components, we used pairwise equality constraints along the paths in our component-level models. The results are provided in online supplement A and suggest that firm size and age have different effects on EO's components. In turn, the effects of firm size on the components of EO are not significantly different from another and this observation also applies to firm age. Relatedly, innovativeness and proactiveness are more similar to another than, for instance, innovativeness is to risk-taking. Third, we compare our results with the approach of Viswesvaran and Ones (1995). The results are provided in online supplement B. Using this alternative procedure yielded a worse model fit, but all relationships remain stable suggesting robustness among different MASEM methods.

Fourth, we use meta-regression procedures to control for task-environment and industry (manufacturing vs. service) influences on correlations of interest. Industry is coded as a dummy variable (0 = manufacturing industry; 1 = service industry). The task environment is operationalized by drawing on the reported mean scores, all rescaled to a 7-point Likert scale, for environmental hostility, complexity, munificence, and dynamism (Rosenbusch et al., 2013). Due to a low number of cases, we had to omit environmental complexity from our assessments. The results are provided in online supplement C and reveal only six significant moderator effects at the component-level. Industry is observed to affect the relationship between risk-taking and non-financial performance, suggesting that the relationship is more pronounced for manufacturing firms than for service firms. Next, with increasing environmental dynamism, the relationship between proactiveness and growth

appears to be become stronger. Last, increasing levels of environmental hostility appear to weaken the relationships between innovativeness and profitability, innovativeness and non-financial performance, and proactiveness with non-financial performance. We additionally observe that the relationship between risk-taking and innovativeness seems to be more pronounced with increased environmental hostility.

Non-linear Analysis

We integrate restricted cubic splines with meta-regression and are the first, to our knowledge, to do so in EO research. Non-linearity is usually assessed by adding logarithmic or quadratic terms to regression models but this practice is oftentimes insufficient to appropriately map more complex shapes and the usage of more flexible methods e.g. multiple fractured polynomials or restricted cubic splines, is advised (Harrell, 2015; Nikolaeva, Bhatnagar, & Ghose, 2015). We use the "rms" package in conjunction with "metafor" to integrate restricted cubic splines with meta-regression. We followed the recommendations of Harrell(2015) regarding the number and location choice of knots. Mean scores of the variable of interest are entered as linear and non-linear moderators e.g. the mean scores of innovativeness serve as a linear and non-linear moderator on the innovativeness - profitability relationship. We use ANOVA and a likelihood ratio test to investigate whether the more complex non-linear model is superior to the simpler linear model and create plots for visual inspection.

RESULTS

Univariate Meta-Analysis

The pooled correlations, together with outlier and influence diagnostics, are shown in Table 1. Unidimensional EO measures and mixed performance correlations are solely

included to control for differences among performance relationships between aggregate and disaggregate measures.

Insert Table 1 about here

Meta-Analytic Structural Equation Modeling

The relevant correlations were drawn from 437 of the 555 independent samples, with a total sample size of 114,899 firms. The remaining samples are only used in the non-linearity assessments. The results of the aggregate EO model, depicted in Figure 1, are reported in Table 2. All paths, except firm size to growth performance, are statistically significant, and the findings indicate that firm age seems to be negatively ($B = -0.06$, $p < 0.001$) related to EO, and more intriguingly, that firm size appears to be positively ($B = 0.13$, $p < 0.001$) related to EO. Second, EO is positively related to profitability ($B = 0.19$, $p < 0.001$), growth ($B = 0.29$, $p < 0.001$) and non-financial performance ($B = 0.32$, $p < 0.001$), suggesting that EO has greater benefit for growth and non-pecuniary benefits than profitability. The model fit is generally acceptable (χ^2 (12) = 15.37, $p = 0.221$ RMSEA = 0.001; SRMR = 0.020; TLI = 0.99; CFI = 0.99).

Insert Table 2 about here

Concerning finer-grained models and approaches, the results of the independent component-level EO model depicted in Figure 2, are shown in Table 3. Firm age appears to be negatively related to innovativeness and risk-taking but unrelated to proactiveness whereas firm size seems to be positively related to all three. Only innovativeness is significantly related with profitability ($B = 0.11$, $p = 0.02$), whereas proactiveness ($B = 0.06$, $p = 0.25$) and risk-taking ($B = 0.02$, $p = 0.64$) are not. Thus, innovation appears to drive gains in profitability. In terms of growth, innovativeness ($B = 0.17$, $p < 0.001$) and proactiveness ($B =$

0.11, p = 0.08) have comparable relationships and risk-taking appears not to be related with growth (B = 0.01, p = 0.81). As such, the results suggest that innovation and moving fast relative to competitors might foster growth. Innovativeness also has the strongest relationship with non-financial performance (B = 0.22, p < 0.001), whereas proactiveness (B = 0.11, p = 0.06) has a comparatively smaller effect and risk-taking, again, is not related with non-financial performance (B = -0.01, p = 0.91). Taken together, innovativeness appears to be the strongest driver for profitability and non-financial performance, both innovativeness and proactiveness drive growth, and risk-taking, surprisingly, seems not to affect performance. The implications of this surprising finding will be returned to within the discussion. Notably, the model fit is good (χ^2 (2) = 3.94, p = 0.139. RMSEA = 0.002; SRMR = 0.008; TLI = 0.98; CFI = 0.99) and seems to be advantageous over the aggregate EO model.

Insert Table 3 about here

The results of our attitudinal/behavioral split EO model in the vein of Anderson et al. (2015), are shown in Figure 3 and presented in Table 4. Firm size is positively related to entrepreneurial behavior and risk-taking but age is negatively related to both. The behavioral component is positively related to all three performance types whereas risk-taking seems to be unrelated. This finding suggests that performance is mainly driven by the two behavioral components of EO. Moreover, the model fit (χ^2 (7) = 4.406, p = 0.732; RMSEA = 0.000; SRMR = 0.011; TLI = 1.00; CFI = 1.00) is close to the independent component-level model, suggesting that the two behavioral components are indeed very similar to another.

Insert Table 4 about here

Extending the thoughts of Anderson et al. (2015), the findings for an integrative structural component-level model of EO, depicted in Figure 4, are given in Table 5. The path

coefficients are largely equivalent to the independent component-level model. The structural model suggests that managerial risk-taking seems to be a strong driver of both firms' innovativeness (B = 0.39, p < 0.001) and proactiveness (B = 0.40, p < 0.001). Assessing the significant total effect of risk-taking on profitability (B = 0.09), growth (B = 0.12), and non-financial performance (B = 0.12), indicates that risk-taking is indeed more indirectly related to performance. Moreover, whether through innovativeness or proactiveness, risk-taking seems to have comparable performance effects. The model fit is equivalent to the independent component-level model (χ^2 (2) = 3.94, p = 0.139; RMSEA = 0.002; SRMR = 0.008; TLI = 0.98; CFI = 0.99).

Insert Table 5 about here

Non-Linearity Assessment

Our tests reveal four potential non-linear effects on the component-level, which are depicted in Figure 6 and the complete non-linear assessments are available in online supplement D. First, in terms of firm performance, the relationship between risk-taking and profitability seems to be U-shaped. Lower and higher levels of risk-taking appear to be positively related to profitability ("conservative stewardship" or "all in gambles"), whereas mediocre levels are negatively related to firms' profitability.[3] Second, in terms of interdimensional relationships, our results suggest a convex effect of risk-taking on proactiveness. Initially, proactiveness increases with higher levels of risk-taking. However, after reaching an inflection point, proactiveness decreases rather steeply with increasing levels of risk-taking, and the relationship might even become negative. Third, in terms of antecedent relationships, we find a convex effect of firm size on innovativeness. Innovativeness appears to increase slightly with firm size, then begins to decline, though not to negative levels, before beginning to improve again. Additionally, firm age is evidenced to

have a concave effect on proactiveness. Proactiveness appears to improve with age, up to a certain inflection point, and then begins to decrease, even to negative levels.

Insert Figure 6 about here

DISCUSSION

Drawing on the most comprehensive collection of EO studies to date our meta-analysis examines component-level relationships in EO research and, in doing, offers directions for the future development of this important research domain (Anderson et al., 2015, 2019; Covin & Lumpkin, 2011; Lomberg et al., 2017; Wales, 2016). EO research has spanned both managerial dispositions and firm-level behaviors (Covin & Wales, 2019), but this distinction has only recently been explicitly acknowledged within EO models (Anderson et al., 2015). Our study observes that research exploring aggregate EO and "shared-variance" theoretic models, while parsimonious, has concealed a great deal of information regarding how and why entrepreneurially-oriented firms influence firm performance. We now consider our findings, the curious role of managerial attitudes towards risk-taking in relation to firms' entrepreneurial behavior, and what changes might help move the EO conversation into new areas and directions.

Managerial Attitudes Toward Risk-Taking: A Necessary Correlate?

This research offers substantial evidence that risk-taking, as presently operationalized in terms of managerial attitudes, operates differently from entrepreneurial behavior, and more significantly, in its present form most strongly explains performance through its indirect, motivating effects on entrepreneurial behavior. First, in our baseline aggregate EO model, showing acceptable fit, we observe the weakest performance effect of aggregate EO is on profitability and the strongest on non-financial performance. Our findings suggest that

aggregate EO provides a parsimonious “shorthand” for entrepreneurial organizations, but also that conceptual advances are possible to provide a deeper, more nuanced understanding of EO (Covin & Lumpkin, 2011). In that regard, when turning to an independent component-level model, the model fit improves and the level of insight and information that can be gained is compelling. Innovativeness appears to be the predominant driver among all three performance types, whereas proactiveness exhibits more of a marginal impact on growth and non-financial performance. Intriguingly, risk-taking seems not to affect performance at all. These findings are similarly echoed within our attitudinal/behavioral split model of EO inspired by Anderson et al. (2015). We observe that managerial attitudes towards risk-taking are correlated with a firm’s entrepreneurial behavior, but the performance effects of EO appear to be solely the result of entrepreneurial behavior. Moreover, from a model fit perspective, we note that the discrepancy with the independent component-level model is marginal at best, lending support to the view of Anderson et al. (2015, 2019) who argue that the two behavioral components are more similar to another and more distinct to managerial attitudes toward risk-taking.

Extending past research by drawing on attitude-behavior linkages (Ajzen & Fishbein, 1977; Hambrick, 2007), we find that managerial attitudes toward risk-taking may have the potential to explain firm performance indirectly by increasing firms’ entrepreneurial behavior. This lends support to past presumptions about managerial attitudes towards risk-taking helping ensure that firms’ entrepreneurial behavioral patterns are stable over time (Anderson et al., 2015; Covin & Lumpkin, 2011) and separation of strategic process and content within the EO literature (Lumpkin & Dess, 1996). Based on these findings, we direct our discussion to the different ways in which risk-taking might be treated in future EO research beyond its present inclusion as a theoretical correlate of an organization’s overall aggregate or holistic EO.

Risks Inherent in Entrepreneurial Action. There is an extensive history of past research which supports the notion that a degree of risk is implied when firms engage in innovation and entrepreneurship e.g. any innovative and proactive product-market departure from the status quo may (or may not) actually constitute a performance improvement as intended, raising the question whether risk-taking always needs to be included within a study of firm's EO?

Miller (1983: 780) ties risk to innovation (vs. imitation) stating, "In general, theorists would not call a firm entrepreneurial if it changed its technology or product-line simply by directly *imitating* competitors while refusing to take any risks." Along these lines, Miller and Bromiley (1990) suggest R&D/Sales as an appropriate measure of risk, Simon and Houghton (2003) assess the riskiness of firm's actions by measuring the extent to which their product introductions are pioneering, and according to Hoskisson et al. (2017), managerial risk-taking (i.e., top managers' strategic choices associated with uncertain outcomes) is often *defined* in terms of their R&D investments, innovation, and new market entry among other actions. These collective works suggest that risk-taking is implied within firms' entrepreneurial behavior, and support future studies which focus specifically on a firm's strategic entrepreneurial behaviors (Anderson et al., 2019), or its objective firm actions (Miller & Le Breton–Miller, 2011), as capturing some requisite risk-taking in line with the original conceptualization of entrepreneurial firms (Miller, 2011). Thus, risk-taking is, to an extent, implied and evidenced when firms are observed engaging in entrepreneurial behavior. As such, future studies of EO in certain domains may chose to focus on strategic entrepreneurial behavior, leaving managerial risk-taking implied.

Managerial Attitudes Toward Risk as a Firm Behavioral Antecedent. Our findings reveal evidence that managerial risk-taking dispositions and firm behavioral actions operate differently and we find that managerial risk-taking, as a strong driver of both firms'

innovativeness and proactiveness, to be more indirectly related to performance. These observations draw attention to a managerial component of EO, and explicitly consider how managerial risk-taking offers a distinct driver of firms' entrepreneurial behavior and new entry as opposed to correlate (Lumpkin & Dess, 1996). As Covin and Lumpkin (2011) note, there are multiple paths that EO research may proceed. One such path would be to examine managerial risk-taking in much greater depth as an antecedent of firm's entrepreneurially-oriented behavior.

One way to explain the insignificant relationship between managerial attitudes towards risk-taking and firm performance is that the causally proximal outcome of managerial attitudes towards risk-taking is actually entrepreneurial firm behavior as opposed to a somewhat nebulous higher managerial attitude, higher firm performance linkage. This causal chain is reinforced by the observation that managerial risk-taking unfolds at a different level of analysis from firm behavioral actions (managerial- vs. firm-level). Managerial attitudes are included in a description of entrepreneurial organizations based on the upper echelons theory, that firm actions reflect TMT attributes (Hambrick, 2007). Yet, there could be considerations that affect this relationship, such as a temporal lag between a shift in managerial preferences and a change in firms' entrepreneurial behavior. Also, this connection may, for instance, be moderated by factors such as managerial compensation incentives. Studies interested in exploring the effects of managerial risk-taking (and gambling on bold actions, perhaps to understand hubris or overconfidence) on entrepreneurial behavior and firm performance are encouraged to explore moderated-mediation models of how such managerial disposition influences firm performance.

Retaining but Reconceptualizing Risk-Taking as a Correlate? Covin and Wales (2019) suggest that future studies may also seek to develop more concrete firm behavioral measures of risk or leverage to take the place of extant attitudinal indicators. Managerial

attitudes towards risk-taking are notably more subjective than firm indicators of idiosyncratic risk. Thus, a potential explanation for why risk-taking is not a significant driver of firm-performance is that not all respondents may view risk in the same manner. That is, what is considered risk-taking depends upon a list of factors, such as the time frame considered, to which the M/CS instrument is agnostic. As Bromiley et al. (2001: 272) suggests, "decisions could be classified as risk-seeking in the short-run because they introduce innovation, may be risk-averse in the long-run because without innovation the firm faces inevitable demise." Another factor that may be considered is the firm's past level of performance (Simon, Houghton, & Savelli, 2003).

Improvement in model fit may also occur if managerial risk-taking is recognized as multidimensional e.g. venturing managers seek to minimize downside risks while maximizing upside potential (sinking the boat vs. missing the boat). The M/CS instrument principally captures risk-taking only in terms of potential downside loss, rating "[...] the degree to which managers are willing to make large and risky resource commitments—i.e. those which have a reasonable chance of costly failure." (Miller & Friesen, 1978: 923). However, large investments as evidence of downside risk, do not always or seamlessly align with past descriptions of how entrepreneurial actors behave and therefore may require greater conceptual and empirical scrutiny. For instance, real options reasoning suggests that entrepreneurial innovation and management often unfolds more incrementally in terms of staged investments (Stevenson & Gumpert, 1985). Additionally, expert entrepreneurs generally do not make large resource gambles according to the "affordable loss" principle of effectuation (Sarasvathy, 2001). Moreover, practitioner-focused "lean" philosophies similarly strongly argue against big resource bets when organizations are pioneering new innovations. Finally, large resource commitments toward uncertain ventures confronting many unknowns is a big gamble and managers do not fancy themselves gamblers when innovating (March &

Shapira, 1987). These studies suggest that risk-taking considered from the perspective of "sinking the boat" should rarely be sought after. Considering these conceptual advances in our understanding of risk over the past 40 years since EO's present items were constructed, it may be time to consider risk from the perspective of "missing the boat" or upside-potential in EO research given its alignment with how entrepreneurially oriented firms behave in the pursuit of new opportunities for growth (Hoskisson et al., 2017; Janney & Dess, 2006).

Improving the Status Quo: The Low-Hanging Fruit

As the field transitions to improved measures and conceptualizations of EO, this research proposes several changes to how research employing the M/CS instrument can proceed in the interim. First, our findings suggest the importance of *always* reporting *both* the aggregate and individual-component level effects within future EO research (even if only as a footnote or online appendix). Miller (2011) briefly mentioned such aggregate and component-level reporting as arguably the "best of both worlds", and based on our findings we strongly concur. This allows EO, and organizations as being more (or less) entrepreneurial actors, to be theorized within studies without sacrificing insight into what dimensions might be driving observed relationships.

Second, studies of EO should more decidedly recognize that innovation and entrepreneurial firm behavior represent the "heart" of EO when conceptualizing and theorizing about the M/CS and its connection to firm performance outcomes (Covin & Miles, 1999). Relatedly, to deepen our understanding of moderation (Covin & Lumpkin, 2011; Rauch et al., 2009), it would be beneficial to note when certain component-level effects are more (or less) influential as well.

Third, this research draws attention to organizational attributes and conditions, and their influence on different components of EO as deserving greater attention in future studies. At a minimum firm age and size should be controlled for in *all* future studies of EO. This

research demonstrates how firm age and size are significant organizational determinants of EO in our models, and observes firm size to be positively whereas firm age to be negatively related to EO and its components, except the relationship between size and innovativeness and age and proactiveness, which appear to be non-linear and will be discussed below. Regarding firm size, EO seems to increase marginally with size, suggesting that potential resources advantages associated with size seem to slightly outweigh the disadvantages. In terms of firm age, as firms grow older they may find it difficult to overcome inertial forces, suggesting that path dependency and imprinting-based theoretic lenses may be considered in future research (Sydow et al., 2009). The divergent effects of firm size and age are also notable given that these firm characteristics are usually strongly positively related with each other. However, their relationship with EO seems to be more complex, and it is an interesting avenue for future research to disentangle the roles of the different theoretical mechanisms that are typically associated with firm size and age by drawing on more specific variables in order to better capture these mechanisms.

Fourth, our analysis of EO reveals that most relationships seem to be linear, however, it indicates that reliance on linear effects may conceal certain organizational relationships. This suggests that to further advance the status quo future studies should also plan to report whether (or not) non-linearity is observed within aggregate as well as component-level relationships. For instance, in terms of non-linear risk-taking effects, managerial attitudes toward risk-taking appear to have a concave effect on their firm's level of proactiveness. Low-to-medium increases in managerial attitudes toward risk-taking appear to positively intensify the firm's proactiveness, whereas higher levels of risk-taking rapidly unfold diminishing effects on proactivity. Thus, managers with a more positive attitude towards risk-taking appear more likely to seize customer and market opportunities, yet with very high risk-

taking, may spread their firms' resources too thin and act too quickly on opportunities that are, in the end, neither feasible nor promising.

Moreover, contrary to previous studies on the role of risk-taking (e.g. Kreiser et al., 2013; Miller, 2011), we observe a direct, U-shaped effect on profitability only. As discussed, risk-taking generally works through entrepreneurial firm behavior. In terms of a non-linear direct effect, lower and higher levels of risk-taking ("conservative stewardship" vs. "all in gambles") are related to the highest profitability, whereas mediocre levels are negatively related to firms' profitability. This is interesting as it may imply a "stuck in the middle" effect. Risk-taking generally leads to a reduction in profitability, but at very high-levels could signal that a "vein has been struck" and the company is presently mining the opportunity with all available resources. Yet, depending on how leveraged the firm is, and how quickly the vein dries up, it could put the firm at risk for resource exhaustion and discontinuation. That is, we note that high risk-taking is profitable among *surviving* firms, and unfortunately since survival has not been studied in EO research except in very rare instances, we cannot examine this relationship further.

Other non-linear effects observed include firm size exhibiting a positive non-linear effect on innovativeness. Small firms appear to capitalize on innovativeness, but as these firms continue to grow the advantages associated with smallness, i.e., flexibility, are seemingly outweighed by more formal structures, established solutions, etc., thereby causing innovativeness to slightly decline. Nevertheless, as firms continue to grow, resource-accumulation advantages spur further increases in firm innovativeness. However, our research finds that the EO literature has predominantly focused on SMEs. Thus, in order derive more fine-grained and robust insight on the role of firm size in the context of EO's components, more data on large firms is required.

In terms of non-linear proactiveness relationships, a liability of obsolescence appears to affect firms' proactiveness. At first, it seems that proactiveness improves with age due, perhaps, to gains in experience, resource accumulations, and more sophisticated routines which improve the efficiency and capacity of firms to scan the environment for opportunities to exploit. However, as firms grow older still, complacency, decreased pioneering, and a reduction in exploration may, for instance, accompany this maturity. However, among the samples that provide firm age mean scores, the average firm age is 23 years with a standard deviation of 15 years. This observation suggests that past EO research has generally focused on older, more established enterprises, suggesting that the new venture stage is less well understood.

Fifth, our study suggests that the status quo can be improved by paying greater attention to the specificity of how firm performance is captured. Hybrid performance measures are the most frequently used performance assessment in EO research (Gupta & Wales, 2017). Building on this insight, we find these measures to be quite heterogeneously composed and to produce higher correlations than when more specific performance indicators are employed. Whether this is caused by the increased number of available studies, the variable composure of these measures, or a combination of both, is difficult to discern. Perhaps of greater concern, the observed heterogeneous composition of performance measures can be troubling from a research transparency or p-hacking perspective (Aguinis et al., 2018) and specific performance configurations could unintentionally cause biases in EO—performance assessments. Thus, our study suggests that when hybrid performance measures are used in future research, the composition should be strongly justified, and correlations on the item level always reported.

LIMITATIONS

As with all scholarship, our analysis has both strengths and limitations. First, scholars criticize the narrow focus on EO—performance investigations and its emphasis on environmental factors (Covin & Lumpkin, 2011), and point to research on firm- and individual-level factors that affect EO inside organizations as necessary to engender insights into how EO is supported and strengthened by organizations (Wales, Monsen, & McKelvie, 2011). However, the available data is rather limited, resulting in fragmented variable sets, which render it impossible to extend our MASEM analysis to these areas. Second, we disentangle performance into three broad categories. We tried to break these categories further down into more fine-grained performance types e.g. absolute vs. relative or subjective vs. objective measures, but the heterogeneity in performance measures across studies made this impractical. The relationships between different performance types may also depend on the objectives of individual firms (e.g. Steffens, Davidsson, & Fitzsimmons, 2009), which is beyond the scope of meta-analysis given that they are generally not stated. We account for these various rationales by modeling the three performance types to be correlated with another. Third, we had to adapt the formative reconceptualization of (Anderson et al., 2015). It is impossible to meta-analytically replicate their formative conceptualization as their global EO indicators, required to identify the second-order formative EO construct are unfortunately not included in most (if any) other studies. Closely adhering to their operationalization of EO as a higher-order formative factor would also have prevented us from exploring the unique performance outcomes of the two components. Fourth, not all studies in our sample reported the required mean scores, applied transformations and points of the scales. In these cases, we contacted the corresponding authors and requested missing information but not all could provide us with the information. Hence, it would be highly desirable if future EO studies are more thorough and transparent in their reporting practices (Aguinis et al., 2018). Fifth, our

non-linear findings should be viewed as informative snapshots based on available data given that assessments on a low number of cases may fail to detect effects (Harrell, 2015; Nikolaeva et al., 2015). Finally, the majority of past EO research draws on cross-sectional data. This contributes to the possibility of survivor bias and we are unable to assess whether EO or its components are associated with firm discontinuation and we also cannot test the presumption that managerial attitudes towards risk-taking increase behavioral stability.

CONCLUSION

In sum, drawing on more than 540 primary studies, this research adopts a MASEM approach to explore how the EO literature can further develop to illuminate new insights. Component-level relationships are examined and the role of managerial risk-taking considered, as well as key organizational determinants, outcomes, and non-linearity within EO research. It is our hope that the findings presented in this meta-analytic investigation help inspire new research questions, models, and approaches within the future study of EO.

NOTES

[1)] It is important to note that Miller's critique is not to be confused with the uni- vs. multi-dimensional "debate" (Covin & Lumpkin, 2011), which has led to general acceptance of two fundamentally different dimensional combinations and treatments of new entry in EO research (Covin & Wales, 2019; Wales, Wiklund, & McKelvie, 2015). Rather, the question is whether a "best of both worlds" approach represents a critical path forward for more comprehensive future investigations and discoveries based upon M/CS EO, the measurement model at the heart of most all past EO research (Wales, Gupta, et al., 2013).

[2)] The reporting of EO along these samples is as follows: 310 use the aggregate, 203 report on the component-level and of these, 87 report all three core dimensions. Only 23 studies adopt a best of worlds approach and 19 studies report an aggregate/component mixture of EO e.g. an aggregate consisting of proactiveness and risk-taking, whereas innovativeness is reported separately. One study has two samples which belong to different categories. Only 61 studies report one or both dimensions of Lumpkin and Dess (1996). Concerning performance, 86 studies use profitability measures, 90 growth, 98 non-financial performance, and notably, 211 studies draw on mixed performance measures.

[3)] Considering the mixed non-linear findings for EO component-to-outcome relationships, it seems to be natural to assume that these are likely to be concealed when EO is viewed in aggregate e.g. we could not detect any non-linear performance relationships of aggregate EO measures. Results and plots on aggregate EO measures are provided in online supplement E.

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APPENDIX

Figure 1. Aggregate EO Model (For clarity of presentation, this and proceeding figures do not include endogenous error terms)

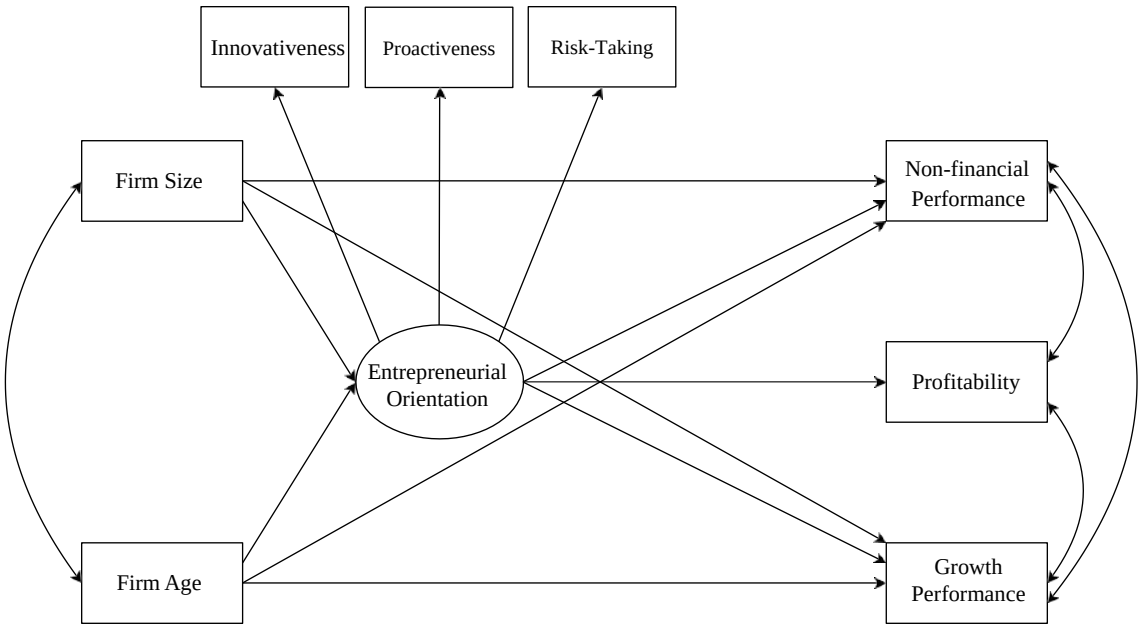


Figure 2. Independent Component-Level EO Model

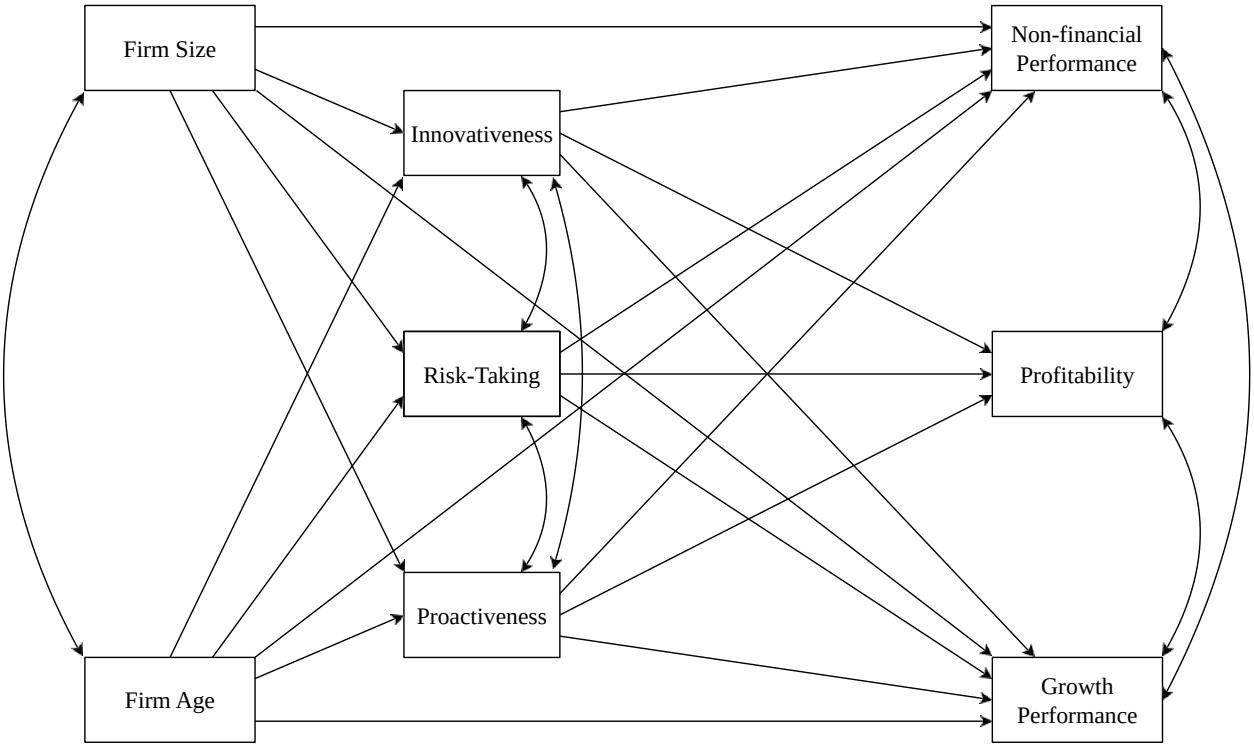


Figure 3. Attitudinal/Behavioral EO Model

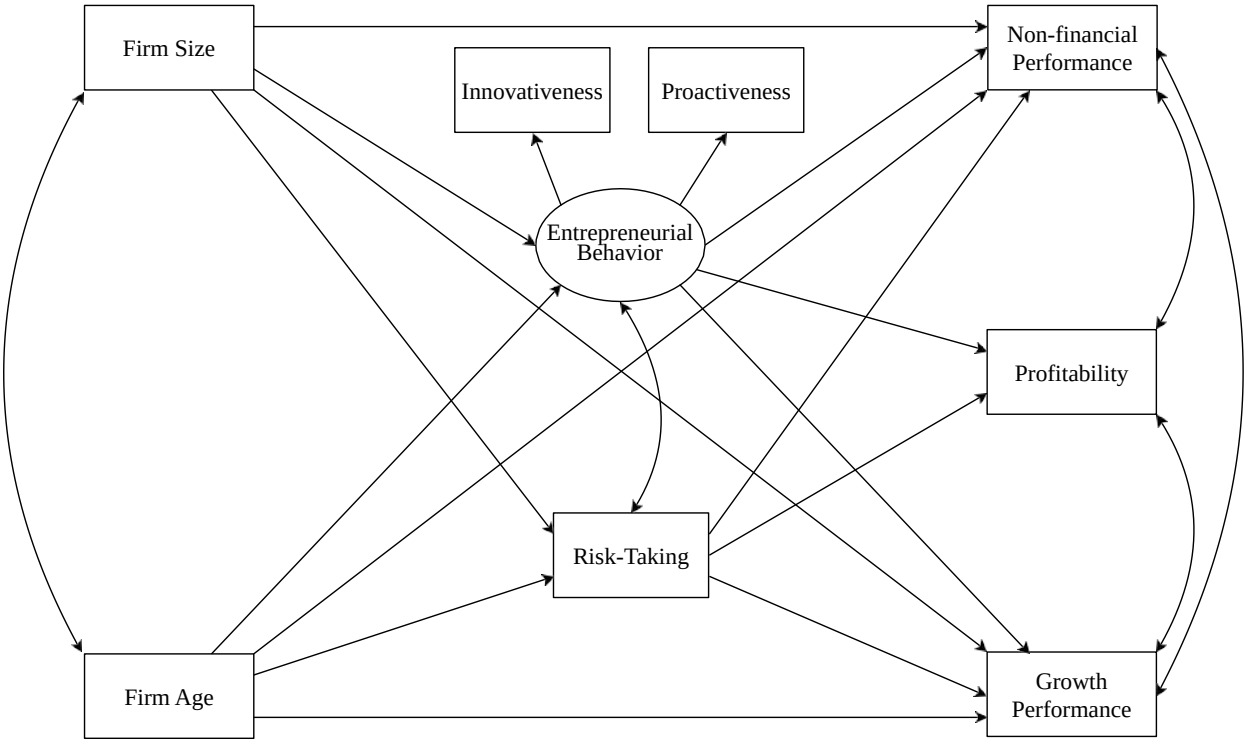


Figure 4. Attitudinal/Behavioral EO Sequential Model

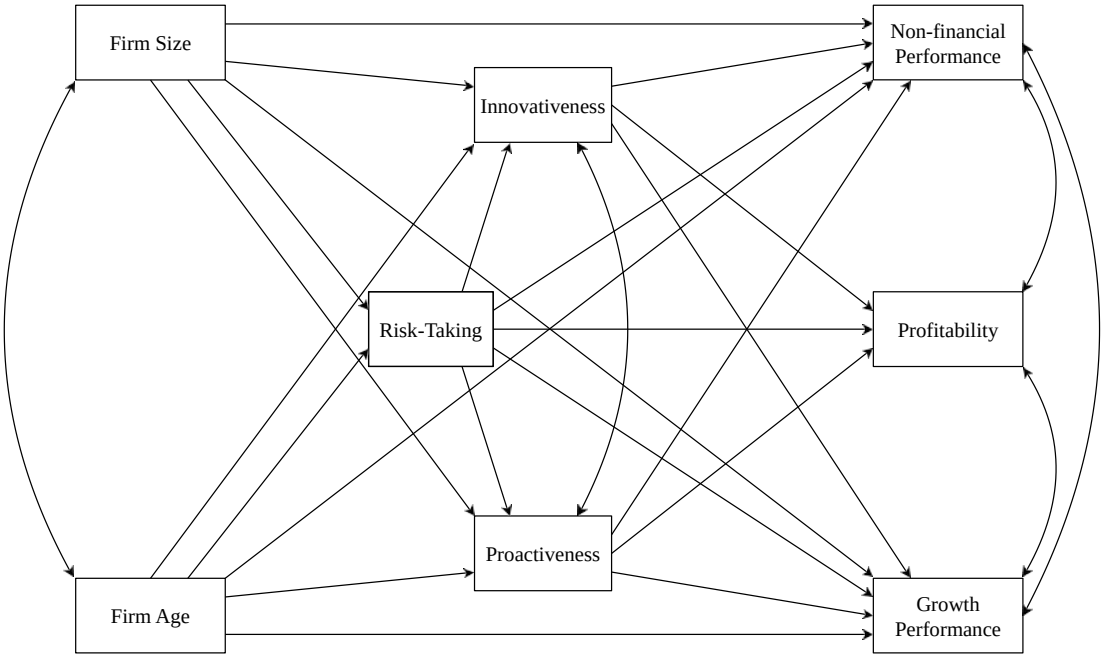


Figure 5. Number of Studies by Year of Publication

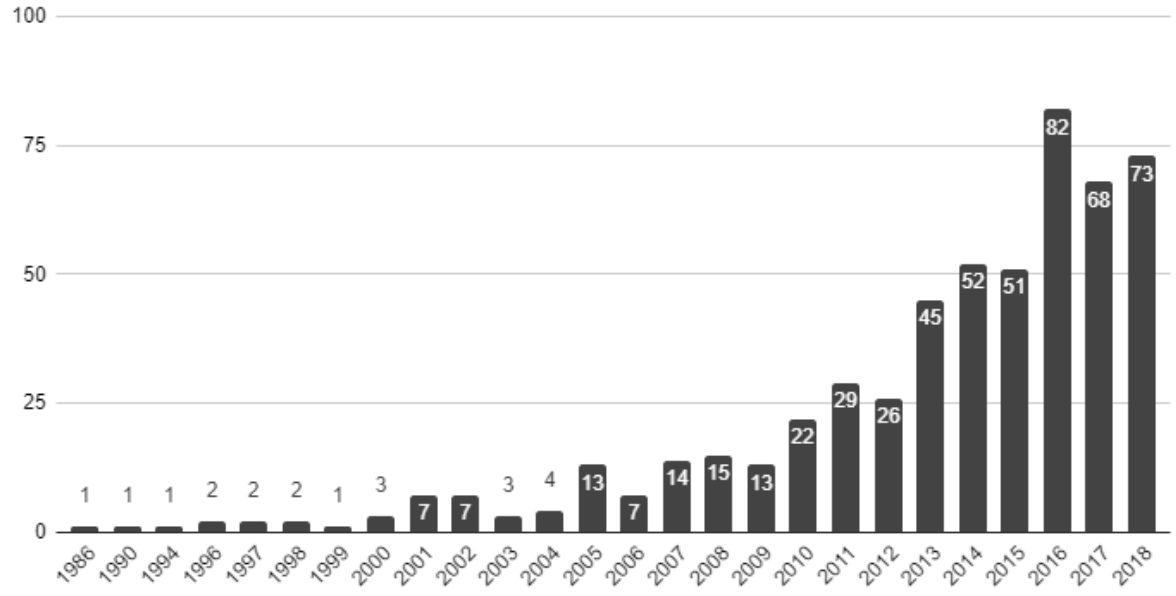


Figure 6. Significant Non-Linear Component-Level Relationships

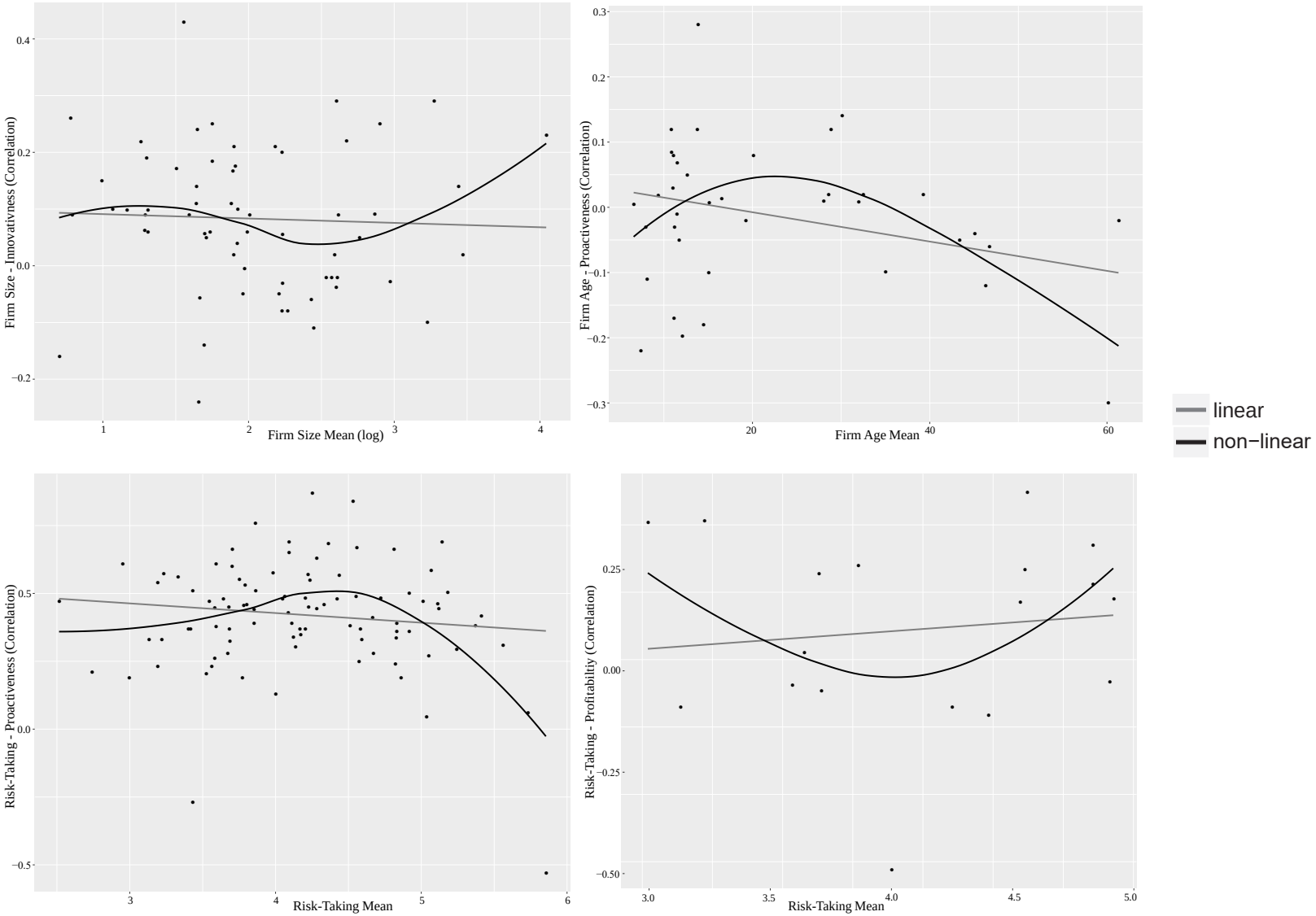


Table 1. Univariate Meta-Analysis – Pooled Correlations

Effect	k	N	Univariate									Influence Diagnostic				Trim & Fill		
			$\bar{r}$	SE	p-val	ci.lb	ci.ub	cr.lb	cr.ub	tau2	Q (df) p-val	I2	num	$\bar{r}$	r_delta	egger_p	miss	$\bar{r}$	r_delta
EO - PF	53	13,943	0.23	0.025	< 0.001	0.18	0.28	0.02	0.44	0.026	1757.35(52) < 0.001	90.58%	1	0.22	0.01	0.088	17	0.30	-0.07
EO - NP	69	18,131	0.25	0.024	< 0.001	0.21	0.30	0.01	0.50	0.035	1140.94(68) < 0.001	91.95%	0			0.304	13	0.32	-0.06
EO - GP	55	11,287	0.25	0.025	< 0.001	0.20	0.30	0.03	0.47	0.029	576.17(54) < 0.001	88.42%	0			0.001	10	0.30	-0.05
EO - MP	152	36,416	0.34	0.014	< 0.001	0.31	0.37	0.13	0.55	0.026	2882.20(151) < 0.001	90.53%	2	0.34	0.00	< 0.001	35	0.40	-0.06
IN - PR	111	31,275	0.48	0.020	< 0.001	0.44	0.52	0.22	0.73	0.039	2665.67(110) < 0.001	95.86%	1	0.49	-0.01	< 0.001	0		
IN - RT	121	32,595	0.40	0.017	< 0.001	0.37	0.44	0.17	0.63	0.032	2159.73(120) < 0.001	93.38%	1	0.41	-0.01	< 0.001	0		
IN - PF	31	8,445	0.15	0.034	< 0.001	0.08	0.21	-0.08	0.37	0.030	507.76(30) < 0.001	90.31%	1	0.13	0.02	0.133	0		
IN - NP	35	9,087	0.28	0.041	< 0.001	0.20	0.36	-0.02	0.59	0.055	1481.07(34) < 0.001	95.53%	0			0.103	5	0.34	-0.06
IN - GP	32	10,767	0.24	0.033	< 0.001	0.17	0.31	0.01	0.47	0.032	746.18(31) < 0.001	92.96%	1	0.22	0.02	0.534	5	0.29	-0.05
IN - MP	67	16,206	0.33	0.025	< 0.001	0.28	0.38	0.08	0.58	0.038	972.03(66) < 0.001	93.15%	0			< 0.001	0		
IN - FS	90	24,370	0.08	0.013	< 0.001	0.05	0.10	-0.05	0.20	0.010	290.29(89) < 0.001	72.45%	0			0.296	0		
IN - FA	66	16,866	-0.02	0.011	0.110	-0.04	0.00	-0.10	0.06	0.004	133.54(65) < 0.001	50.54%	0			0.526	0		
PR - RT	121	36,107	0.41	0.019	< 0.001	0.37	0.44	0.15	0.66	0.038	2599.17(120) < 0.001	95.15%	2	0.42	-0.01	< 0.001	0		
PR - PF	29	7,404	0.12	0.037	0.002	0.04	0.19	-0.13	0.36	0.035	334.38(28) < 0.001	90.61%	2	0.12	0.00	0.939	4	0.07	0.05
PR - NP	20	5,755	0.23	0.038	< 0.001	0.15	0.30	0.02	0.44	0.025	237.42(19) < 0.001	88.69%	0			0.028	4	0.18	0.05
PR - GP	29	9,806	0.20	0.044	< 0.001	0.12	0.29	-0.10	0.51	0.053	790.59(28) < 0.001	95.50%	1	0.23	-0.03	0.278	6	0.13	0.07
PR - MP	36	8,205	0.32	0.032	< 0.001	0.26	0.39	0.09	0.55	0.032	384.11(35) < 0.001	90.80%	0			< 0.001	7	0.38	-0.06
PR - FS	63	18,637	0.09	0.015	< 0.001	0.06	0.12	-0.03	0.21	0.009	191.06(62) < 0.001	72.18%	1	0.08	0.01	0.651	13	0.12	-0.03
PR - FA	42	11,560	-0.01	0.018	0.508	-0.05	0.02	-0.14	0.11	0.009	185.54(41) < 0.001	72.38%	1	0.00	-0.01	0.409	0		
RT - PF	29	6,790	0.09	0.038	0.017	0.02	0.17	-0.15	0.34	0.035	253.97(28) < 0.001	89.61%	1	0.11	-0.02	0.707	6	0.03	0.06
RT - NP	21	6,003	0.13	0.046	0.006	0.04	0.22	-0.14	0.39	0.040	267.25(20) < 0.001	92.39%	1	0.16	-0.03	0.885	3	0.08	0.05
RT - GP	33	10,202	0.13	0.040	< 0.001	0.05	0.21	-0.15	0.41	0.047	792.80(32) < 0.001	94.24%	1	0.16	-0.03	0.356	0		
RT - MP	40	9,091	0.18	0.035	< 0.001	0.11	0.25	-0.09	0.46	0.044	566.62(39) < 0.001	92.16%	1	0.20	-0.02	0.039	8	0.25	-0.07
RT - FS	81	21,721	0.05	0.015	< 0.001	0.03	0.08	-0.09	0.19	0.012	297.98(80) < 0.001	76.25%	2	0.07	-0.01	0.193	0		
RT - FA	54	13,352	-0.05	0.015	< 0.001	-0.08	-0.02	-0.16	0.06	0.007	162.00(53) < 0.001	63.23%	1	-0.04	-0.01	0.783	0		
FP - NP	29	9,702	0.33	0.055	< 0.001	0.22	0.43	-0.04	0.69	0.079	4008.74(28) < 0.001	98.43%	0			0.168	6	0.42	-0.09
FP - GP	20	3,540	0.39	0.060	< 0.001	0.28	0.51	0.05	0.73	0.066	439.53(19) < 0.001	96.21%	0			0.001	0		
FP - FS	50	12,924	0.06	0.022	0.010	0.01	0.10	-0.12	0.23	0.018	279.05(49) < 0.001	82.55%	0			0.160	7	0.09	-0.03
FP - FA	39	12,675	0.01	0.020	0.735	-0.03	0.05	-0.13	0.14	0.011	161.94(38) < 0.001	77.65%	2	-0.01	0.02	0.243	0		
NP - GP	14	2,648	0.30	0.070	< 0.001	0.16	0.44	-0.03	0.64	0.063	346.08(13) < 0.001	95.43%	0			0.009	0		
NP - FS	43	11,407	0.22	0.045	< 0.001	0.13	0.31	-0.15	0.59	0.082	3886.10(42) < 0.001	98.13%	0			< 0.001	6	0.27	-0.05
NP - FA	39	11,897	0.19	0.028	< 0.001	0.13	0.25	-0.02	0.40	0.027	377.19(38) < 0.001	90.11%	0			0.048	8	0.24	-0.05
GP - FS	46	11,081	0.06	0.026	0.025	0.01	0.11	-0.15	0.27	0.027	332.47(45) < 0.001	86.95%	0			0.139	0		
GP - FA	43	7,898	-0.08	0.025	< 0.001	-0.13	-0.03	-0.27	0.11	0.021	223.00(42) < 0.001	80.53%	1	-0.07	-0.01	0.753	0		
FS - FA	256	70,543	0.20	0.012	< 0.001	0.18	0.23	-0.04	0.44	0.035	4065.36(255) < 0.001	92.25%	2	0.20	0.00	< 0.001	44	0.26	-0.05

Notes: EO = entrepreneurial orientation; IN = innovativeness; PR = proactiveness; RT = risk-taking; PF = profitability; GP = growth performance; NP = non-financial performance; MP = mixed performance; FS = firm size; FA = firm age; k = number of independent samples; N = total sample size; $\bar{r}$ = inverse variance weighted mean correlation; SE = standard error; p-val = p-value; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; cr.lb = 80% credibility interval lower bound; cr.ub = 80% credibility interval upper bound; tau2 = estimated between-study heterogeneity; Q = Q statistic; I2 = proportion of total variation due to between-study heterogeneity; num = number of influential studies; r_delta = discrepancy with univariate $\bar{r}$; egger = p-value of the Egger's test; miss = number of mirrored studies.

Table 2. Aggregate EO Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.41	< 0.001
Firm Size → Entrepreneurial Orientation	0.13	0.012	0.10	0.15	10.35	< 0.001
Firm Age → Entrepreneurial Orientation	-0.06	0.013	-0.09	-0.04	-4.71	< 0.001
Firm Size → Growth Performance	0.04	0.028	-0.01	0.10	1.49	0.136
Firm Age → Growth Performance	-0.08	0.026	-0.13	-0.03	-3.01	0.003
Firm Size → Non-financial Performance	0.14	0.046	0.05	0.23	3.03	0.003
Firm Age → Non-financial Performance	0.17	0.030	0.11	0.23	5.66	< 0.001
Entrepreneurial Orientation → Innovativeness	0.70	0.024	0.65	0.75	29.27	< 0.001
Entrepreneurial Orientation → Proactiveness	0.69	0.024	0.64	0.74	29.06	< 0.001
Entrepreneurial Orientation → Risk-Taking	0.57	0.020	0.53	0.61	28.47	< 0.001
Entrepreneurial Orientation → Profitability	0.19	0.030	0.13	0.25	6.24	< 0.001
Entrepreneurial Orientation → Growth Performance	0.29	0.034	0.23	0.36	8.63	< 0.001
Entrepreneurial Orientation → Non-financial Performance	0.32	0.038	0.25	0.40	8.53	< 0.001
Profitability ↔ Growth Performance	0.33	0.061	0.21	0.45	5.42	< 0.001
Profitability ↔ Non-financial Performance	0.26	0.056	0.15	0.37	4.65	< 0.001
Non-financial Performance ↔ Growth Performance	0.21	0.072	0.07	0.35	2.89	0.004
Indirect Effects						
Firm Size → Entrepreneurial Orientation → Profitability	0.02		0.02	0.03		
Firm Size → Entrepreneurial Orientation → Non-financial Performance	0.04		0.03	0.05		
Firm Size → Entrepreneurial Orientation → Growth Performance	0.04		0.03	0.05		
Firm Age → Entrepreneurial Orientation → Profitability	-0.01		-0.02	-0.01		
Firm Age → Entrepreneurial Orientation → Non-financial Performance	-0.02		-0.03	-0.01		
Firm Age → Entrepreneurial Orientation → Growth Performance	-0.02		-0.03	-0.01		
Total Effects						
Firm Size → Non-financial Performance	0.18		0.09	0.27		
Firm Size → Growth Performance	0.08		0.03	0.13		
Firm Age → Non-financial Performance	0.15		0.09	0.21		
Firm Age → Growth Performance	-0.10		-0.14	-0.05		
Model fit: χ^2 (12) = 15.37, p = 0.221; RMSEA = 0.001; SRMR = 0.020; TLI = 0.99; CFI = 0.99						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 3. Independent Component-Level EO Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.41	< 0.001
Firm Size → Innovativeness	0.09	0.013	0.06	0.11	6.79	< 0.001
Firm Age → Innovativeness	-0.03	0.012	-0.06	-0.01	-2.89	0.004
Firm Size → Proactiveness	0.09	0.014	0.07	0.12	6.63	< 0.001
Firm Age → Proactiveness	-0.03	0.018	-0.06	0.01	-1.57	0.117
Firm Size → Risk-Taking	0.07	0.014	0.04	0.10	4.83	< 0.001
Firm Age → Risk-Taking	-0.06	0.015	-0.09	-0.03	-4.24	< 0.001
Firm Size → Growth Performance	0.05	0.027	0.00	0.11	1.93	0.054
Firm Age → Growth Performance	-0.09	0.026	-0.14	-0.04	-3.34	0.001
Firm Size → Non-financial Performance	0.15	0.045	0.06	0.24	3.32	0.001
Firm Age → Non-financial Performance	0.16	0.030	0.10	0.22	5.36	< 0.001
Innovativeness ↔ Proactiveness	0.46	0.020	0.43	0.50	23.66	< 0.001
Innovativeness ↔ Risk-Taking	0.39	0.017	0.36	0.42	22.79	< 0.001
Proactiveness ↔ Risk-Taking	0.39	0.018	0.36	0.43	21.68	< 0.001
Innovativeness → Profitability	0.11	0.049	0.01	0.21	2.24	0.025
Proactiveness → Profitability	0.06	0.053	-0.04	0.17	1.14	0.254
Risk-Taking → Profitability	0.02	0.049	-0.07	0.12	0.46	0.644
Innovativeness → Growth Performance	0.17	0.051	0.07	0.27	3.37	0.001
Proactiveness → Growth Performance	0.11	0.064	-0.02	0.23	1.72	0.085
Risk-Taking → Growth Performance	0.01	0.052	-0.09	0.12	0.24	0.811
Innovativeness → Non-financial Performance	0.22	0.061	0.10	0.34	3.56	< 0.001
Proactiveness → Non-financial Performance	0.11	0.059	-0.01	0.23	1.88	0.060
Risk-Taking → Non-financial Performance	-0.01	0.060	-0.13	0.11	-0.11	0.916
Profitability ↔ Growth Performance	0.35	0.060	0.23	0.46	5.72	< 0.001
Non-financial Performance ↔ Growth Performance	0.23	0.071	0.09	0.37	3.23	0.001
Profitability ↔ Non-financial Performance	0.27	0.055	0.17	0.38	4.97	< 0.001
Indirect Effects						
Firm Size → Innovativeness → Profitability	0.01		0.00	0.02		
Firm Size → Proactiveness → Profitability	0.01		0.00	0.02		
Firm Size → Risk-Taking → Profitability	0.00		-0.01	0.01		
Firm Size → Innovativeness → Non-financial Performance	0.02		0.01	0.03		
Firm Size → Proactiveness → Non-financial Performance	0.01		0.00	0.02		
Firm Size → Risk-Taking → Non-financial Performance	0.00		-0.01	0.01		
Firm Size → Innovativeness → Growth Performance	0.02		0.01	0.03		
Firm Size → Proactiveness → Growth Performance	0.01		0.00	0.02		
Firm Size → Risk-Taking → Growth Performance	0.00		-0.01	0.01		
Firm Age → Innovativeness → Profitability	0.00		-0.01	0.00		
Firm Age → Proactiveness → Profitability	0.00		-0.01	0.00		
Firm Age → Risk-Taking → Profitability	0.00		-0.01	0.01		
Firm Age → Innovativeness → Non-financial Performance	-0.01		-0.02	0.00		
Firm Age → Proactiveness → Non-financial Performance	0.00		-0.01	0.00		
Firm Age → Risk-Taking → Non-financial Performance	0.00		-0.01	0.01		
Firm Age → Innovativeness → Growth Performance	-0.01		-0.01	0.00		
Firm Age → Proactiveness → Growth Performance	0.00		-0.01	0.00		
Firm Age → Risk-Taking → Growth Performance	0.00		-0.01	0.01		
Total Effects						
Firm Size → Profitability	0.02		0.01	0.02		
Firm Size → Non-financial Performance	0.18		0.09	0.27		
Firm Size → Growth Performance	0.08		0.03	0.13		
Firm Age → Profitability	-0.01		-0.01	0.00		
Firm Age → Non-financial Performance	0.15		0.09	0.21		
Firm Age → Growth Performance	-0.10		-0.14	-0.05		
Model fit: χ^2 (2) = 3.94, p = 0.139; RMSEA = 0.002; SRMR = 0.008; TLI = 0.98; CFI = 0.99						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index;
→ = directional path; ↔ = correlation.

Table 4. Attitudinal/Behavioral EO Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.41	< 0.001
Firm Size → Entrepreneurial Behavior	0.13	0.014	0.10	0.16	9.35	< 0.001
Firm Age → Entrepreneurial Behavior	-0.05	0.015	-0.08	-0.02	-3.28	0.001
Firm Size → Risk-Taking	0.07	0.014	0.04	0.09	4.77	< 0.001
Firm Age → Risk-Taking	-0.06	0.015	-0.09	-0.03	-4.25	< 0.001
Firm Size → Growth Performance	0.04	0.028	-0.02	0.09	1.28	0.200
Firm Age → Growth Performance	-0.08	0.026	-0.13	-0.03	-3.21	0.001
Firm Size → Non-financial Performance	0.13	0.046	0.04	0.22	2.87	0.004
Firm Age → Non-financial Performance	0.16	0.030	0.10	0.22	5.36	< 0.001
Entrepreneurial Behavior → Innovativeness	0.69	0.024	0.64	0.74	28.94	< 0.001
Entrepreneurial Behavior → Proactiveness	0.68	0.024	0.64	0.73	28.98	< 0.001
Entrepreneurial Behavior ↔ Risk-Taking	0.57	0.022	0.53	0.61	26.24	< 0.001
Entrepreneurial Behavior → Profitability	0.23	0.061	0.11	0.35	3.76	< 0.001
Risk-Taking → Profitability	-0.05	0.063	-0.17	0.08	-0.73	0.467
Entrepreneurial Behavior → Growth Performance	0.37	0.069	0.24	0.51	5.37	< 0.001
Risk-Taking → Growth Performance	-0.09	0.069	-0.23	0.04	-1.30	0.195
Entrepreneurial Behavior → Non-financial Performance	0.42	0.076	0.27	0.57	5.49	< 0.001
Risk-Taking → Non-financial Performance	-0.12	0.078	-0.27	0.04	-1.48	0.140
Profitability ↔ Growth Performance	0.32	0.062	0.20	0.44	5.14	< 0.001
Non-financial Performance ↔ Growth Performance	0.18	0.074	0.04	0.33	2.48	0.013
Profitability ↔ Non-financial Performance	0.24	0.057	0.13	0.36	4.25	< 0.001
Indirect Effects						
Firm Size → Entrepreneurial Behavior → Profitability	0.03		0.01	0.05		
Firm Size → Risk-Taking → Profitabiltiy	0.00		-0.01	0.01		
Firm Size → Entrepreneurial Behavior → Non-financial Performance	0.05		0.03	0.08		
Firm Size → Risk-Taking → Non-financial Performance	-0.01		-0.02	0.00		
Firm Size → Entrepreneurial Behavior → Growth Performance	0.05		0.03	0.07		
Firm Size → Risk-Taking → Growth Performance	-0.01		-0.02	0.00		
Firm Age → Entrepreneurial Behavior → Profitability	-0.01		-0.02	0.00		
Firm Age → Risk-Taking → Profitability	0.00		-0.01	0.01		
Firm Age → Entrepreneurial Behavior → Non-financial Performance	-0.02		-0.04	-0.01		
Firm Age → Risk-Taking → Non-financial Performance	0.01		0.00	0.02		
Firm Age → Entrepreneurial Behavior → Growth Performance	-0.02		-0.03	-0.01		
Firm Age → Risk-Taking → Growth Performance	0.01		0.00	0.02		
Total Effects						
Firm Size → Profitability	0.03		0.02	0.04		
Firm Size → Non-financial Performance	0.18		0.09	0.27		
Firm Size → Growth Performance	0.08		0.03	0.14		
Firm Age → Profitability	-0.01		-0.03	0.00		
Firm Age → Non-financial Performance	0.14		0.07	0.20		
Firm Age → Growth Performance	-0.11		-0.16	-0.06		
Model fit: χ^2 (7) = 4.406, p = 0.732; RMSEA = 0.000; SRMR = 0.011; TLI = 1.00; CFI = 1.00						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 5. Attitudinal/Behavioral EO Sequential Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.41	< 0.001
Firm Size → Innovativeness	0.06	0.014	0.03	0.09	4.31	< 0.001
Firm Age → Innovativeness	-0.01	0.013	-0.04	0.02	-0.71	0.481
Firm Size → Proactiveness	0.07	0.015	0.04	0.09	4.37	< 0.001
Firm Age → Proactiveness	0.00	0.019	-0.04	0.03	-0.18	0.855
Firm Size → Risk-Taking	0.07	0.014	0.04	0.10	4.83	< 0.001
Firm Age → Risk-Taking	-0.06	0.015	-0.09	-0.03	-4.24	< 0.001
Firm Size → Growth Performance	0.05	0.027	0.00	0.11	1.93	0.054
Firm Age → Growth Performance	-0.09	0.026	-0.14	-0.04	-3.34	0.001
Firm Size → Non-financial Performance	0.15	0.045	0.06	0.24	3.32	0.001
Firm Age → Non-financial Performance	0.16	0.030	0.10	0.22	5.36	< 0.001
Risk-Taking → Innovativeness	0.39	0.017	0.36	0.42	22.84	< 0.001
Risk-Taking → Proactiveness	0.40	0.018	0.36	0.43	21.72	< 0.001
Innovativeness ↔ Proactiveness	0.31	0.022	0.27	0.35	14.28	< 0.001
Innovativeness → Profitability	0.11	0.049	0.01	0.21	2.24	0.025
Innovativeness → Growth Performance	0.17	0.051	0.07	0.27	3.37	0.001
Innovativeness → Non-financial Performance	0.22	0.061	0.10	0.34	3.56	< 0.001
Proactiveness → Profitability	0.06	0.053	-0.04	0.17	1.14	0.254
Proactiveness → Growth Performance	0.11	0.064	-0.02	0.23	1.72	0.085
Proactiveness → Non-financial Performance	0.11	0.059	-0.01	0.23	1.88	0.060
Risk-Taking → Profitability	0.02	0.049	-0.07	0.12	0.46	0.644
Risk-Taking → Growth Performance	0.01	0.052	-0.09	0.12	0.24	0.811
Risk-Taking → Non-financial Performance	-0.01	0.060	-0.13	0.11	-0.11	0.916
Profitability ↔ Growth Performance	0.35	0.060	0.23	0.46	5.72	< 0.001
Non-financial Performance ↔ Growth Performance	0.23	0.071	0.09	0.37	3.23	0.001
Profitability ↔ Non-financial Performance	0.27	0.055	0.17	0.38	4.97	< 0.001
Indirect Effects						
Firm Size → Risk-Taking → Innovativeness	0.03		0.02	0.04		
Firm Size → Risk-Taking → Proactiveness	0.03		0.02	0.04		
Firm Size → Innovativeness → Profitability	0.01		0.00	0.01		
Firm Size → Proactiveness → Profitability	0.00		0.00	0.01		
Firm Size → Risk-Taking → Profitability	0.00		-0.01	0.01		
Firm Size → Risk-Taking → Innovativeness → Profitability	0.00		0.00	0.01		
Firm Size → Risk-Taking → Proactiveness → Profitability	0.00		0.00	0.01		
Firm Size → Innovativeness → Non-financial Performance	0.01		0.01	0.02		
Firm Size → Proactiveness → Non-financial Performance	0.01		0.00	0.02		
Firm Size → Risk-Taking → Non-financial Performance	0.00		-0.01	0.01		
Firm Size → Risk-Taking → Innovativeness → Non-financial Performance	0.01		0.00	0.01		
Firm Size → Risk-Taking → Proactiveness → Non-financial Performance	0.00		0.00	0.01		
Firm Size → Innovativeness → Growth Performance	0.01		0.00	0.02		
Firm Size → Proactiveness → Growth Performance	0.01		0.00	0.02		
Firm Size → Risk-Taking → Growth Performance	0.00		-0.01	0.01		
Firm Size → Risk-Taking → Innovativeness → Growth Performance	0.01		0.00	0.01		
Firm Size → Risk-Taking → Proactiveness → Growth Performance	0.00		0.00	0.01		
Firm Age → Risk-Taking → Innovativeness	-0.03		-0.04	-0.01		
Firm Age → Risk-Taking → Proactiveness	-0.03		-0.04	-0.01		
Firm Age → Innovativeness → Profitability	0.00		-0.01	0.00		
Firm Age → Proactiveness → Profitability	0.00		0.00	0.00		
Firm Age → Risk-Taking → Profitability	0.00		-0.01	0.01		
Firm Age → Risk-Taking → Innovativeness → Profitability	0.00		-0.01	0.00		
Firm Age → Risk-Taking → Proactiveness → Profitability	0.00		-0.01	0.00		
Firm Age → Innovativeness → Non-financial Performance	0.00		-0.01	0.00		
Firm Age → Proactiveness → Non-financial Performance	0.00		-0.01	0.01		
Firm Age → Risk-Taking → Non-financial Performance	0.00		-0.01	0.01		
Firm Age → Risk-Taking → Innovativeness → Non-financial Performance	-0.01		-0.01	0.00		
Firm Age → Risk-Taking → Proactiveness → Non-financial Performance	0.00		-0.01	0.00		
Firm Age → Innovativeness → Growth Performance	0.00		-0.01	0.00		
Firm Age → Proactiveness → Growth Performance	0.00		-0.01	0.01		
Firm Age → Risk-Taking → Growth Performance	0.00		-0.01	0.01		
Firm Age → Risk-Taking → Innovativeness → Growth Performance	0.00		-0.01	0.00		
Firm Age → Risk-Taking → Proactiveness → Growth Performance	0.00		-0.01	0.00		

Risk-Taking → Innovativeness → Profitability	0.04	0.01	0.08
Risk-Taking → Proactiveness → Profitability	0.02	-0.02	0.07
Risk-Taking → Innovativeness → Non-financial Performance	0.09	0.04	0.13
Risk-Taking → Proactiveness → Non-financial Performance	0.04	0.00	0.09
Risk-Taking → Innovativeness → Growth Performance	0.07	0.03	0.11
Risk-Taking → Proactiveness → Growth Performance	0.04	-0.01	0.09
Total Effects			
Firm Size → Profitability	0.02	0.01	0.02
Firm Size → Non-financial Performance	0.18	0.09	0.27
Firm Size → Growth Performance	0.08	0.03	0.13
Firm Age → Profitability	-0.01	-0.01	0.00
Firm Age → Non-financial Performance	0.15	0.09	0.21
Firm Age → Growth Performance	-0.10	-0.14	-0.05
Risk-Taking → Profitability	0.09	0.02	0.16
Risk-Taking → Non-financial Performance	0.12	0.03	0.21
Risk-Taking → Growth Performance	0.12	0.05	0.20
Model fit: χ^2 (2) = 3.94, p = 0.139; RMSEA = 0.002; SRMR = 0.008; TLI = 0.98; CFI = 0.99			

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

ONLINE SUPPLEMENT A

Equality Constraints

Table 1. Component-level models equality constraint results

Constraint	χ^2- Difference p-value	
	Independent component-level model	**Attitudinal/behavior EO sequential model**
Firm Size vs. Firm Age on		
Innovativeness	< 0.001	0.002
Proactiveness	< 0.001	0.015
Risk-Taking	< 0.001	< 0.001
Non-Financial Performance	0.872	0.872
Growth Performance	0.001	0.001
Firm Size on		
Innovativeness vs. Proactiveness	0.740	0.755
Innovativeness vs. Risk-Taking	0.343	0.699
Proactiveness vs. Risk-Taking	0.219	0.896
Non-financial Performance vs. Growth Performance	0.064	0.064
Firm Age on		
Innovativeness vs. Proactiveness	0.799	0.790
Innovativeness vs. Risk-Taking	0.114	0.021
Proactiveness vs. Risk-Taking	0.131	0.027
Non-financial Performance vs. Growth Performance	< 0.001	< 0.001
Innovativeness vs. Proactiveness on		
Profitability	0.584	0.584
Non-financial Performance	0.312	0.312
Growth Performance	0.532	0.532
Innovativeness vs. Risk-Taking on		
Profitability	0.273	0.273
Non-financial Performance	0.025	0.025
Growth Performance	0.053	0.053
Proactiveness vs. Risk-Taking on		
Profitability	0.652	0.652
Non-financial Performance	0.233	0.233
Growth Performance	0.320	0.320
Innovativeness on		
Profitability vs. Non-financial Performance	0.172	0.172
Profitability vs. Growth Performance	0.380	0.380
Non-financial Performance vs. Growth Performance	0.575	0.575
Proactiveness on		
Profitability vs. Non-financial Performance	0.527	0.527
Profitability vs. Growth Performance	0.559	0.559
Non-financial Performance vs. Growth Performance	0.981	0.981
Risk-Taking on		
Innovativeness vs. Proactiveness	-	0.850
Profitability vs. Non-financial Performance	0.708	0.708
Profitability vs. Growth Performance	0.887	0.887
Non-financial Performance vs. Growth Performance	0.812	0.812

Notes: A significant χ^2-Difference indicates that constraining the two compared effect sizes to be equal leads to a significant decline in model fit compared to a model without this constraint. A significant p-value therefore indicates that the compared effect sized are significantly different from each other.

ONLINE SUPPLEMENT B

Viswesvaran & Ones (1995) Approach Results

To perform a Viswesvaran & Ones (1995) type MASEM, we draw on the "uniR1" and "uniR2" functions implemented within the "metaSEM" package of Cheung (2005). The former function pools a meta-analytic correlation matrix and calculates the harmonic sample size (in our case 9,596) and the second one draws on this data, treats the correlation matrix as covariance matrix and fits a structural equation model.

Table 1. Aggregate EO Model

	B	SE	ci.lb	ci.ub	t-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.22	0.009	0.20	0.24	23.49	< 0.001
Firm Size → Entrepreneurial Orientation	0.10	0.009	0.08	0.11	11.01	< 0.001
Firm Age → Entrepreneurial Orientation	-0.05	0.009	-0.07	-0.03	-5.72	< 0.001
Firm Size → Growth Performance	0.04	0.010	0.02	0.06	3.87	< 0.001
Firm Age → Growth Performance	-0.07	0.009	-0.09	-0.05	-7.26	< 0.001
Firm Size → Non-financial Performance	0.19	0.010	0.17	0.21	19.76	< 0.001
Firm Age → Non-financial Performance	0.16	0.010	0.14	0.18	16.63	< 0.001
Entrepreneurial Orientation → Innovativeness	1.00	0.000	1.00	1.00		
Entrepreneurial Orientation → Proactiveness	0.98	0.026	0.93	1.03	38.20	< 0.001
Entrepreneurial Orientation → Risk-Taking	0.82	0.022	0.78	0.87	37.29	< 0.001
Entrepreneurial Orientation → Profitability	0.25	0.018	0.21	0.28	13.48	< 0.001
Entrepreneurial Orientation → Growth Performance	0.35	0.019	0.32	0.39	18.72	< 0.001
Entrepreneurial Orientation → Non-financial Performance	0.33	0.018	0.29	0.37	18.22	< 0.001
Profitability ↔ Growth Performance	0.37	0.011	0.35	0.39	34.94	< 0.001
Profitability ↔ Non-financial Performance	0.21	0.010	0.19	0.23	21.07	< 0.001
Non-financial Performance ↔ Growth Performance	0.28	0.010	0.26	0.30	28.57	< 0.001
Model fit: χ^2 (12) = 157.19, p < 0.001. RMSEA = 0.032; SRMR = 0.017; TLI = 0.97; CFI = 0.98						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; RMR = root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 2. Independent Component-Level EO Model

	B	SE	ci.lb	ci.ub	t-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.22	0.010	0.20	0.24	21.27	< 0.001
Firm Size → Innovativeness	0.09	0.010	0.07	0.11	8.46	< 0.001
Firm Age → Innovativeness	-0.03	0.010	-0.05	-0.01	-3.03	0.002
Firm Size → Proactiveness	0.10	0.010	0.08	0.12	9.20	< 0.001
Firm Age → Proactiveness	-0.04	0.010	-0.06	-0.02	-3.79	< 0.001
Firm Size → Risk-Taking	0.08	0.010	0.06	0.10	7.42	< 0.001
Firm Age → Risk-Taking	-0.08	0.010	-0.10	-0.06	-7.55	< 0.001
Firm Size → Growth Performance	0.05	0.009	0.03	0.06	4.80	< 0.001
Firm Age → Growth Performance	-0.07	0.009	-0.09	-0.06	-8.00	< 0.001
Firm Size → Non-financial Performance	0.20	0.010	0.18	0.22	21.02	< 0.001
Firm Age → Non-financial Performance	0.15	0.010	0.13	0.17	16.02	< 0.001
Innovativeness ↔ Proactiveness	0.44	0.011	0.42	0.46	39.84	< 0.001
Innovativeness ↔ Risk-Taking	0.36	0.011	0.34	0.39	33.82	< 0.001
Proactiveness ↔ Risk-Taking	0.38	0.011	0.36	0.41	35.47	< 0.001
Innovativeness → Profitability	0.09	0.012	0.07	0.11	7.82	< 0.001
Proactiveness → Profitability	0.04	0.012	0.01	0.06	2.98	0.003
Risk-Taking → Profitability	0.05	0.011	0.03	0.07	4.41	< 0.001
Innovativeness → Growth Performance	0.16	0.011	0.14	0.19	14.29	< 0.001
Proactiveness → Growth Performance	0.06	0.012	0.03	0.08	4.97	< 0.001
Risk-Taking → Growth Performance	0.02	0.011	0.00	0.04	2.05	0.041
Innovativeness → Non-financial Performance	0.18	0.011	0.16	0.20	16.34	< 0.001
Proactiveness → Non-financial Performance	0.03	0.011	0.01	0.05	2.74	0.006
Risk-Taking → Non-financial Performance	0.02	0.011	0.00	0.04	1.61	0.108
Profitability ↔ Growth Performance	0.39	0.011	0.37	0.41	36.43	< 0.001
Non-financial Performance ↔ Growth Performance	0.30	0.010	0.28	0.31	30.31	< 0.001
Profitability ↔ Non-financial Performance	0.22	0.010	0.20	0.24	22.40	< 0.001
Model fit: χ^2 (2) = 24.142, p < 0.001; RMSEA = 0.033; SRMR = 0.008; TLI = 0.968; CFI = 0.99						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; RMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 3. Attitudinal/Behavioral EO Model

	B	SE	ci.lb	ci.ub	t-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.22	0.010	0.20	0.24	21.27	< 0.001
Firm Size → Entrepreneurial Behavior	0.10	0.009	0.08	0.11	10.65	< 0.001
Firm Age → Entrepreneurial Behavior	-0.04	0.009	-0.05	-0.02	-4.09	< 0.001
Firm Size → Risk-Taking	0.08	0.010	0.06	0.10	7.42	< 0.001
Firm Age → Risk-Taking	-0.08	0.010	-0.10	-0.06	-7.55	< 0.001
Firm Size → Growth Performance	0.03	0.010	0.02	0.05	3.57	< 0.001
Firm Age → Growth Performance	-0.07	0.009	-0.09	-0.06	-7.78	< 0.001
Firm Size → Non-financial Performance	0.19	0.010	0.17	0.21	19.32	< 0.001
Firm Age → Non-financial Performance	0.15	0.010	0.14	0.17	15.98	< 0.001
Entrepreneurial Behavior → Innovativeness	1	0	1	1		
Entrepreneurial Behavior → Proactiveness	0.97	0.025	0.92	1.01	39.04	< 0.001
Entrepreneurial Behavior ↔ Risk-Taking	0.38	0.011	0.36	0.40	35.88	< 0.001
Entrepreneurial Behavior → Profitability	0.25	0.025	0.20	0.30	9.71	< 0.001
Risk-Taking → Profitability	0.00	0.014	-0.03	0.03	0.12	0.906
Entrepreneurial Behavior → Growth Performance	0.42	0.027	0.37	0.48	16.00	< 0.001
Risk-Taking → Growth Performance	-0.06	0.014	-0.09	-0.03	-4.08	< 0.001
Entrepreneurial Behavior → Non-financial Performance	0.41	0.026	0.36	0.46	15.87	< 0.001
Risk-Taking → Non-financial Performance	-0.06	0.014	-0.09	-0.03	-4.44	< 0.001
Profitability ↔ Growth Performance	0.37	0.011	0.35	0.39	34.32	< 0.001
Non-financial Performance ↔ Growth Performance	0.27	0.010	0.25	0.29	27.02	< 0.001
Profitability ↔ Non-financial Performance	0.20	0.010	0.18	0.22	20.58	< 0.001
Model fit: χ^2 (7) = 97.547, p < 0.001. RMSEA = 0.036; SRMR = 0.014; TLI = 0.96; CFI = 0.99						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; RMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 4. Attitudinal/Behavior EO Sequential Model

	B	SE	ci.lb	ci.ub	t-value	p-value
Direct Effects						
Firm Size ↔ Firm Age	0.22	0.010	0.20	0.24	21.27	< 0.001
Firm Size → Innovativeness	0.06	0.010	0.04	0.08	6.14	< 0.001
Firm Age → Innovativeness	0.00	0.010	-0.02	0.02	-0.27	0.785
Firm Size → Proactiveness	0.07	0.010	0.05	0.08	6.84	< 0.001
Firm Age → Proactiveness	-0.01	0.010	-0.03	0.01	-0.93	0.352
Firm Size → Risk-Taking	0.08	0.010	0.06	0.10	7.42	< 0.001
Firm Age → Risk-Taking	-0.08	0.010	-0.10	-0.06	-7.55	< 0.001
Firm Size → Growth Performance	0.05	0.009	0.03	0.06	4.80	< 0.001
Firm Age → Growth Performance	-0.07	0.009	-0.09	-0.06	-8.00	< 0.001
Firm Size → Non-financial Performance	0.20	0.010	0.18	0.22	21.02	< 0.001
Firm Age → Non-financial Performance	0.15	0.010	0.13	0.17	16.02	< 0.001
Risk-Taking → Innovativeness	0.37	0.010	0.35	0.39	38.75	< 0.001
Risk-Taking → Proactiveness	0.39	0.009	0.37	0.41	41.29	< 0.001
Innovativeness ↔ Proactiveness	0.30	0.009	0.28	0.32	32.60	< 0.001
Innovativeness → Profitability	0.09	0.012	0.07	0.11	7.82	< 0.001
Innovativeness → Growth Performance	0.16	0.011	0.14	0.19	14.29	< 0.001
Innovativeness → Non-financial Performance	0.18	0.011	0.16	0.20	16.34	< 0.001
Proactiveness → Profitability	0.04	0.012	0.01	0.06	2.98	0.003
Proactiveness → Growth Performance	0.06	0.012	0.03	0.08	4.97	< 0.001
Proactiveness → Non-financial Performance	0.03	0.011	0.01	0.05	2.74	0.006
Risk-Taking → Profitability	0.05	0.011	0.03	0.07	4.41	< 0.001
Risk-Taking → Growth Performance	0.02	0.011	0.00	0.04	2.05	0.041
Risk-Taking → Non-financial Performance	0.02	0.011	0.00	0.04	1.61	0.108
Profitability ↔ Growth Performance	0.39	0.011	0.37	0.41	36.43	< 0.001
Non-financial Performance ↔ Growth Performance	0.30	0.010	0.28	0.31	30.31	< 0.001
Profitability ↔ Non-financial Performance	0.22	0.010	0.20	0.24	22.40	< 0.001
Model fit: χ^2 (2) = 24.142, p < 0.001; RMSEA = 0.033; SRMR = 0.008; TLI = 0.96; CFI = 0.99						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

ONLINE SUPPLEMENT C

Meta-Regression Results

Table 1. Meta-Regression Robustness Checks

Effect	Moderator	k	N	B	SE	p-val	ci.lb	ci.ub	tau2	I2
RT - IN	Industry Dummy 0 = Manufacturing 1 = Service	53	11,860	0.03	0.051	0.52	-0.07	0.14	0.021	88.02%
RT - PR		52	11,706	-0.06	0.058	0.29	-0.18	0.05	0.027	92.38%
IN - PF		18	4,374	-0.02	0.081	0.81	-0.19	0.15	0.014	78.09%
PR - PF		15	3,377	0.10	0.087	0.29	-0.09	0.29	0.014	75.91%
RT - PF		18	3,248	0.03	0.087	0.78	-0.16	0.21	0.017	76.01%
IN - NP		16	3,807	0.04	0.106	0.69	-0.19	0.27	0.028	90.28%
PR - NP		10	2,327	-0.01	0.065	0.90	-0.16	0.15	0.001	22.23%
RT - NP		12	2,526	-0.20	0.096	0.07	-0.41	0.02	0.006	60.19%
IN - GP		12	2,659	0.14	0.103	0.20	-0.09	0.37	0.012	75.90%
PR - GP		9	2,098	0.23	0.149	0.18	-0.14	0.59	0.015	80.68%
RT - GP		13	2,717	0.20	0.117	0.11	-0.06	0.47	0.017	80.64%
RT - IN	Environmental Hostility	14	2,763	0.11	0.033	0.01	0.03	0.18	0.003	51.40%
RT - PR		13	2,577	0.11	0.091	0.25	-0.09	0.31	0.034	95.45%
IN - PF		4	989	-0.37	0.107	0.07	-0.83	0.09	0.000	0.00%
PR - PF		7	1,430	-0.02	0.180	0.94	-0.48	0.45	0.008	63.00%
RT - PF		4	762	0.72	0.977	0.54	-3.48	4.92	0.007	52.76%
IN - NP		6	1,290	-0.78	0.169	0.01	-1.25	-0.31	0.002	35.82%
PR - NP		4	1,166	-0.52	0.162	0.08	-1.22	0.17	0.000	6.81%
RT - NP		4	1,282	-0.09	0.347	0.82	-1.58	1.41	0.026	87.74%
IN - GP		5	1,312	0.01	0.059	0.94	-0.18	0.19	0.003	47.26%
PR - GP		5	1,068	0.02	0.082	0.87	-0.25	0.28	0.008	61.60%
RT - GP		5	874	-0.03	0.033	0.48	-0.13	0.08	0.000	0.00%
RT - IN	Environmental Munificence	8	3,358	0.17	0.212	0.45	-0.35	0.69	0.084	97.30%
RT - PR		5	2,562	-0.25	0.296	0.46	-1.19	0.69	0.067	96.21%
IN - PF		5	1,179	-0.02	0.150	0.91	-0.50	0.46	0.009	67.98%
PR - PF		3	721	-0.05	0.120	0.75	-1.57	1.47	0.000	0.01%
RT - PF		3	761	0.12	0.187	0.63	-2.25	2.49	0.007	60.76%
IN - NP		6	1,179	0.06	0.249	0.82	-0.63	0.75	0.042	92.10%
PR - NP		4	878	0.13	0.131	0.44	-0.44	0.69	0.002	29.57%
RT - NP		4	865	-0.86	2.628	0.78	-12.17	10.45	0.098	96.25%
IN - GP		4	2,437	0.08	0.058	0.30	-0.17	0.33	0.000	0.04%
PR - GP		3	2,206	0.04	0.191	0.87	-2.38	2.46	0.009	72.72%
RT - GP		3	2,206	0.09	0.139	0.63	-1.67	1.85	0.004	50.52%
RT - IN	Environmental Dynamism	16	4,604	0.10	0.082	0.25	-0.08	0.27	0.033	91.84%
RT - PR		18	5,489	0.16	0.113	0.19	-0.09	0.40	0.057	96.96%
IN - PF		5	1,054	-0.05	0.119	0.73	-0.43	0.33	0.003	39.73%
PR - PF		7	1,200	-0.11	0.106	0.34	-0.38	0.16	0.015	74.03%
RT - PF		3	446	-0.38	0.090	0.15	-1.52	0.77	0.000	0.00%
IN - NP		8	1,518	-0.14	0.198	0.49	-0.63	0.34	0.024	85.71%
PR - NP		5	929	0.14	0.102	0.25	-0.18	0.47	0.000	0.06%
RT - NP		5	1,279	1.06	1.106	0.41	-2.46	4.58	0.063	94.67%
IN - GP		7	3,038	0.18	0.099	0.13	-0.08	0.43	0.005	62.60%
PR - GP		8	3,143	0.23	0.117	0.09	-0.05	0.52	0.011	78.17%
RT - GP		8	3,085	0.12	0.115	0.32	-0.16	0.40	0.023	88.83%

Notes: IN = innovativeness; PR = proactiveness; RT = risk-taking; PF = profitability; GP = growth performance; NP = non-financial performance; k = number of independent samples; N = total sample size; B = unstandardized regression coefficient; SE = standard error; p-val = p-value; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; tau2 = estimated between-study heterogeneity; I2 = remaining proportion of total variation that is due to between-study heterogeneity; Industry Dummy = manufacturing (0) / service(1).

ONLINE SUPPLEMENT D

Table 1 shows the detailed non-linear assessments. Lower AIC, BIC and log-likelihood values indicate a better fit, and to test whether the difference between linear and non-linear models is meaningful, a likelihood ratio test is used. For additional visual inspection, we also plotted all evaluated relationships. These are shown in figure 1 to 17.

Table 1. Non-Linear Meta-Regression ANOVA Results

Effect	Moderator		k	df	AIC	BIC	logLik	LRT	p-val	tau2	R2
IN – PF	Innovativeness Mean	non-linear	21	4	-11.54	-7.37	9.77	0.02	0.885	0.020	0.08%
		linear	21	3	-13.52	-10.39	9.76			0.020	
IN – NP		non-linear	28	4	-8.61	-3.28	8.30	0.27	0.604	0.028	1.05%
		linear	28	3	-10.34	-6.34	8.17			0.029	
IN – GP		non-linear	27	4	-20.07	-14.89	14.04	0.06	0.811	0.017	0.43%
		linear	27	3	-22.02	-18.13	14.01			0.017	
PR – PF	Proactiveness Mean	non-linear	18	4	-4.40	-0.84	6.20	2.03	0.154	0.024	13.92%
		linear	18	3	-4.37	-1.70	5.19			0.028	
PR – NP		non-linear	16	4	-11.22	-8.13	9.61	0.94	0.331	0.014	7.91%
		linear	16	3	-12.27	-9.96	9.14			0.015	
PR – GP		non-linear	24	4	-9.07	-4.35	8.53	1.58	0.209	0.026	7.33%
		linear	24	3	-9.49	-5.95	7.74			0.028	
RT – PF	Risk-Taking Mean	non-linear	18	4	2.53	6.09	2.73	3.08	0.079	0.036	18.23%
		linear	18	3	3.62	6.29	1.19			0.044	
RT – NP		non-linear	17	4	4.24	7.57	1.88	0.11	0.739	0.043	0.58%
		linear	17	3	2.35	4.85	1.83			0.043	
RT – GP		non-linear	28	4	-13.55	-8.22	10.77	0.03	0.853	0.023	0.00%
		linear	28	3	-15.51	-11.52	10.76			0.023	
RT – IN		non-linear	93	5	-56.52	-43.86	33.26	3.12	0.210	0.024	4.62%
		linear	93	3	-57.40	-49.80	31.70			0.026	
RT – PR		non-linear	93	5	-48.23	-35.57	29.11	21.01	0.000	0.028	23.15%
		linear	93	3	-31.22	-23.62	18.61			0.036	
FS – IN	Firm Size Mean (logged)	non-linear	63	5	-82.56	-71.85	46.28	6.00	0.050	0.008	14.73%
		linear	63	3	-80.57	-74.14	43.28			0.009	
FS – PR		non-linear	46	5	-72.73	-63.59	41.37	3.60	0.165	0.004	21.17%
		linear	46	3	-73.13	-67.64	39.57			0.005	
FS – RT		non-linear	57	5	-86.29	-76.08	48.15	2.69	0.261	0.006	10.40%
		linear	57	3	-87.60	-81.48	46.80			0.007	
FA – IN	Firm Age Mean	non-linear	54	5	-94.32	-84.38	52.16	2.37	0.306	0.003	6.57%
		linear	54	3	-95.95	-89.99	50.98			0.004	
FA – PR		non-linear	38	5	-59.99	-51.80	34.99	8.01	0.018	0.004	37.13%
		linear	38	3	-55.98	-51.06	30.99			0.007	
FA – RT		non-linear	49	5	-78.88	-69.42	44.44	3.81	0.149	0.004	23.16%
		linear	49	3	-79.08	-73.40	42.54			0.005	

Notes: IN = innovativeness; PR = proactiveness; RT = risk-taking; PF = profitability; NP = non-financial performance; GP = growth performance; FS = firm size; FA = firm age; k = number of effects; df = degrees of freedom; AIC = Akaike information criterion; BIC = Bayesian information criterion; logLik = log-likelihood; LRT = likelihood ratio test; p-val = p-value of the LRT, a significant finding indicates that the non-linear model is advantageous over the linear model; tau2 = estimated between-study heterogeneity; R2 = percentage of (residual) heterogeneity in the linear model that is accounted for in the non-linear model.

Figure 1. Firm Size– Innovativeness Non-Linearity

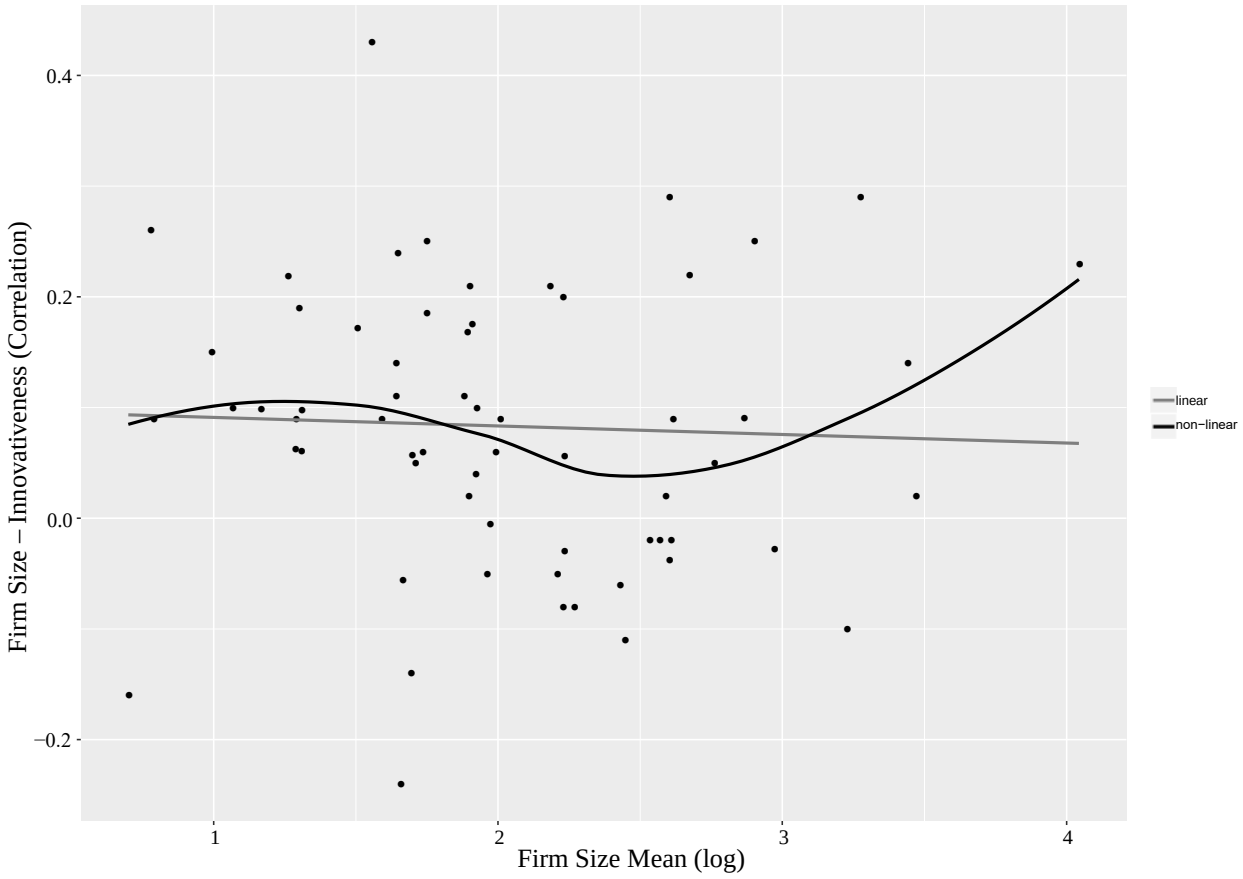


Figure 2. Firm Size – Proactiveness Non-Linearity

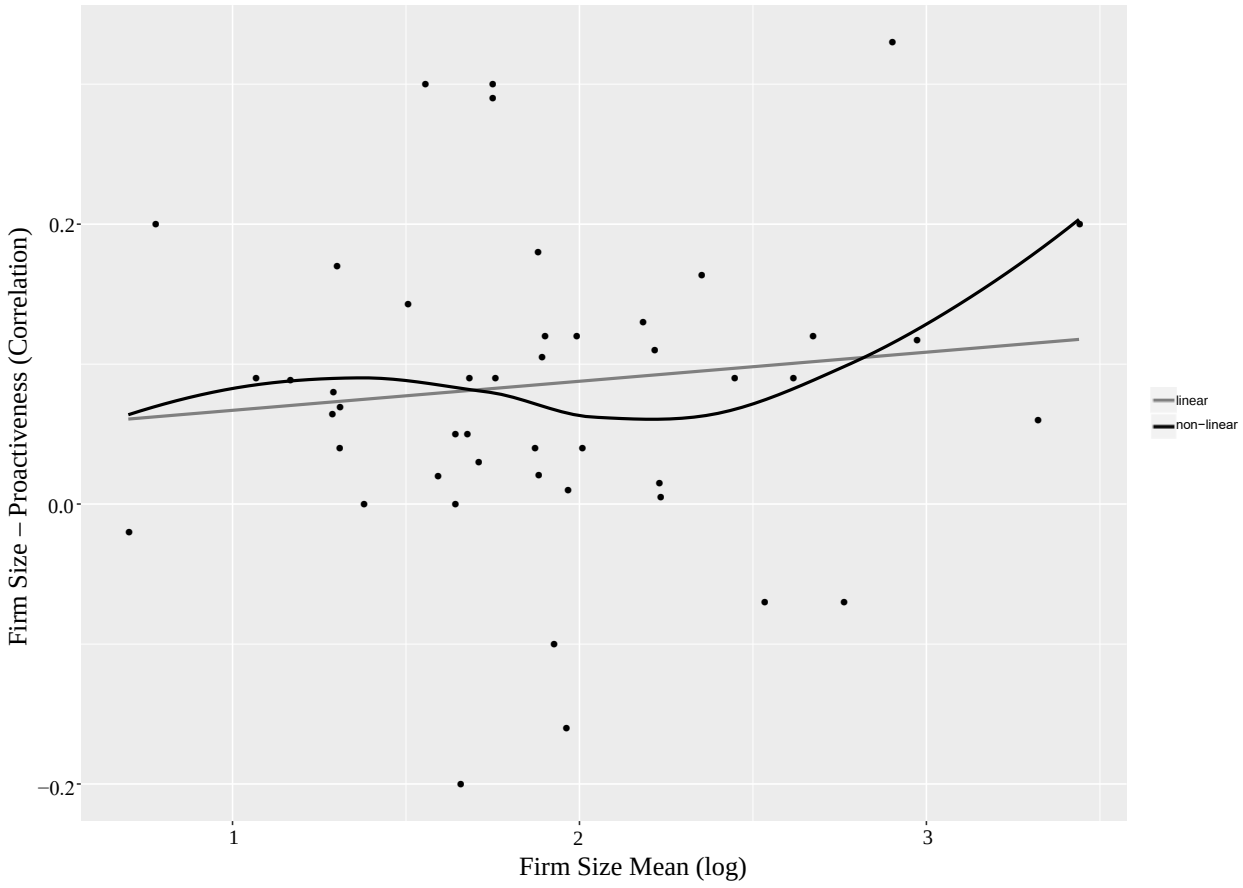


Figure 3. Firm Size – Risk-Taking Non-Linearity

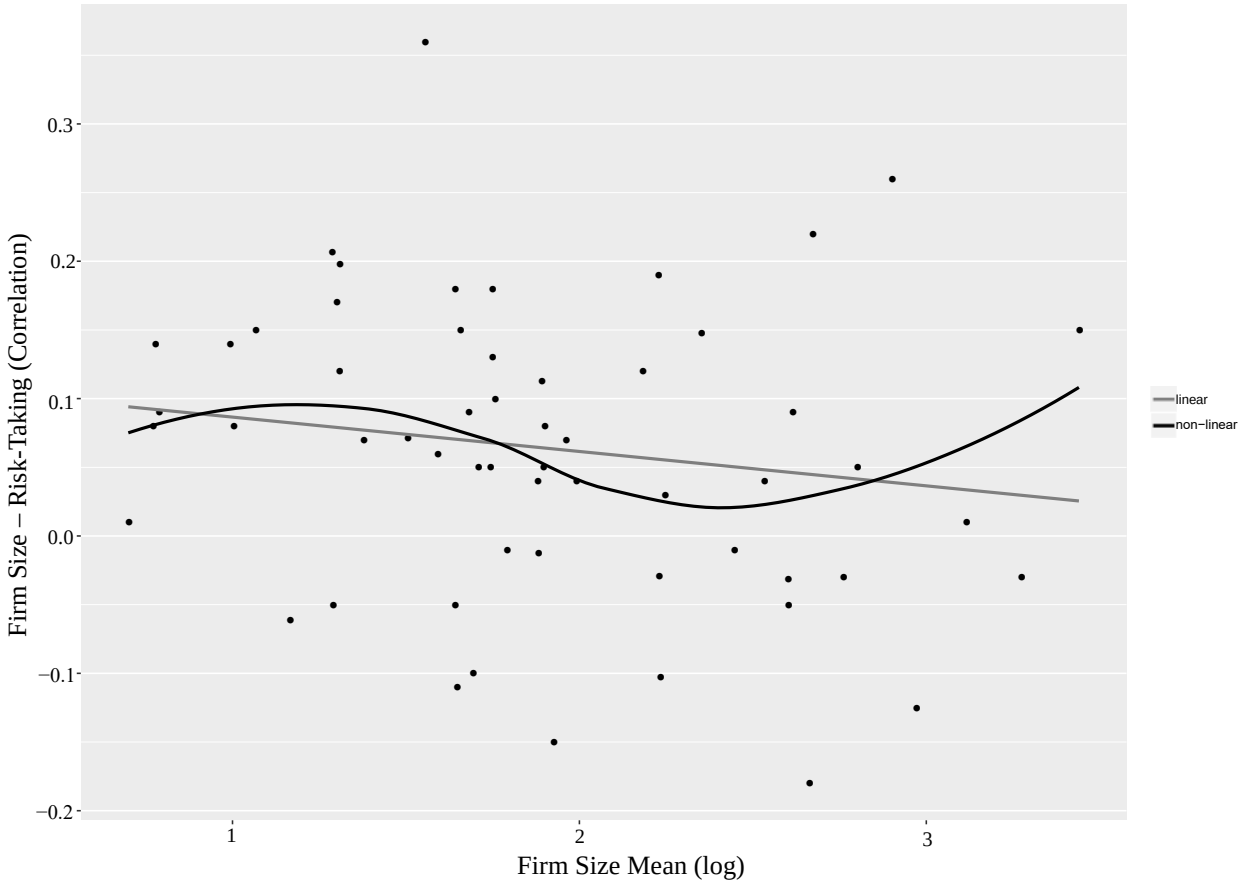


Figure 4. Firm Age – Innovativeness Non-Linearity

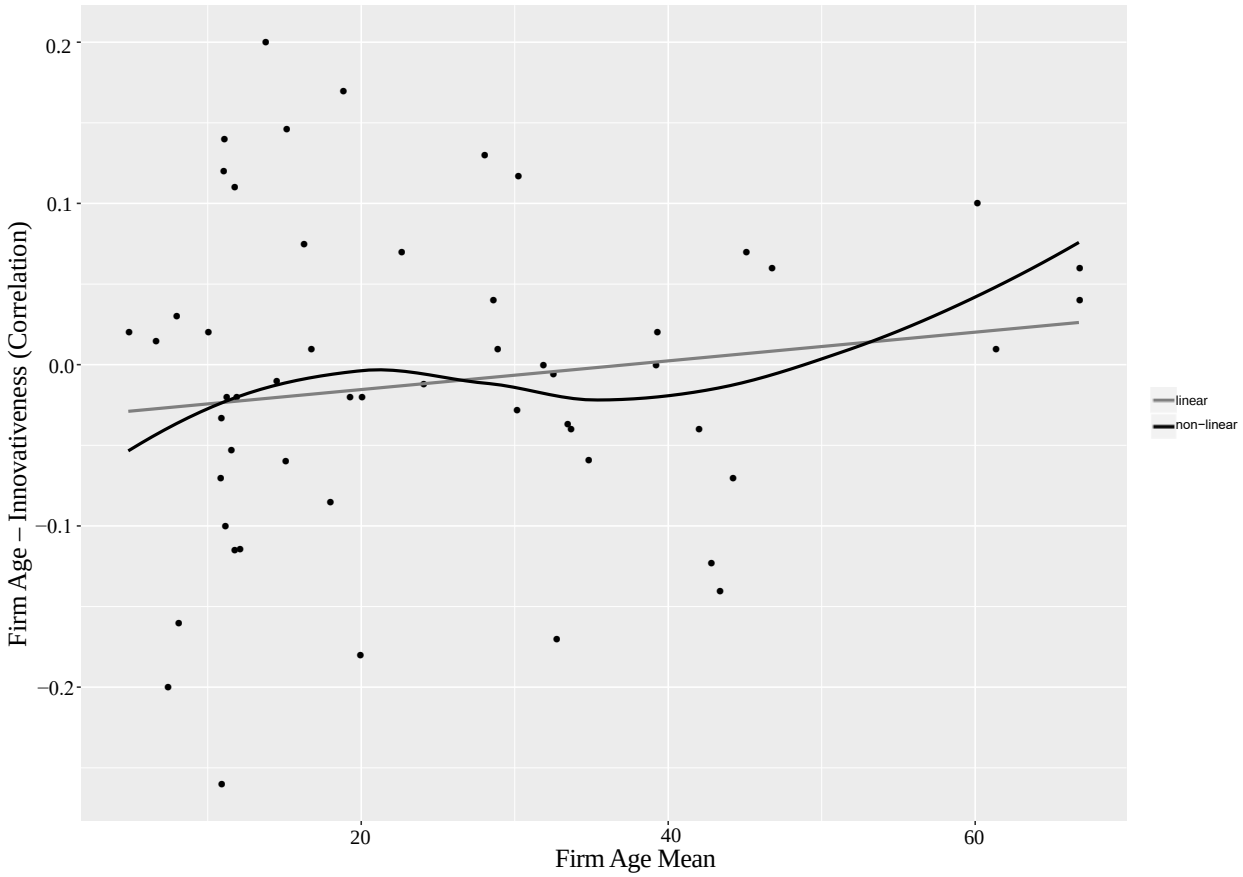


Figure 5. Firm Age – Proactiveness Non-Linearity

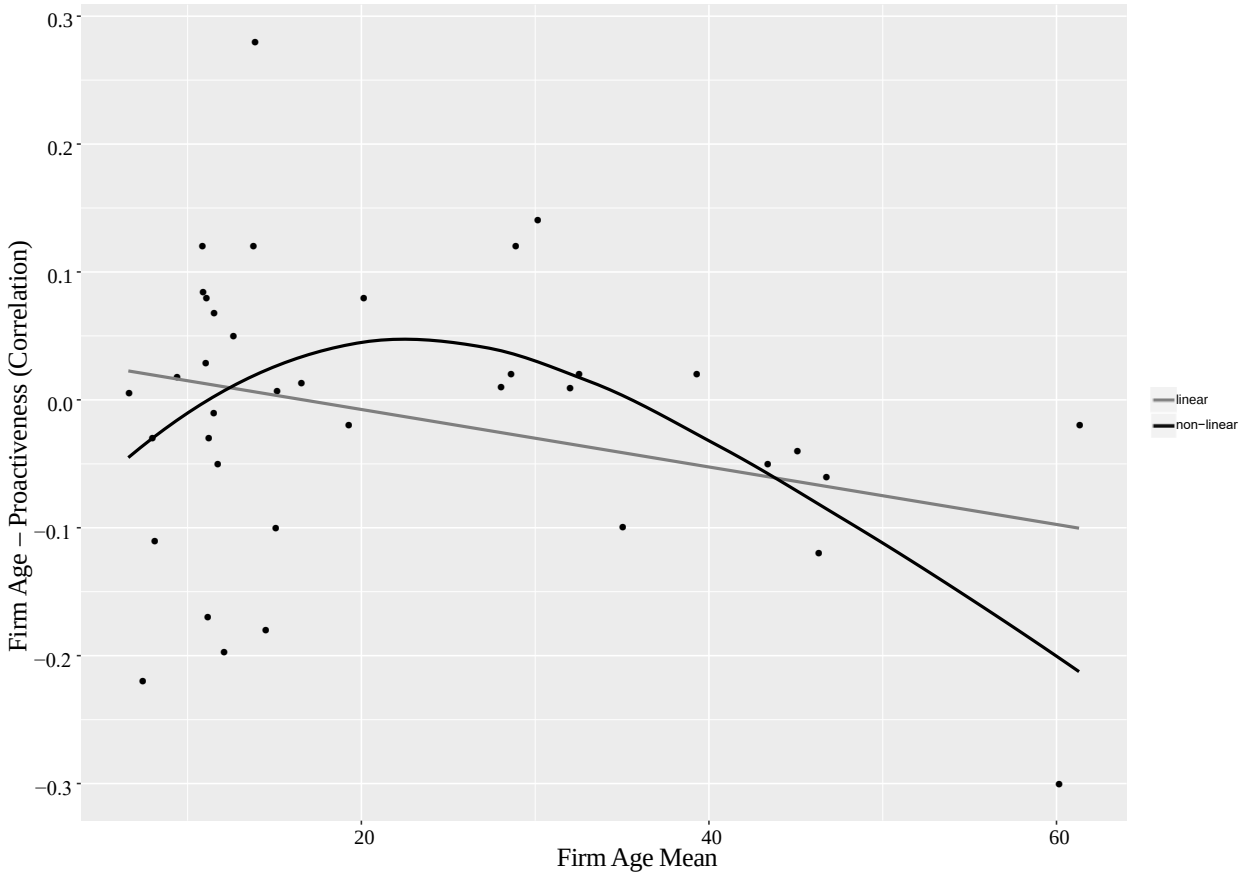


Figure 6. Firm Age – Risk-Taking Non-Linearity

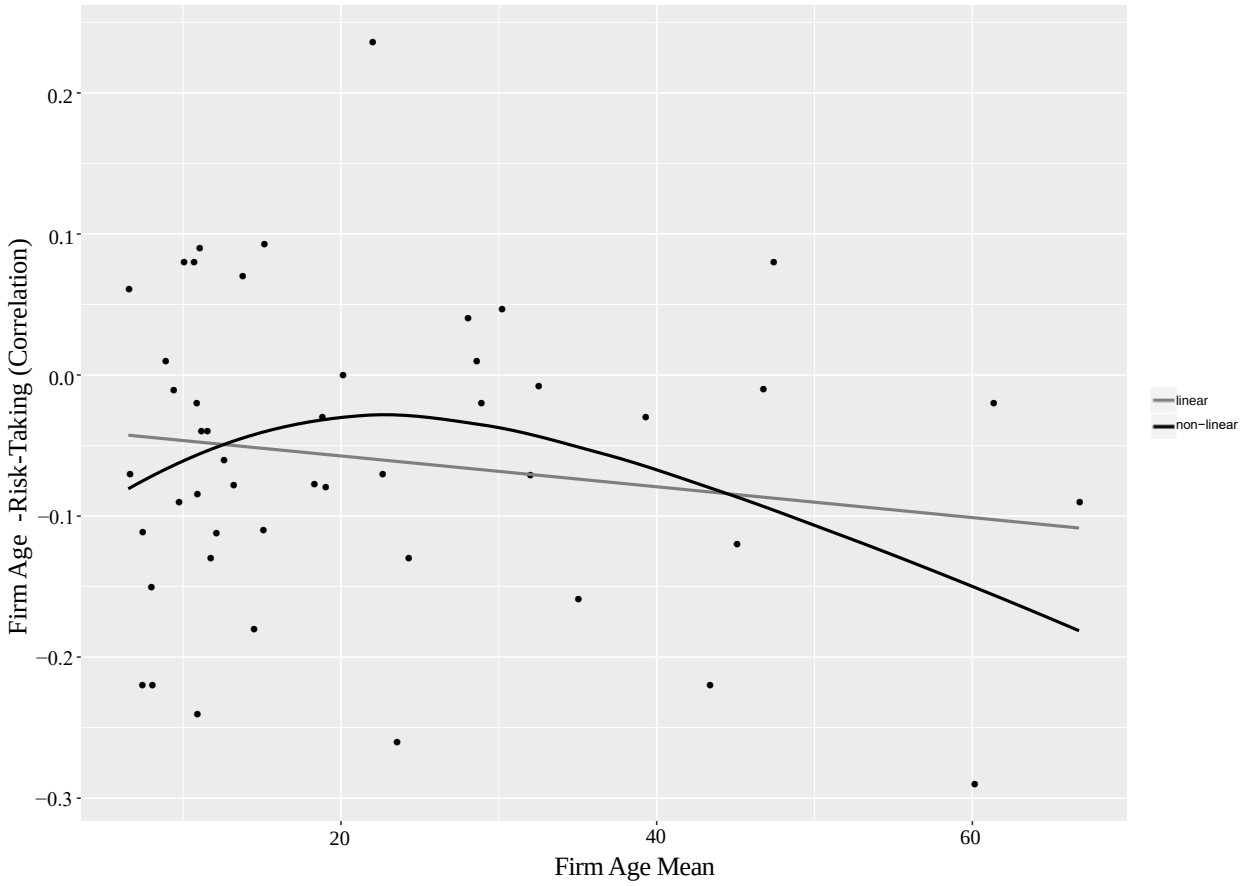


Figure 7. Innovativeness – Profitability Non-Linearity

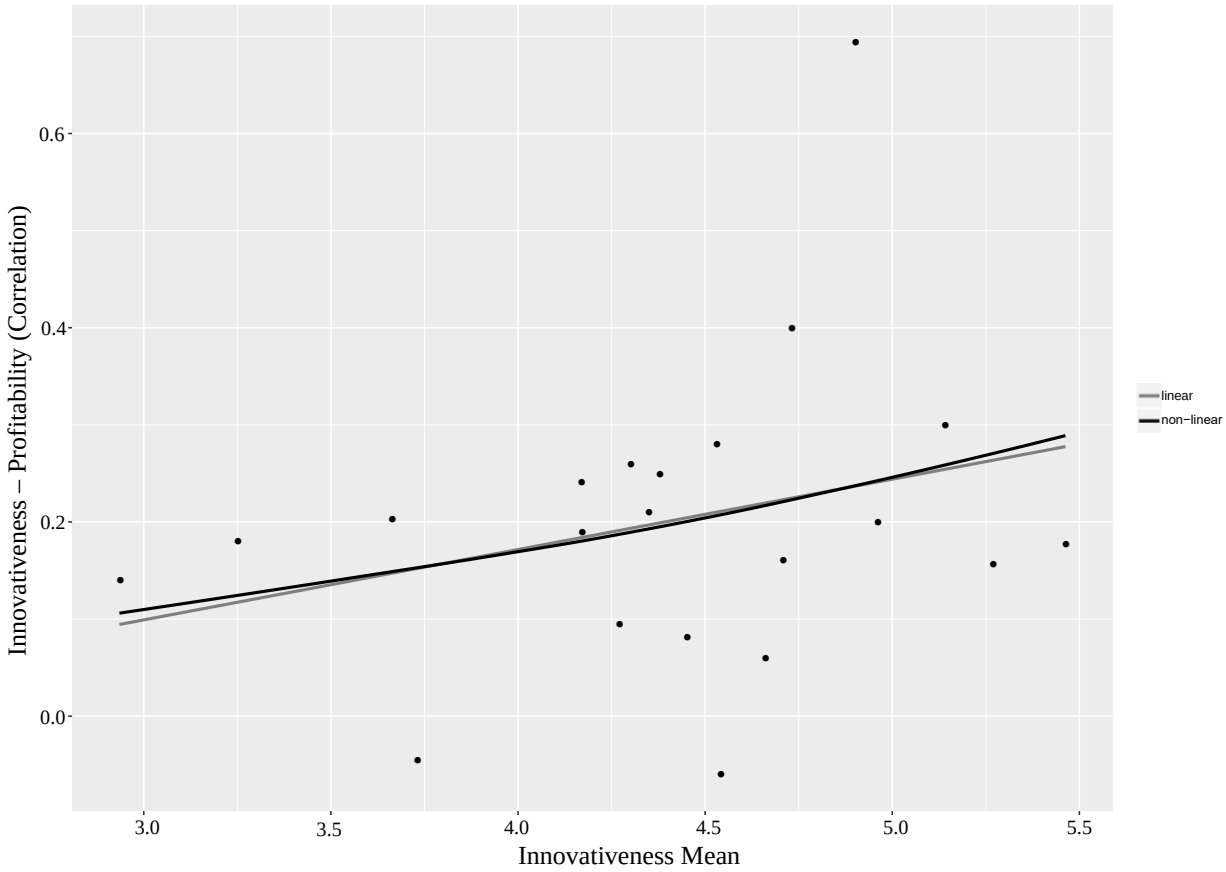


Figure 8. Innovativeness – Non-Financial Performance Non-Linearity

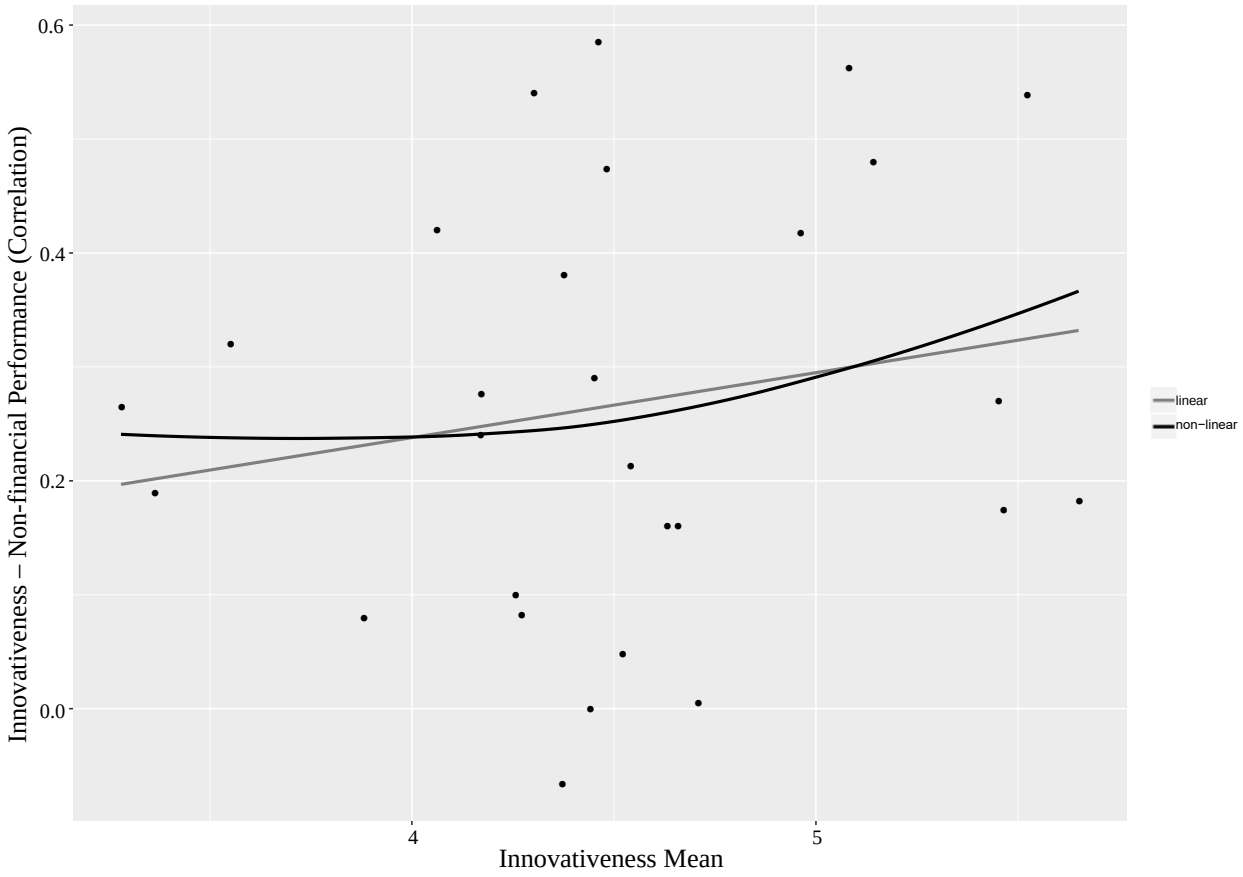


Figure 9. Innovativeness – Growth Performance Non-Linearity

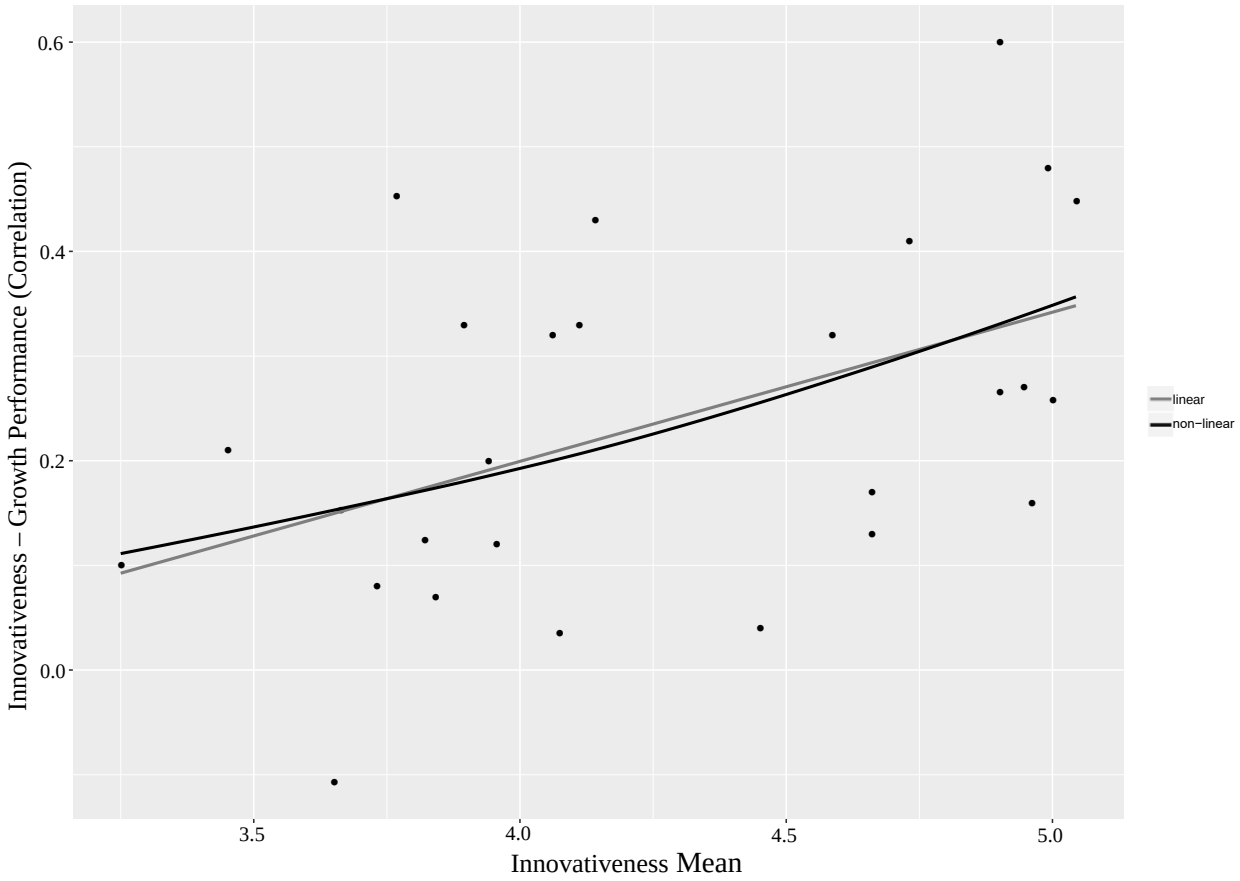


Figure 10. Proactiveness – Profitability Non-Linearity

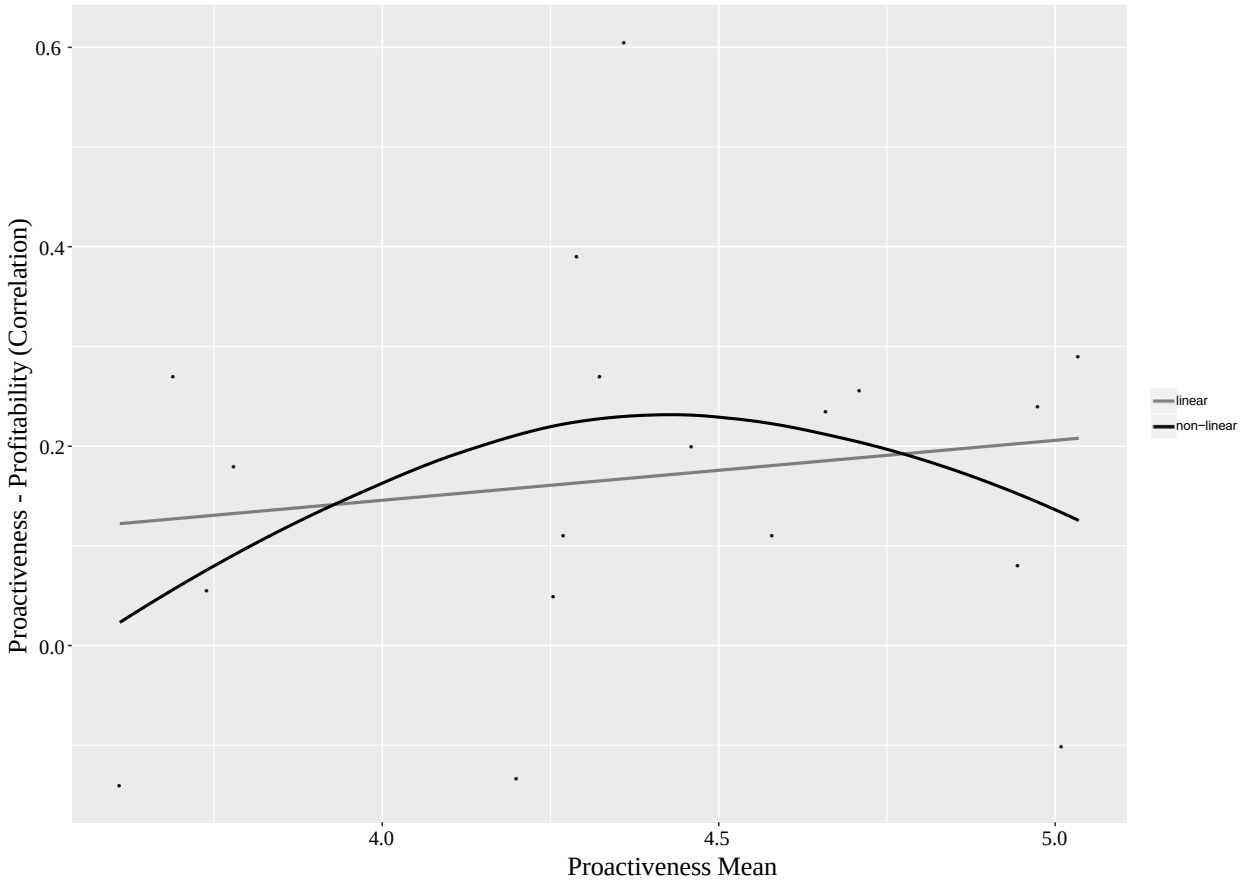


Figure 11. Proactiveness – Non-Financial Performance Non-Linearity

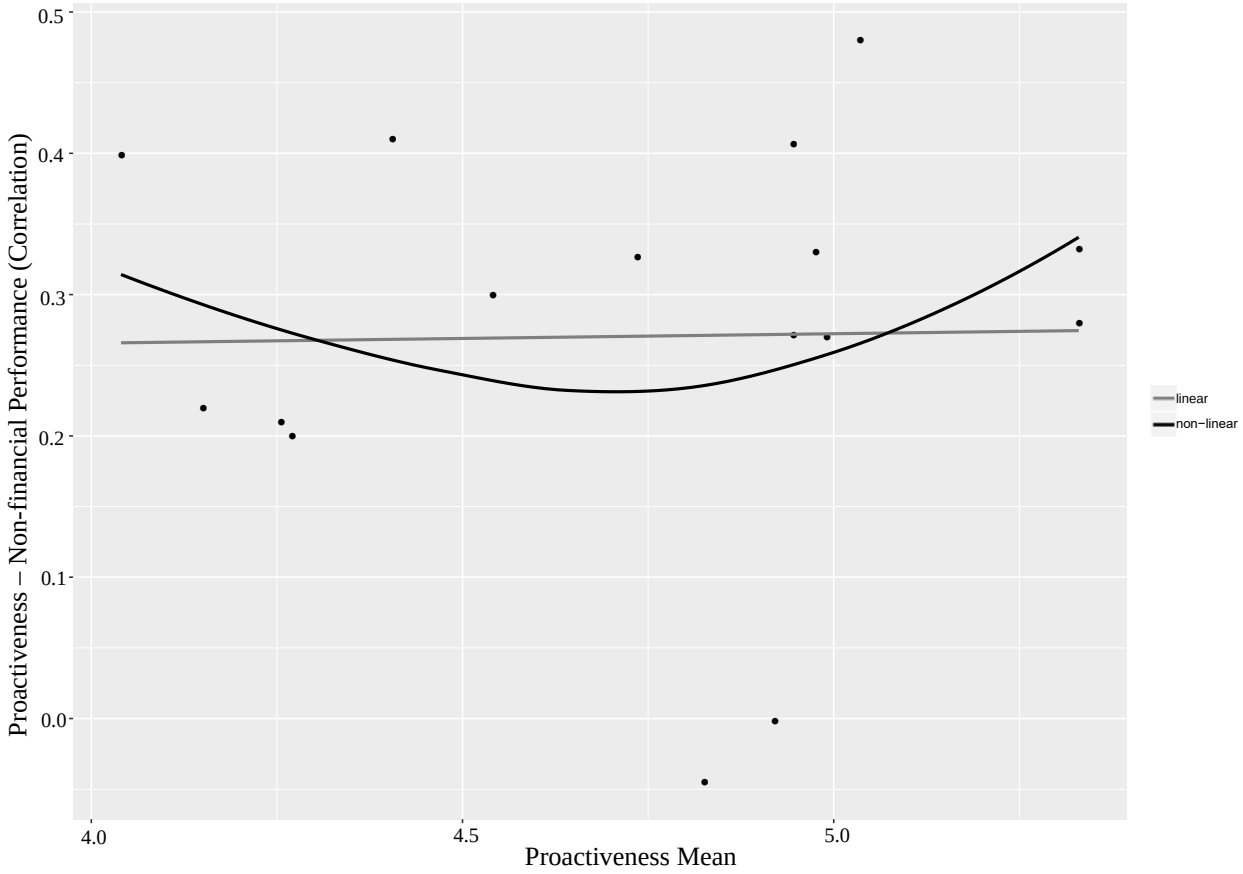


Figure 12. Proactiveness – Growth Performance Non-Linearity

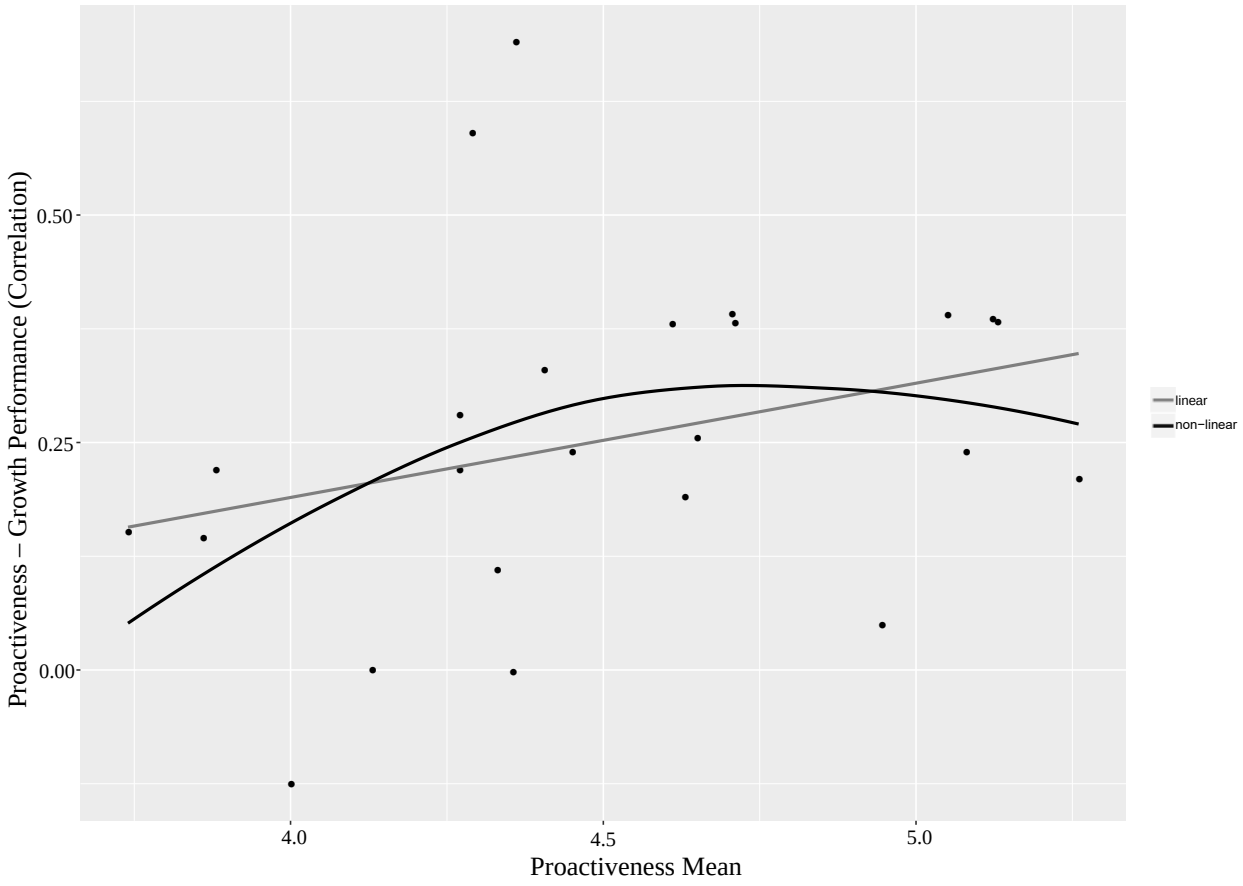


Figure 13. Risk-Taking – Innovativeness Non-Linearity

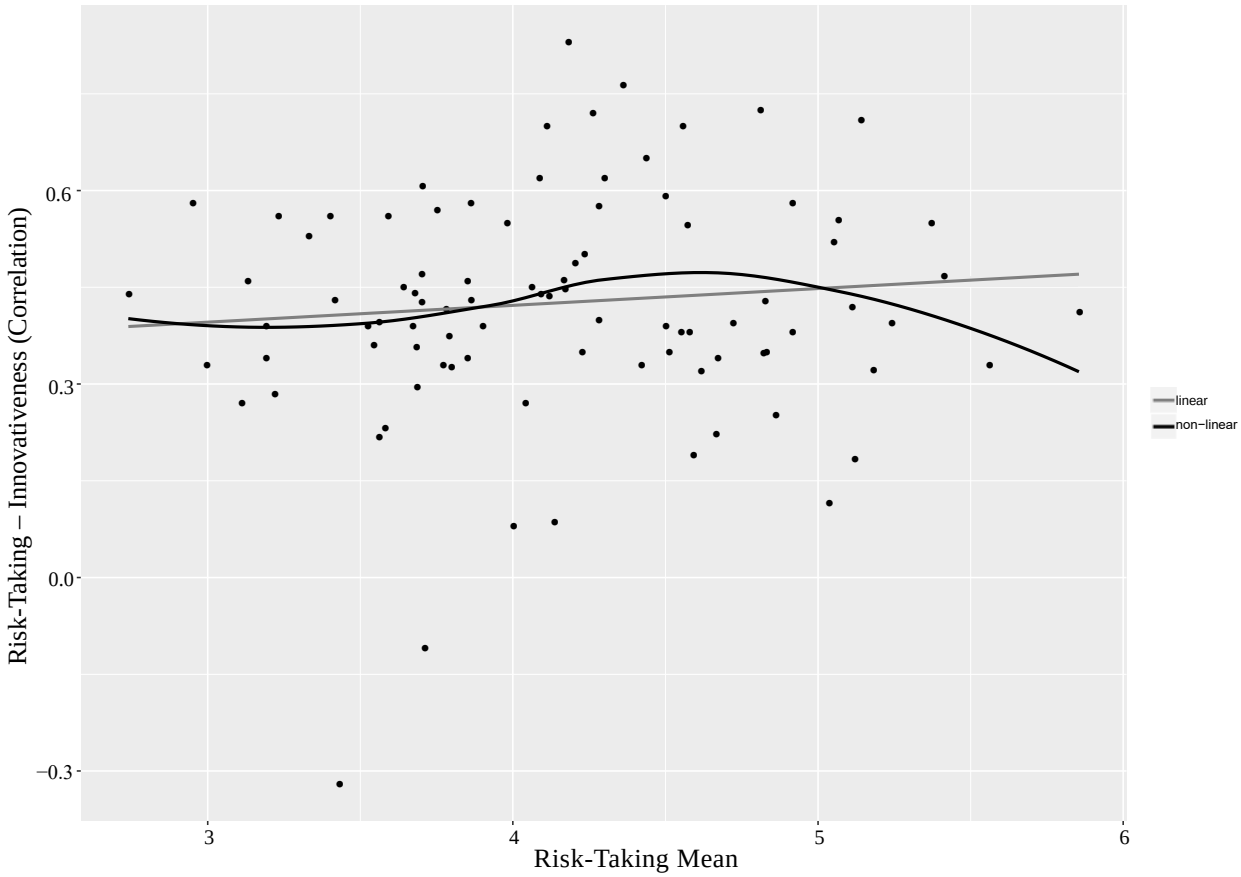


Figure 14. Risk-Taking – Proactiveness Non-Linearity

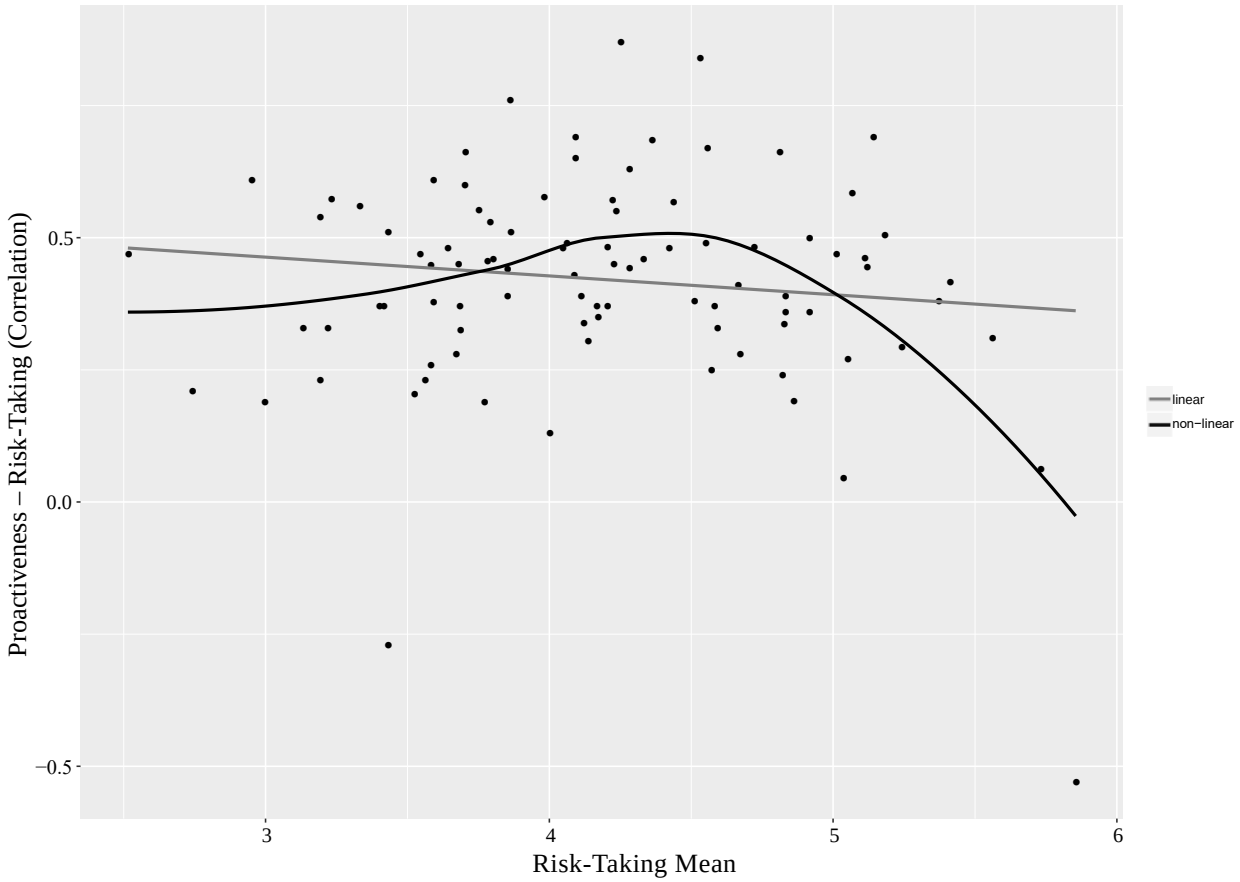


Figure 15. Risk-Taking – Profitability Non-Linearity

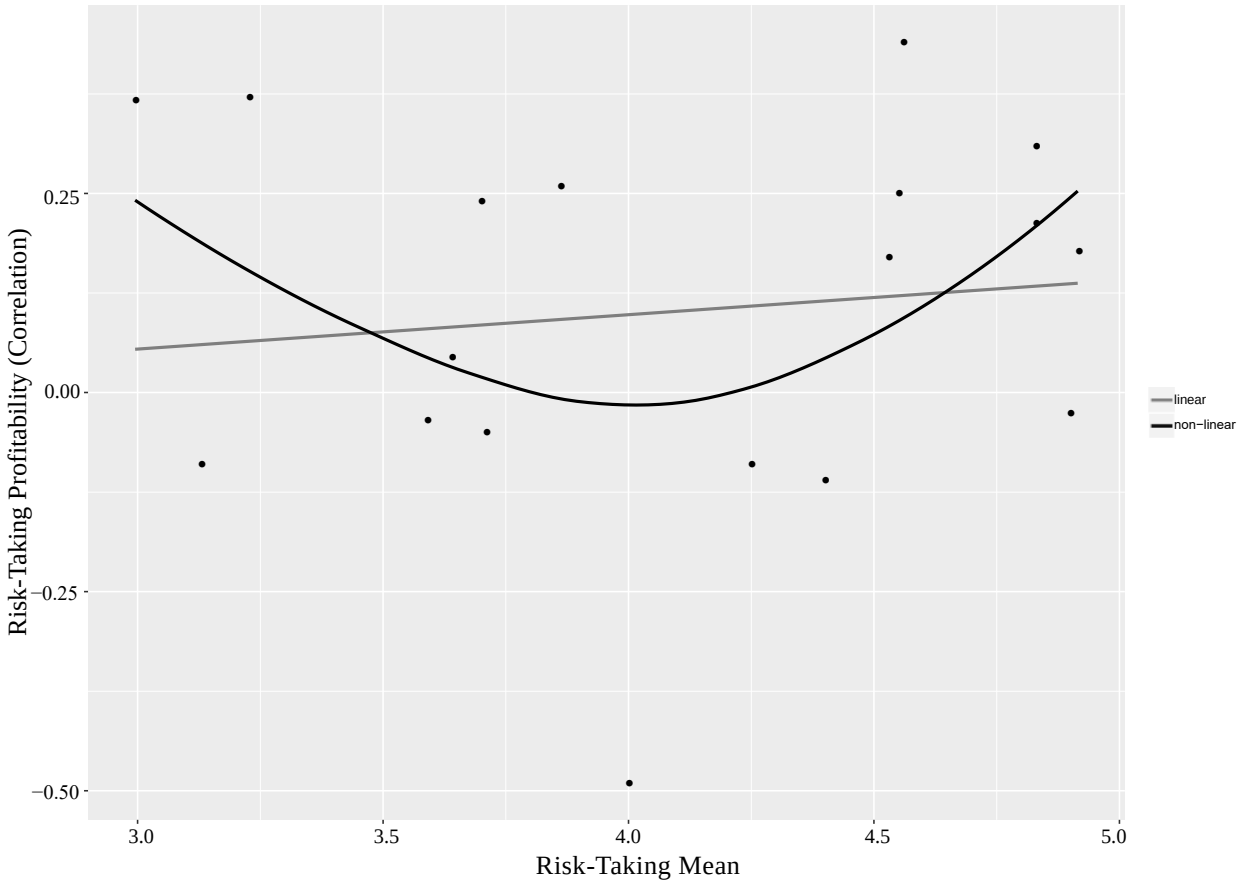


Figure 16. Risk-Taking – Non-Financial Performance Non-Linearity

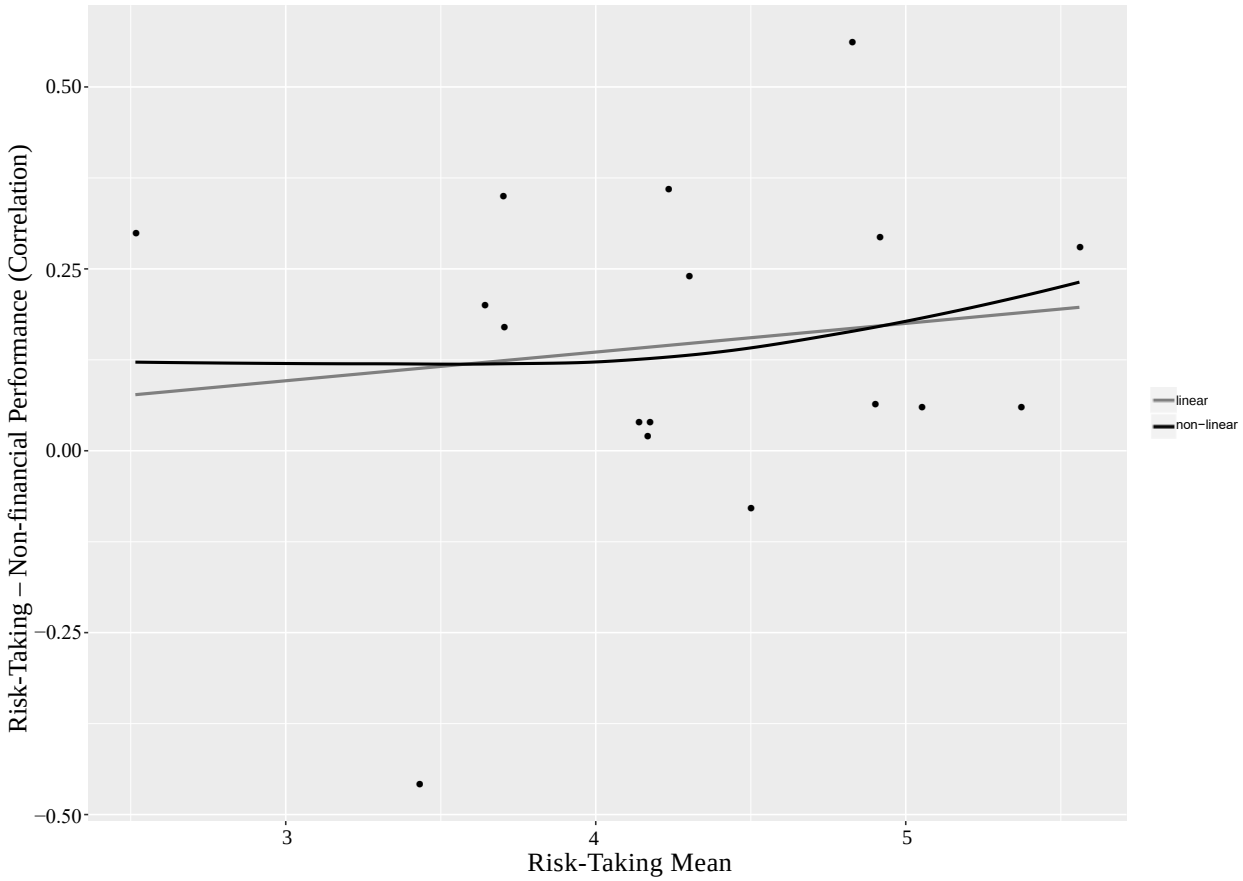
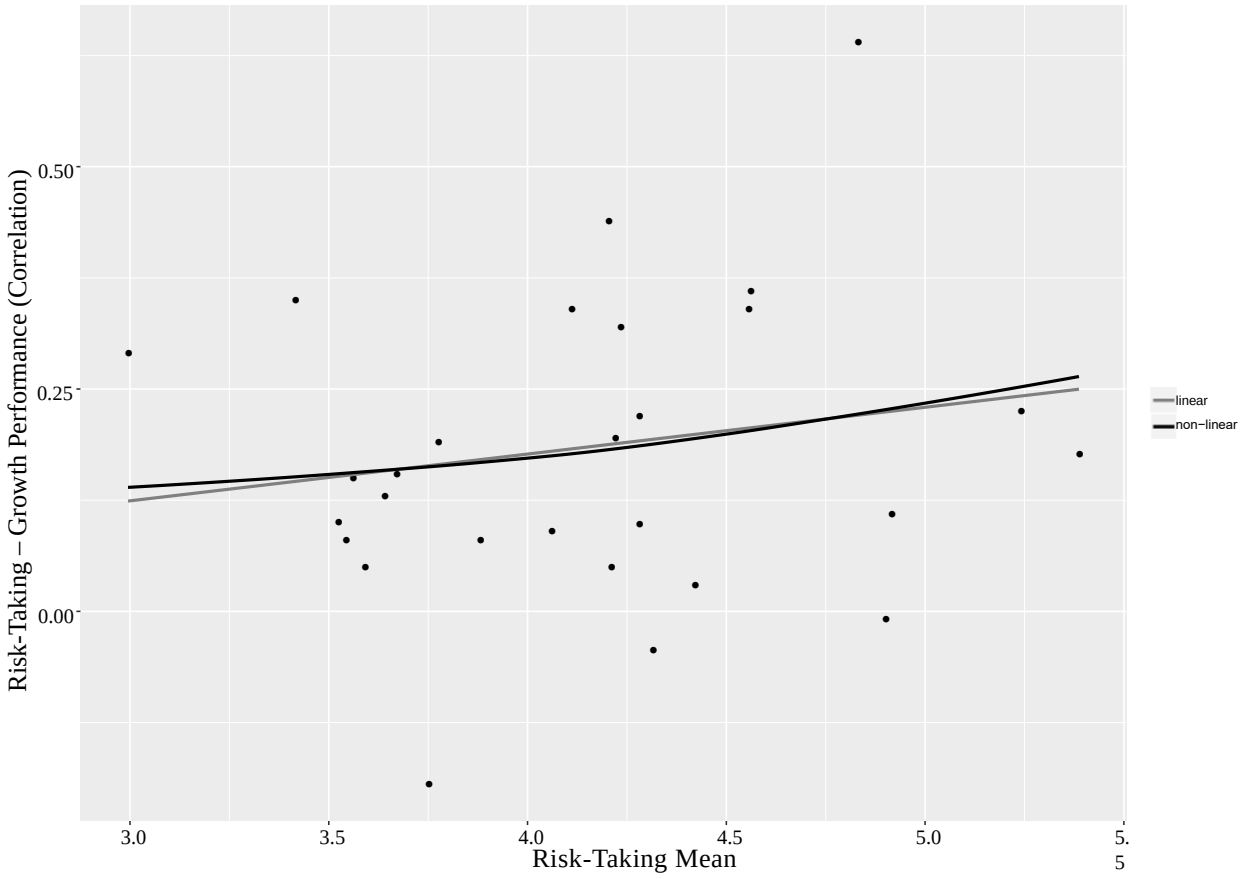


Figure 17. Risk-Taking – Growth Performance Non-Linearity



ONLINE SUPPLEMENT E

Non-Linearity Assessment of Aggregate EO Measures and Performance

Table 1. Non-Linear meta-regression ANOVA results

Effect	Moderator		k	df	AIC	BIC	logLik	LRT	p-val	tau2	R2
EO - PF	Entrepreneurial Orientation Mean	non-linear	40	5	-15.24	-6.80	12.62	1.89	0.389	0.028	4.85%
		linear	40	3	-17.35	-12.29	11.68			0.029	
EO - NP		non-linear	51	5	-23.25	-13.59	16.63	3.62	0.163	0.026	8.27%
		linear	51	3	-23.63	-17.83	14.81			0.028	
EO - GP		non-linear	43	5	-10.87	-2.07	10.44	3.27	0.195	0.030	10.44 %
		linear	43	3	-11.60	-6.32	8.80			0.033	

Notes: EO = entrepreneurial orientation; PF = profitability; NP = non-financial performance; GP = growth performance; k = number of effects; df = degrees of freedom; AIC = Akaike information criterion; BIC = Bayesian information criterion; logLik = log-likelihood; LRT = likelihood ratio test; p-val = p-value of the LRT, a significant finding indicates that the non-linear model is advantageous over the linear model; tau2 = estimated between-study heterogeneity; R2 = percentage of (residual) heterogeneity in the linear model that is accounted for in the non-linear model.

REVISITING THE MEDIATING ROLE OF ENTREPRENEURIAL ORIENTATION IN THE TASK ENVIRONMENT – PERFORMANCE RELATIONSHIP: A FINER-GRAINED REPLICATION

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ABSTRACT

This research performs a finer-grained replication of Rosenbusch, Rauch, and Bausch's (2013) meta-analytic investigation of the entrepreneurial orientation's (EO) mediating role in task environment to firm performance relationships. To achieve this, we draw on more than 480 primary studies to investigate and compare an aggregate and component-level model of EO. Advancing on Rosenbusch et al. (2013), this research controls for firm size and age and deconstructs firm performance into profitability, growth, and non-financial performance. We provide cumulative evidence that the three core components of EO unfold unique effects with environmental antecedents and performance consequences. Hence, neglecting to pay attention to EO's components and only focusing on the aggregate measure could obfuscate important nuances and even lead to erroneous theoretic conclusions.

INTRODUCTION

Since Miller's (1983) seminal article on the correlates of entrepreneurship, often credited as the starting point of the entrepreneurial orientation construct (EO), the popularity of EO proliferated quickly in the scholarly community and still, over three decades later, remains to be one of the most vibrant topics in the entrepreneurship literature (Covin & Lumpkin, 2011; Covin & Wales, 2019; Rauch, Wiklund, Lumpkin, & Frese, 2009; Wales, Gupta, Marino, & Shirokova, 2019; Wales, Gupta, & Mousa, 2013; Wales, 2016). The origin of EO is deeply rooted in contingency theory that is concerned with how internal factors and external circumstances shape the configuration of firms and their strategic actions (Lawrence & Lorsch, 1967; Mintzberg, 1979; Lumpkin & Dess, 2001). Conceivably, it is hardly surprising that the ensuing literature focused strongly on exploring how the task environment (i.e., environmental dynamism, complexity, munificence, and hostility) is affecting the manifestation of entrepreneurial behavior across firms (Covin & Slevin, 1989; Miller & Friesen, 1983; Covin & Lumpkin, 2011). Specific external situations may encourage or discourage the pursuit of EO as a viable means to achieve high performance (Becherer & Maurer, 1997; Covin & Slevin, 1991; Miller & Friesen, 1983) and a plethora of empirical research accumulated on relationships between the task environment, EO, and firm performance (Covin & Lumpkin, 2011; Saeed, Yousafzai, & Engelen, 2014; Wales et al., 2013). Rosenbusch, Rauch, and Bausch (2013) drew on this extensive literature base to explore if EO is a mediating mechanism in task environment to performance relationships. Their meta-analytic findings support this assumption and suggest that EO appears to be a robust mechanism for firms to increase their performance levels in munificent, complex, and dynamic environments. While these findings are undoubtedly informative, especially for managers, long-standing calls and more recent findings advise to revisit this mediating

mechanism of EO from a finer-grained perspective (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015; Miller, 2011; Wales, 2016).

Miller (1983, 2011) conceptualized EO as an aggregate index of innovativeness, proactiveness, and risk-taking, to form a broad enough construct to capture entrepreneurial behavior across different contexts but also stressed the need to control for variations in the exhibition of EO's components across these contexts. Hence, the potential for component-level differences is deeply embedded within the foundation of the EO construct. However, these notions for finer-grained assessments remained mostly unheeded, and sole aggregate reportings are dominating the literature (Rauch et al., 2009; Saeed et al., 2014). Nevertheless, more studies begin to adopt "best of both worlds" reporting practices and present results on both the aggregate and component-level (Miller, 2011). Moreover, rare component-level studies reveal intriguing insights. Anderson et al. (2015) observe that while environmental hostility is negatively affecting innovativeness and proactiveness, it is unrelated to risk-taking. In addition to that, two studies find the components of EO to differ in their effects on specific performance outcomes (Hughes & Morgan, 2007; Kreiser, Marino, Kuratko, & Weaver, 2013).

Taken together, to consider "new ways of seeing" we revisit and build upon the work of Rosenbusch et al. (2013). In doing this, we shed new light on well-established relationships and to explore the question of how finer-grained investigations of EO may proceed (Miller, 2011; Shaw, Bansal, & Gruber, 2017). Today's wealth of empirical work on EO affords us to employ recent meta-analytical structural equation modeling techniques (MASEM) and to offer valuable contributions towards model building and the future study of EO (Aguinis, Dalton, Bosco, Pierce, & Dalton, 2011; Bergh et al., 2016; Shaw & Ertug, 2017).

First, in addition to adapting the aggregate EO model of Rosenbusch et al. (2013), we propose a component-level model in which we view EO's components as individual but correlated components (Miller, 2011). Thereby we can explore how each component might be differently affected by elements of the task environment. Second, in contrast to Rosenbusch et al. (2013), we deconstruct overall firm performance into profitability, growth, and non-financial performance. In doing this, we can explicitly model-specific performance paths of EO and its components to these salient outcomes to gain more detailed insights (Gupta & Wales, 2017). Finally, older and larger firms are differently affected by their external environment and may manifest EO differently than their younger and smaller counterparts (Anderson & Eshima, 2013; Covin & Slevin, 1989; Damanpour, 1992; Miller, 2011; Rauch et al., 2009; Saeed et al., 2014). To account for these organizational considerations, we include firm size and age as control variables.

In sum this research draws on a finer-grained replication of the work of Rosenbusch et al. (2013), to offer component-level insights into EO's role as the missing link in task environment--performance relationships. Thereby, we help to answer recent (Anderson et al., 2015) and long-standing (Lumpkin & Dess, 1996) calls to consider insights on EO's component influences in antecedent-to-outcome relationships.

CONCEPTUAL BACKGROUND

In this section, we will briefly cover the variables relevant to our finer-grained replication of Rosenbusch et al. (2013) and introduce our proposed models.

Variable Considerations

Entrepreneurial Orientation. An entrepreneurial firm is defined as one that "engages in product market innovation, undertakes somewhat risky ventures, and is first to come up with 'proactive' innovations, beating competitors to the punch" (Miller, 1983: 770). To

measure this firm-level phenomenon, the Miller (1983) / Covin and Slevin (1989) instrument (M/CS), with its holistic inclusiveness of innovativeness, proactiveness, and risk-taking, has become the dominant conceptualization of EO in the literature (George & Marino, 2011; Rauch et al., 2009). Predicated on this fact and in line with Rosenbusch et al. (2013), we will limit our investigations to these three core components of EO.

Task Environment. Firms are affected by their external environment in various vital ways, e.g., the availability of critical resources, the nature of available information, and existing opportunities (Dess & Beard, 1984; Pfeffer & Salancik, 1978). Therefore, external circumstances can constrain the range of available strategic options and may force firms to adopt specific strategic postures (Covin & Slevin, 1991; Eisenhardt & Schoonhoven, 1990; Khandwalla, 1977). In that regard, munificent environments are those in which plenty of opportunities and resources exist, with high industry growth rates and profit margins (Dess & Beard, 1984; Lumpkin & Dess, 2001). In contrast to this, in hostile environments, resources are scarce, competition is fierce, customer loyalties are low or non-existing, and there are few venturing opportunities (Covin & Slevin, 1989; Miller, 1987). Next, dynamic environments are characterized by high degrees of uncertainty and unpredictable change, e.g., in technology and customer behavior, which renders it almost impossible to anticipate future events and their outcomes (Khandwalla, 1977; Miller & Friesen, 1983). Fourth and last, environmental complexity gauges the degree of heterogeneity in influential factors that are present within an environment and the difficulties involved to make sense of and harness these diverse but interconnected aspects (Dess & Beard, 1984). For firms to successfully operate in such environments, it is integral to build highly specialized routines (Mintzberg, 1979).

Firm Performance. The widespread application of mixed performance measures is likely to obfuscate more nuanced relationships of EO with certain aspects of firm performance (Gupta & Wales, 2017). Saeed et al. (2014) find EO to be more strongly related

to growth than to profitability. Moreover, although profitability and growth are viewed to be the central performance outcomes of EO, we also include non-financial aspects like product quality and customer satisfaction (Lumpkin & Dess, 1996). Thus, we deconstruct firm performance into profitability, growth, and non-financial performance.

Organizational Controls. Firm age and size are likely to play a role in how the task environment is affecting the manifestation of EO, but their role is less well understood (Wales, Monsen, & McKelvie, 2011; Wiklund & Shepherd, 2003). Younger firms are often portrayed as less experienced than their older counterparts and are likely to possess less specialized resources and routines (Sørensen & Stuart, 2000; Thornhill & Amit, 2003). However, in times of industry upheaval and reorientation, younger firms are less burdened by deeply imprinted routines, which should afford them with greater agility (Barron, West, & Hannan, 1994; Sydow, Schreyögg, & Koch, 2009). On the one hand, larger firms are typically associated with more extensive resource stocks enabling them to take on higher risks. On the other hand, with increasing size, firms are likely to become less flexible and more bureaucratic (Damanpour, 1992).

Model Compositions

To offer finer-grained perspectives on EO's components in antecedent-to-outcome relationships, we propose two distinct models. This replication study operates within the norms of previous comprehensive meta-analytic assessments (i.e., Rauch et al., 2009), and we offer our expectations regarding these models in summary form, rather than specific hypotheses.

Aggregate EO Model. Our first model is shown in Figure 1 and is an adaption of the model tested by Rosenbusch et al. (2013). This model serves as a baseline and is drawing on the traditional M/CS approach of combining all three dimensions into a first-order reflective construct (Covin & Slevin, 1991). As item-level correlations are typically unavailable in

primary studies, we operationalize EO with its three components as its indicators. Regarding the effect of the task environment on aggregate EO, we follow the rationales of Rosenbusch et al. (2013) and expect that munificent, dynamic, and more complex environments will be more conducive and hostility to be more detrimental to the manifestation of EO. Thus, the pursuit of EO can help firms to take advantage of these posited environmental circumstances and turn these into above-average performance returns. In order to emulate the composite performance measure employed by Rosenbusch et al. (2013), we combine growth, profitability, and non-financial performance into a first-order reflective performance construct, too.

Insert Figure 1 about here

Component-Level EO Model. Considering recent component-level findings (e.g., Anderson et al., 2015; Hughes & Morgan, 2007; Kreiser et al., 2013), it is reasonable to imagine potential differences in terms of how the dimensions of EO manifest relationships with antecedents and outcomes (Lumpkin & Dess, 1996). In line with our aggregate EO model expectations, we expect that more munificent, dynamic, and complex environments will be more conducive for EO's components. However, we expect the effect of hostility to be more complicated. A hostile environment can directly discourage firms from being more innovative and proactive (Miller & Friesen, 1983; Rosenbusch et al., 2013). Though, there might be situations in which the pursuit of bold high risk/high reward initiatives might be well suited to bring about change and to break out of entrenched positions (Covin & Slevin, 1989). Thus, hostility might be unrelated to innovativeness and proactiveness, but it may exhibit a positive effect on risk-taking. Turning to firm performance, firms that proactively anticipate demand, innovate frequently, and take risks to position new offerings aggressively in the marketplace, appear to achieve performance advantages (Rauch et al., 2009; Saeed et

al., 2014). In that regard, past research suggests that EO is more positively related to growth and non-financial performance, than to a firm's level of profitability (Saeed et al., 2014). Thus, we also expect that EO's three components will be more positively related to certain aspects of performance, such as non-financial and growth, than to profitability. The corresponding component-level model of EO is shown in Figure 2.

Insert Figure 2 here

METHOD

Literature Search

In order to identify articles relevant to our study, we searched three databases (Science Direct, EBSCO, and ISI Web of Science) for the following EO keywords: "entrepreneurial orientation", "strategic posture", and "corporate entrepreneurship". Each study had to meet the following inclusion criteria: (a) Correlations between variables of interest must be reported, and the number of sampled firms must be clearly stated; (b) The sample must consist of for-profit firms; (c) EO or any of its three components must refer to firm-level strategies; (d) Performance variables must refer to overall firm performance and not just some subset thereof. On completion of our search and exclusion process in January 2019, we identified 485 suitable studies.

Coding Procedure

A comprehensive coding sheet was developed to reduce potential coding errors and a list of included studies, with exemplary coding information, is available upon request.

Entrepreneurial Orientation. Innovativeness, proactiveness, and risk-taking must be measured with the M/CS scale, adaptations thereof, or scales that share similarities on the item level. Furthermore, we also considered studies that only draw on an aggregate measure

of EO or corporate entrepreneurship to collect additional correlations between the variables of interest in an entrepreneurial context.

Firm Performance. Performance variables were classified as profitability measures when these are based on e.g., net income or return on investment. Variables were coded as growth performance when they referred to growth in the outcome e.g., growth in sales, revenues, and market share. Finally, non-financial performance constitutes a broader performance category as the other two by encompassing measures like customer satisfaction and loyalty, employee satisfaction and product quality.

Task Environment. To code the four variables of the task environment, we adopted the coding scheme of Rosenbusch et al. (2013: 641).

Firm-Level Controls. We coded firm size as the number of employees and firm age as the years of the firm since its inception.

Meta-Analytic Procedure

In order to test our structural models, we draw on the two-stage meta-analytic structural equation modeling approach of Cheung (Cheung, 2015a; Cheung & Chan, 2005). This more advanced MASEM approach holds several advantages over the approach of Viswesvaran and Ones (1995) that was employed by Rosenbusch et al. (2013). To perform our analyses, we used the statistics software R 3.6.1, the meta-analysis package "metafor" (Viechtbauer, 2010), and the "metaSEM" package of Cheung (2015b). The input data and code used to perform all analyses are available upon request. To control publication bias and potential outliers, we applied the influence diagnostic functions of the "metafor" package (Viechtbauer & Cheung, 2010). While these checks suggest that these biases might be present within some relationships, their impact is not strong enough to skew results in a meaningful way (Viechtbauer & Cheung, 2010).

RESULTS

Meta-Analytic Structural Equation Modeling

Drawing on a total sample of 128,484 firms, the pooled correlation matrix that serves as an input to fit our proposed structural models, is depicted in Table 1.

Insert Table 1 about here

Aggregate EO Model. The results of our adapted aggregate EO model shown in Figure 1, are presented in Table 2. Our findings almost mirror, in both direction and magnitude, the findings of Rosenbusch et al. (2013). Environmental munificence (B = 0.35; $p < 0.001$), dynamism (B = 0.14; $p < 0.001$), and complexity (B = 0.13; p = 0.029) are all significantly related to EO, whereas hostility (B = 0.01; p = 0.767) seems to be unrelated. In turn, EO is positively related to performance (B = 0.52; $p < 0.001$). Taken together, EO appears to align particularly well with munificent environments and also resonates, though to a lesser degree, well with more dynamic and complex environments. On the other hand, hostile environments seem not to affect EO. However, in contrast to Rosenbusch et al. (2013), the observed model fit is notably worse (χ^2 (36) = 139.52, $p < 0.001$. RMSEA = 0.005; SRMR = 0.051; TLI = 0.93; CFI = 0.96).

Insert Table 1 about here

Component-Level EO Model. The results of our component-level model of EO, shown in Figure 2, are presented in Table 3. First, we observe that environmental hostility is unrelated to innovativeness (B = 0.02; p = 0.574), proactiveness (B = 0.00; p = 0.982), and risk-taking (B = 0.00; p = 0.889). Hence, we cannot replicate the findings of Anderson et al. (2015) in our meta-analytic setting. Next, environmental munificence seems to have the strongest relationship with all three components of EO i.e. with innovativeness (B = 0.31; p =

< 0.001) , proactiveness (B = 0.15; p = 0.075), and risk-taking (B = 0.18; p = 0.024). Third, environmental dynamism is positively related to innovativeness (B = 0.13; p = 0.003) and risk-taking (B = 0.09; p = 0.050) but unrelated to proactiveness (B = 0.05; p = 0.260). Finally, environmental complexity is related to proactiveness (B = 0.12; p = 0.047) but not to innovativeness (B = 0.11; p = 0.168) and risk-taking (B = 0.04; p = 0.497). In sum, environmental munificence is also the dominant driver on the component-level and has the strongest effect on innovativeness. In contrast to this, while environmental hostility is unrelated to all three components of EO, the findings for dynamism and complexity turn out to be more heterogeneous. Turning to performance outcomes, we observe that whereas innovativeness (B = 0.15; p = 0.001) is positively related to profitability, proactiveness (B = 0.03; p = 0.529) and risk-taking (B = 0.03; p = 0.617) are not. Second, in terms of growth performance, proactiveness (B = 0.08; p = 0.402) and risk-taking (B = 0.02; p = 0.761) seem unrelated but innovativeness (B = 0.23; p < 0.001) seems to have a positive relationship. Lastly, only innovativeness (B = 0.26; p < 0.001) seems to affect non-financial performance whereas proactiveness (B = 0.09; p = 0.111) and risk-taking (B = -0.01; p = 0.891) appear to be unrelated. Thus, only innovativeness seems to drive the performance outcomes of EO. We will return to the implications of these surprising findings within the discussion. Notably, the model fit is significantly better (χ^2 (12) = 66.65, p < 0.001. RMSEA = 0.006; SRMR = 0.038; TLI = 0.89; CFI = 0.89).

Insert Table 3 here

Post Hoc Analysis

In contrast to Rosenbusch et al. (2013), we also explore whether EO is more likely to be a partial rather than a full mediator in task environment to performance relationships. To

achieve this, we draw on a modification indices assessment in order to evaluate whether the inclusion or exclusion of certain paths will significantly change the observed model fit. Our results indicate four direct effects that are likely to improve the model fit. We included these direct effects step by step in descending order of their supposed impact. The model fit evaluations are shown in Table 4. Especially munificent environments seem to exert a strong direct effect on firm performance while hostile environments are negative for growth. Hence, EO is not a full mediator in all task environment to performance type relationships.

Insert Table 4 here

DISCUSSION

The purpose of the present study was to conduct a finer-grained replication study of Rosenbusch et al. (2013) to explore how component-level EO research may proceed (Anderson et al., 2015; Covin & Lumpkin, 2011; Miller, 2011; Wales, 2016). Contributing to evidence-based entrepreneurship research (Frese, Rousseau, & Wiklund, 2014), we find strong support for Miller's (2011) "best of both worlds" assertion, that future research should always report both aggregate and component-level findings. That is, while aggregate EO has tremendous conceptual and theoretical value, its components indeed exhibit significant variance in antecedent to component and component to outcome relationships (Miller, 2011). There is more to learn from component-level relationships than an aggregate glance would suggest.

Substantiating Rosenbusch et al. (2013)

Turning to our aggregate EO model, we find our observed effects to be almost equivalent to those reported by Rosenbusch et al. (2013). Thus, we concur that adopting a

higher level of EO is beneficial for firms operating in munificent, complex, and dynamic environments. However, regarding EO's effect on firm performance, our results suggest that EO is even more strongly related to higher levels of performance. Among the four elements of the task environment, we also observe that munificent environments seem to be most favorable for EO, whereas hostile environments do not affect EO. Pertaining to this non-significant finding, this could be attributed to the multifacetedness of hostility e.g., Zahra and Bogner (2000) find that the innovation--performance relationship is stronger in non-price driven hostilities than in price-driven ones. In addition to that, EO could also be perceived as a means to break clear of hostile environments by initiating change, but such strategic actions may not always be crowned with success and threaten firm survival (Covin & Slevin, 1989, 1991; Miller & Friesen, 1983). Furthermore, the degree to which a hostile environment is likely to affect the manifestation of EO could also be, in part, dependent upon the specialized resource stocks and capabilities of a firm (Anderson & Eshima, 2013; Wiklund & Shepherd, 2003). Therefore, it might be an exciting future research avenue to disentangle the interplay of resource stocks, different variants of hostility, and entrepreneurial behavior.

Beyond the Catchall: Component-Level Variation

Our component-level model of EO reveals compelling levels of detail on both antecedent to component and component to firm performance relationships.

The Task Environment and EO. First, it is important to note that hostility appears to be unrelated to all three components of EO. This observation suggests that the findings of Anderson et al. (2015) may not generalize well across a broader range of samples. However, this also indicates that there might be contexts or situations in which hostile environments may differently affect the components of EO. These ambiguities emphasize the need for primary studies to adopt "best of both worlds" reporting practices and to illuminate the impact of different hostility types on EO. Next, and in line with our aggregate findings

among the elements of the task environment, munificence has the most substantial effect on EO's components. Consequently, munificent environments appear to be the most active environmental driver of EO and seem to be especially conducive for the occurrence of innovative behavior.

The picture is getting more fragmented when we are turning to environmental dynamism and complexity. First, dynamic environments seem to facilitate innovativeness and to some lesser degree risk-taking, but do not affect proactiveness. This is surprising because one would expect that dynamic environments necessitate proactivity in order to keep with the rate of change. Rosenbusch et al. argue that "the rapid rate of change and difficulty in predicting future events require a high degree of proactivity." (2013: 637). A possible explanation for this observation could be that the M/CS scale is capturing proactiveness as beating competitors to the punch. For example, proactive firms adopt an "undo-the-competitors" posture and initiate actions to which competitors must respond (Covin & Slevin, 1989). However, highly dynamic environments may pressure firms to proactively drive new market entries in order to keep up with the occurring rate of change and not to apply pressure on competitors. Second, complex environments appear only to affect the proactiveness component of EO. A potential explanation could be that complex environments do not per se facilitate innovation or incentivize firms to take risks but may reward proactive firms. Firms in complex environments have to build strong learning capabilities to make sense of the amount and diversity of information provided by the environment and to put this to productive use (Cohen & Levinthal, 1990; Engelen, Kube, Schmidt, & Flatten, 2014; Rosenbusch et al., 2013; Zhao, Li, Lee, & Bo Chen, 2011). Consequently, such heterogenous environments may encourage firms to develop strong learning capabilities as a means to gain a competitive advantage. For example, by being the first to introduce new products that

competitors may find difficult to respond to because they might lack the required insights and intangible resources.

Performance Outcomes of EO. Turning to the performance relationships of EO's components, we find that innovativeness seems to be the sole driver of profitability, growth, and non-financial performance. Hence, while the other components of EO may help to define the domain of firm-level entrepreneurship, without innovation, there is no new entry (Covin & Miles, 1999; Rauch et al., 2009; Stevenson & Gumpert, 1985). The performance effects of innovativeness are, as anticipated, the lowest with profitability and highest with non-financial performance, leaving growth to be located in between. Hence, this research suggests that more specific EO—performance investigations are demanded, and more considerable attention needs to be paid to how mixed performance measures are constructed (Gupta & Wales, 2017).

The Mediating Role of EO

Our post hoc findings suggest that EO is not a full mediator of task environment to performance relationships, but too, the picture is more fine-grained. First, we observe that especially environmental munificence has distinct positive direct effects on all three performance types. Hence, such resource and opportunity-rich environments are, in general, beneficial for firm performance, irrespective of a certain level of EO. Thus, in the case of environmental munificence, EO is only a partial mediator. Here, it might be interesting for future studies to investigate to what degree EO is helping firms to get the most out of these environments. While hostility is unrelated to EO, we find that it has a negative direct effect on growth performance, suggesting that unfavorable environmental conditions are challenging or even impossible to mitigate, at least with EO. This finding is especially important to future studies that plan to assess environmental hostility as a moderator on EO--growth performance relationship. While hostility might seem to have a negative effect on the

posited relationship, it is not because of hostility is attenuating EO but is directly affecting growth, suggesting that hostility should be modeled as a predictor and not as a moderator. Regarding complexity and dynamism, we do not observe such strong direct effects for both, indicating that EO might be their missing performance link (Rosenbusch et al., 2013).

Controlling for Organizational Characteristics

Finally, our inclusion of firm size and age as important organizational controls reveals that firm size is positively, and firm age is negatively related to EO. This finding is intriguing considering that previous meta-analyses have, at times, found the EO—performance relationship to weaken as firms become larger (e.g., Saeed et al., 2014). These different effects of firm size and age on EO may also be considered as a notable finding because size and age are positively related to each other. This suggests that their relationships with EO seem to be more complex than it is typically assumed, and the current practice of casually including both as controls variables seems to provide little value. Hence, it is an important future research avenue to apply a finer-grained lens to the diverse mechanisms that are typically proxied through size and age.

LIMITATIONS

As with every meta-analysis, our study has, of course, some limitations which can, in part, be attributed to the underlying primary literature. First, we considered whether we could draw more extensively on contingency theory. Previous meta-analyses showed that industry effects e.g., high-tech vs. low-tech firms and characteristics of the formal and informal institutional environment, do affect EO to performance relationships (Rauch et al., 2009; Saeed et al., 2014). However, the inclusion of these additional external aspects proved to be difficult for several reasons. The industry type is coded from the sample description, and variables of the institutional environment are typically assigned based on the respective

sample's country of origin (see Saeed et al., 2014). Whereas a bivariate meta-analysis can employ meta-regression techniques and multi-level approaches to assess these variables as moderators, a MASEM has to rely on subgroup analyses in that case (Bergh et al., 2016; Cheung, 2015; Viechtbauer, 2010). Unfortunately, almost all subsamples do not exhibit a sufficient number of correlations for all relationships relevant to our models. Thus, the data is too thin or fragmented to perform a meaningful analysis. Relatedly, we also considered the inclusion of internal factors e.g., the MASEM of Miao, Coombs, Qian, and Sirmon (2017) observed that EO is a partial mediator in human and social capital to firm performance relationships. Yet, the correlational overlap of these two variables with various firm performance types and the elements of the task environment, was, again, too poor to allow for the inclusion of these two. Taken together, we considered providing a more comprehensive contingency driven view but data limitations made this impossible. Similarly, we tried to break our three performance categories further down into subjective/objective and relative/absolute performance measures. However, their application across studies is also too fragmented to be of use within a MASEM context.

Second, almost all studies in our database rely on cross-sectional data and are therefore prone to suffer from a number of biases. First, if the data is collected at the same point in time, we can only infer the strength of association between all variables but not if one variable is causally relating to another (Antonakis, Bendahan, Jacquart, & Lalive, 2010). For example, we may observe that firms with higher levels of EO tend to have higher performance levels, but it is impossible to tell if one is causing the other and to what degree. In addition to that, this lack of temporal sequences and patterns within the data, makes it impossible to account for potential feedback loops e.g., in order to secure future performance, high performing firms may reinvest resources to improve further or the actions of firms may also shape the nature and dynamics of their environments (Covin & Slevin, 1991; Miller &

Friesen, 1982). Moreover, this type of data is also agnostic to time-lag effects. These effects refer to the time it takes until a change in an environmental condition is affecting the manifestation of EO and in turn, how long it takes for a change in EO to cause a change in a specific performance outcome. Lastly, at any point in time, we can only observe surviving firms e.g., firms who were able to cope with their environments and whose entrepreneurial activities paid off, while others might have been eliminated from the larger population (Denrell, 2003). Due to this undersampling of failure, all inferences may only hold among surviving firms.

CONCLUSION

Recent calls for studies to adopt a "best of both worlds" approach appear warranted, and reporting practices must evolve (Miller, 2011). We provide cumulative evidence that the three core dimensions of EO are likely to unfold unique effects with antecedents and consequences. That is, depending on internal and external configurations, these dimensions could be differently manifested within firms (Miller, 2011). Therefore, firms that share comparable aggregate levels of EO might vary in their levels of innovativeness, proactiveness, and risk-taking. In turn, this component-level variation could lead to variations in how aggregate EO is related to antecedents and outcomes across these firms.

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APPENDIX

Figure 1. Aggregate Model of EO (For clarity of presentation, this and proceeding figures do not include endogenous error terms)

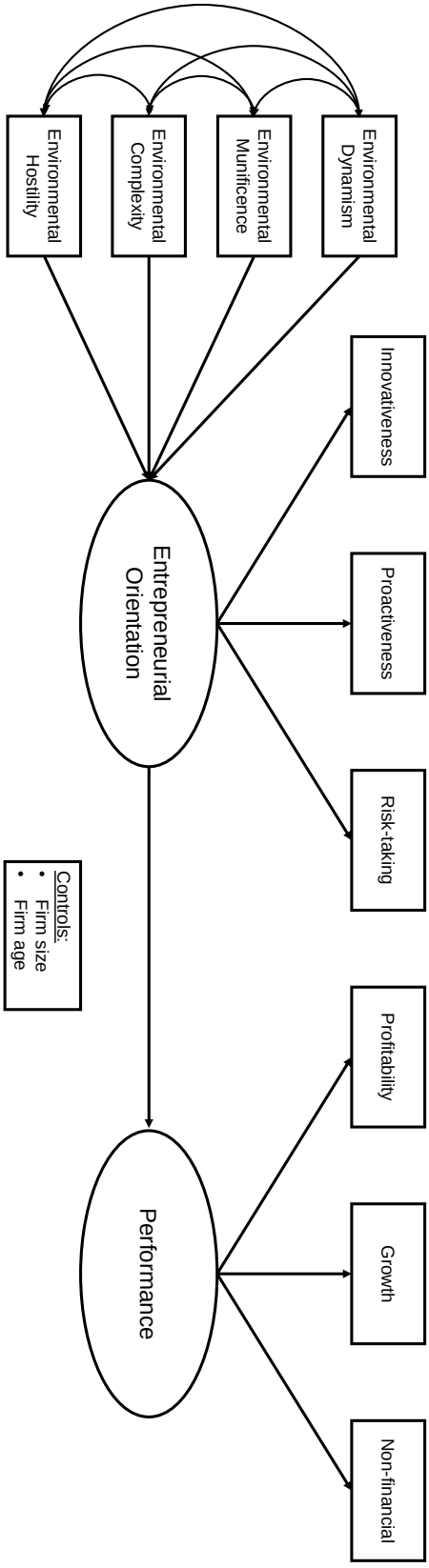

Figure 2. Independent Component-Level Model of EO

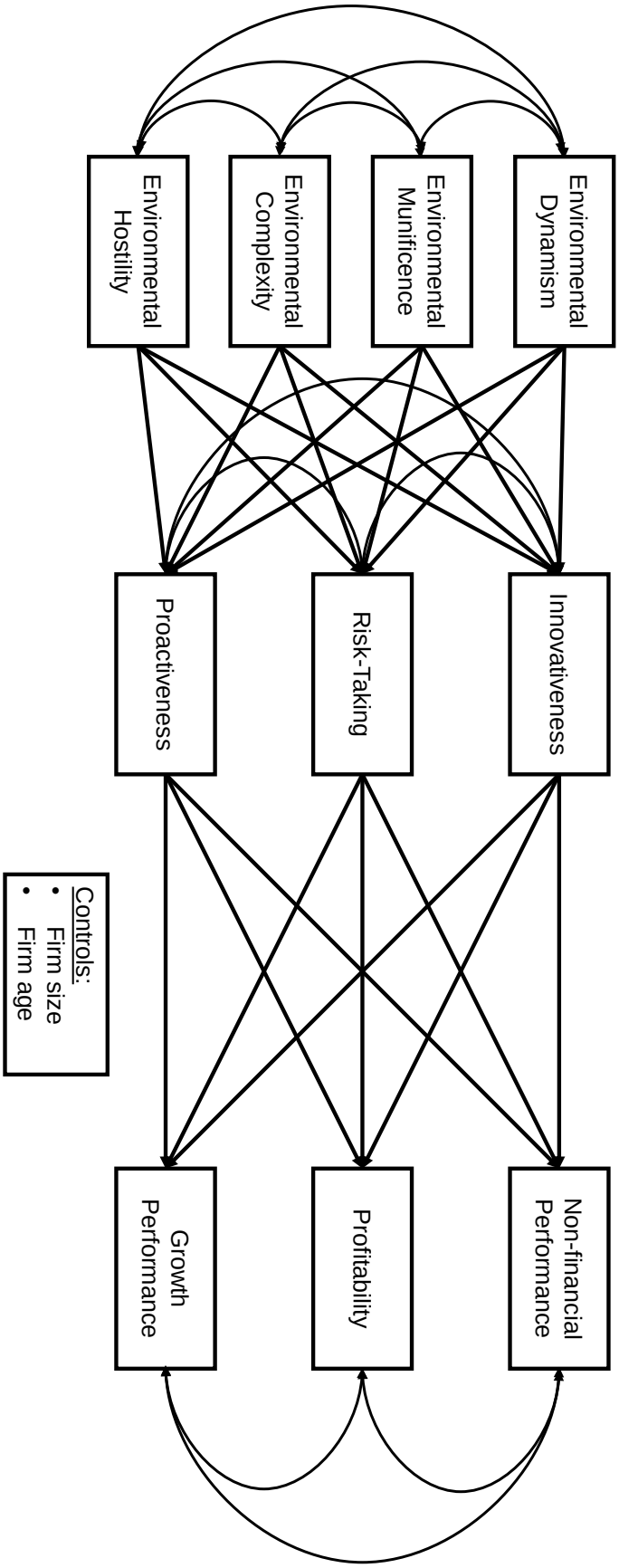

Table 1. Univariate Meta-Analysis – Pooled Correlations

Effect	k	N	Univariate									
			$\bar{r}$	SE	p-val	ci.lb	ci.ub	cr.lb	cr.ub	tau2	Q (df) p-val	I2
ED - EM	38	11,405	0.21	0.038	< 0.001	0.13	0.28	-0.08	0.50	0.051	828.31(37) < 0.001	94.84
ED - EH	69	14,995	0.23	0.026	< 0.001	0.18	0.28	-0.02	0.49	0.040	828.47(68) < 0.001	91.47
ED - EC	24	4,694	0.30	0.044	< 0.001	0.22	0.39	0.04	0.56	0.039	317.98(23) < 0.001	92.02
ED - IN	44	11,384	0.21	0.032	< 0.001	0.15	0.27	-0.04	0.47	0.038	711.76(43) < 0.001	92.27
ED - PR	30	8,104	0.11	0.033	< 0.001	0.05	0.18	-0.10	0.33	0.027	247.50(29) < 0.001	88.51
ED - RT	36	9,063	0.14	0.035	< 0.001	0.07	0.20	-0.12	0.39	0.038	442.95(35) < 0.001	91.27
ED - PF	28	5,077	0.11	0.028	< 0.001	0.06	0.17	-0.05	0.27	0.016	109.92(27) < 0.001	74.89
ED - NP	30	6,032	0.12	0.040	0.002	0.04	0.20	-0.15	0.39	0.043	475.64(29) < 0.001	90.93
ED - GP	27	6,282	0.07	0.036	0.041	0.00	0.14	-0.15	0.29	0.028	206.84(26) < 0.001	86.74
ED - FS	149	38,872	0.02	0.010	0.043	0.00	0.04	-0.11	0.15	0.010	529.02(148) < 0.001	72.46
ED - FA	113	28,185	-0.02	0.013	0.138	-0.04	0.01	-0.17	0.13	0.013	576.77(112) < 0.001	77.31
EM - EH	18	3,803	0.08	0.054	0.128	-0.02	0.19	-0.20	0.37	0.046	251.61(17) < 0.001	91.54
EM - EC	14	4,134	0.20	0.057	< 0.001	0.08	0.31	-0.08	0.47	0.042	321.06(13) < 0.001	94.03
EM - IN	18	5,881	0.22	0.052	< 0.001	0.12	0.33	-0.06	0.50	0.046	419.04(17) < 0.001	94.79
EM - PR	8	3,358	0.13	0.057	0.024	0.02	0.24	-0.08	0.33	0.022	96.11(7) < 0.001	89.32
EM - RT	10	3,967	0.19	0.061	0.001	0.07	0.31	-0.06	0.44	0.034	110.08(9) < 0.001	93.33
EM - PF	11	2,367	0.16	0.049	< 0.001	0.07	0.26	-0.03	0.36	0.021	64.41(10) < 0.001	83.13
EM - NP	14	3,156	0.18	0.049	< 0.001	0.09	0.28	-0.05	0.41	0.029	97.88(13) < 0.001	87.91
EM - GP	8	3,358	0.23	0.022	< 0.001	0.18	0.27	0.18	0.27	0.001	11.98(7) 0	27.27
EM - FS	45	13,264	0.04	0.016	0.012	0.01	0.07	-0.07	0.15	0.007	121.49(44) < 0.001	66.96
EM - FA	35	8,014	0.00	0.023	0.991	-0.05	0.04	-0.15	0.15	0.013	147.96(34) < 0.001	75.38
EH - EC	14	1,855	0.19	0.059	0.001	0.07	0.30	-0.08	0.46	0.041	122.34(13) < 0.001	86.91
EH - IN	35	8,006	0.11	0.027	< 0.001	0.06	0.16	-0.07	0.29	0.020	186.06(34) < 0.001	82.61
EH - PR	28	6,444	0.05	0.030	0.076	-0.01	0.11	-0.13	0.24	0.020	194.34(27) < 0.001	82.84
EH - RT	31	6,629	0.05	0.021	0.027	0.01	0.09	-0.07	0.16	0.008	82.34(30) < 0.001	61.64
EH - PF	19	3,670	0.03	0.043	0.531	-0.06	0.11	-0.19	0.25	0.028	97.66(18) < 0.001	84.22
EH - NP	18	4,875	0.09	0.037	0.013	0.02	0.16	-0.09	0.28	0.020	112.50(17) < 0.001	84.40
EH - GP	20	3,901	-0.06	0.026	0.020	-0.11	-0.01	-0.18	0.06	0.008	52.39(19) < 0.001	60.86
EH - FS	98	23,488	0.02	0.011	0.057	0.00	0.04	-0.09	0.13	0.007	268.059(97) < 0.001	64.19
EH - FA	73	19,636	0.00	0.009	0.923	-0.02	0.02	-0.06	0.06	0.002	105.99(72) 0	32.72
EC - IN	10	2,344	0.17	0.074	0.020	0.03	0.32	-0.13	0.48	0.050	131.97(9) < 0.001	92.90
EC - PR	10	2,920	0.16	0.052	0.001	0.06	0.26	-0.04	0.36	0.022	51.00(9) < 0.001	86.00
EC - RT	13	3,065	0.10	0.044	0.029	0.01	0.18	-0.08	0.28	0.018	54.56(12) < 0.001	80.21
EC - PF	7	1,431	0.16	0.051	0.001	0.06	0.26	0.01	0.32	0.012	25.219(6) < 0.001	71.64
EC - NP	7	1,828	0.17	0.085	0.042	0.01	0.34	-0.12	0.47	0.046	89.75(6) < 0.001	93.08
EC - GP	9	1,028	0.05	0.067	0.442	-0.08	0.18	-0.19	0.29	0.030	42.18(8) < 0.001	77.78
EC - FS	26	6,027	0.03	0.013	0.033	0.00	0.05	0.01	0.04	0.000	14.51(25) 1	0.00
EC - FA	20	4,067	0.01	0.025	0.820	-0.04	0.05	-0.10	0.11	0.007	43.13(19) 0	56.64
IN - PR	111	31,275	0.48	0.019	< 0.001	0.44	0.52	0.23	0.73	0.038	2588.51(110) < 0.001	95.74
IN - RT	121	32,595	0.40	0.017	< 0.001	0.37	0.44	0.17	0.63	0.032	2156.41(120) < 0.001	93.35
IN - PF	31	8,445	0.14	0.032	< 0.001	0.08	0.21	-0.07	0.36	0.027	408.18(30) < 0.001	88.86
IN - NP	36	9,221	0.28	0.039	< 0.001	0.20	0.35	-0.01	0.57	0.050	1168.78(35) < 0.001	94.66
IN - GP	32	10,767	0.24	0.033	< 0.001	0.17	0.31	0.01	0.47	0.032	746.20(31) < 0.001	92.96
IN - FS	90	24,370	0.08	0.013	< 0.001	0.05	0.10	-0.05	0.20	0.010	290.29(89) < 0.001	72.45
IN - FA	66	16,866	-0.02	0.011	0.109	-0.04	0.00	-0.10	0.06	0.004	133.54(65) < 0.001	50.54
PR - RT	121	36,107	0.41	0.019	< 0.001	0.37	0.44	0.15	0.66	0.038	2598.76(120) < 0.001	95.14
PR - PF	29	7,404	0.11	0.036	0.001	0.04	0.18	-0.12	0.35	0.032	282.25(28) < 0.001	89.55
PR - NP	20	5,755	0.22	0.038	< 0.001	0.15	0.30	0.02	0.43	0.025	232.52(19) < 0.001	88.44
PR - GP	29	9,806	0.20	0.044	< 0.001	0.12	0.29	-0.10	0.51	0.053	790.51(28) < 0.001	95.50
PR - FS	63	18,637	0.09	0.015	< 0.001	0.06	0.12	-0.03	0.21	0.009	191.06(62) < 0.001	72.18
PR - FA	42	11,560	-0.01	0.018	0.507	-0.05	0.02	-0.14	0.11	0.009	185.54(41) < 0.001	72.38
RT - PF	29	6,790	0.09	0.038	0.017	0.02	0.16	-0.15	0.33	0.035	251.65(28) < 0.001	89.51
RT - NP	21	6,003	0.12	0.045	0.006	0.04	0.21	-0.13	0.38	0.038	248.35(20) < 0.001	91.89
RT - GP	33	10,202	0.13	0.040	< 0.001	0.05	0.21	-0.15	0.41	0.047	792.75(32) < 0.001	94.24
RT - FS	81	21,721	0.05	0.015	< 0.001	0.03	0.08	-0.09	0.19	0.012	297.98(80) < 0.001	76.25
RT - FA	54	13,352	-0.05	0.015	< 0.001	-0.08	-0.02	-0.16	0.06	0.007	162.00(53) < 0.001	63.23
PF - NP	27	9,692	0.32	0.053	< 0.001	0.21	0.42	-0.03	0.67	0.071	1220.29(26) < 0.001	97.46
PF - GP	20	3,540	0.40	0.060	< 0.001	0.28	0.51	0.05	0.74	0.068	449.28(19) < 0.001	96.37
PF - FS	50	12,924	0.06	0.022	0.009	0.01	0.10	-0.12	0.23	0.018	279.88(49) < 0.001	82.63
PF - FA	39	12,675	0.01	0.020	0.736	-0.03	0.05	-0.13	0.14	0.011	162.01(38) < 0.001	77.66
NP - GP	14	2,648	0.30	0.070	< 0.001	0.17	0.44	-0.03	0.64	0.063	348.08(13) < 0.001	95.44
NP - FS	43	11,407	0.23	0.046	< 0.001	0.14	0.31	-0.15	0.60	0.085	3873.09(42) < 0.001	98.20
NP - FA	39	11,897	0.19	0.028	< 0.001	0.14	0.25	-0.02	0.40	0.027	377.20(38) < 0.001	90.12
GP - FS	46	11,081	0.06	0.026	0.025	0.01	0.11	-0.15	0.27	0.027	332.55(45) < 0.001	86.96
GP - FA	43	7,898	-0.08	0.025	< 0.001	-0.13	-0.03	-0.27	0.11	0.021	223.23(42) < 0.001	80.55
FS - FA	256	70,543	0.20	0.012	< 0.001	0.18	0.23	-0.04	0.44	0.035	4065.36(255) < 0.001	92.25

Notes: ED = environmental dynamism; EM = environmental dynamism; EC = environmental complexity; EH = environmental hostility; IN = innovativeness; PR = proactiveness; RT = risk-taking; PF = profitability; GP = growth performance; NP = non-financial performance; MP = mixed performance; FS = firm size; FA = firm age; k = number of independent samples; N = total sample size; $\bar{r}$ = inverse variance weighted mean correlation; SE = standard error; p-val = p-value; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; cr.lb = 80% credibility interval lower bound; cr.ub = 80% credibility interval upper bound; tau2 = estimated between-study heterogeneity; Q = Q statistic; I2 = proportion of total variation due to between-study heterogeneity.

Table 2. Aggregate EO Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Environmental Hostility → Entrepreneurial Orientation	0.01	0.032	-0.06	0.07	0.30	0.767
Environmental Dynamism → Entrepreneurial Orientation	0.14	0.038	0.06	0.21	3.64	< 0.001
Environmental Munificence → Entrepreneurial Orientation	0.35	0.044	0.26	0.44	7.87	< 0.001
Environmental Complexity → Entrepreneurial Orientation	0.13	0.057	0.01	0.24	2.18	0.029
Entrepreneurial Orientation → Performance	0.52	0.042	0.44	0.61	12.47	< 0.001
Environmental Dynamism ↔ Environmental Hostility	0.23	0.025	0.18	0.28	9.36	< 0.001
Environmental Dynamism ↔ Environmental Munificence	0.21	0.037	0.13	0.28	5.51	< 0.001
Environmental Dynamism ↔ Environmental Complexity	0.30	0.044	0.21	0.38	6.87	< 0.001
Environmental Hostility ↔ Environmental Munificence	0.08	0.051	-0.02	0.18	1.50	0.134
Environmental Hostility ↔ Environmental Complexity	0.18	0.057	0.07	0.30	3.23	0.001
Environmental Munificence ↔ Environmental Complexity	0.20	0.057	0.08	0.31	3.44	0.001
Controls						
Firm Size ↔ Environmental Hostility	0.02	0.011	0.00	0.04	2.06	0.040
Firm Size ↔ Environmental Dynamism	0.02	0.010	0.00	0.04	2.15	0.032
Firm Size ↔ Environmental Munificence	0.04	0.015	0.01	0.07	2.84	0.005
Firm Size ↔ Environmental Complexity	0.03	0.013	0.00	0.05	2.12	0.034
Firm Size → Entrepreneurial Orientation	0.10	0.014	0.08	0.13	7.30	< 0.001
Firm Size → Performance	0.08	0.032	0.02	0.15	2.59	0.010
Firm Age ↔ Environmental Hostility	0.00	0.009	-0.02	0.02	0.05	0.958
Firm Age ↔ Environmental Dynamism	-0.02	0.012	-0.04	0.00	-1.62	0.104
Firm Age ↔ Environmental Munificence	0.00	0.022	-0.04	0.05	0.16	0.876
Firm Age ↔ Environmental Complexity	0.01	0.023	-0.04	0.06	0.43	0.668
Firm Age → Entrepreneurial Orientation	-0.06	0.016	-0.09	-0.03	-3.60	< 0.001
Firm Age → Performance	0.06	0.028	0.00	0.11	2.09	0.037
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.40	< 0.001
Model fit: χ^2 (36) = 139.52, p < 0.001; RMSEA = 0.005; SRMR = 0.051; TLI = 0.93; CFI = 0.96						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 3. Independent Component-Level Model

	B	SE	ci.lb	ci.ub	z-value	p-value
Direct Effects						
Environmental Hostility → Innovativeness	0.02	0.035	-0.05	0.09	0.563	0.574
Environmental Dynamism → Innovativeness	0.13	0.042	0.04	0.21	3.002	0.003
Environmental Munificence → Innovativeness	0.31	0.054	0.19	0.41	5.652	< 0.001
Environmental Complexity → Innovativeness	0.11	0.080	-0.05	0.27	1.380	0.168
Environmental Hostility → Proactiveness	0.00	0.036	-0.07	0.07	0.022	0.982
Environmental Dynamism → Proactiveness	0.05	0.042	-0.04	0.13	1.127	0.260
Environmental Munificence → Proactiveness	0.15	0.084	-0.01	0.30	1.782	0.075
Environmental Complexity → Proactiveness	0.12	0.061	0.00	0.24	1.987	0.047
Environmental Hostility → Risk-Taking	0.00	0.026	-0.05	0.05	0.139	0.889
Environmental Dynamism → Risk-Taking	0.09	0.043	0.00	0.17	1.959	0.050
Environmental Munificence → Risk-Taking	0.18	0.080	0.03	0.33	2.263	0.024
Environmental Complexity → Risk-Taking	0.04	0.053	-0.07	0.14	0.679	0.497
Innovativeness ↔ Proactiveness	0.37	0.035	0.31	0.44	10.716	< 0.001
Innovativeness ↔ Risk-Taking	0.29	0.033	0.23	0.36	9.073	< 0.001
Proactiveness ↔ Risk-Taking	0.34	0.026	0.29	0.39	13.492	< 0.001
Innovativeness → Profitability	0.15	0.047	0.06	0.24	3.198	0.001
Proactiveness → Profitability	0.03	0.054	-0.07	0.14	0.629	0.529
Risk-Taking → Profitability	0.03	0.051	-0.07	0.12	0.501	0.617
Innovativeness → Growth Performance	0.23	0.060	0.11	0.34	3.823	< 0.001
Proactiveness → Growth Performance	0.08	0.095	-0.09	0.26	0.837	0.402
Risk-Taking → Growth Performance	0.02	0.070	-0.11	0.15	0.304	0.761
Innovativeness → Non-financial Performance	0.26	0.056	0.15	0.37	4.556	< 0.001
Proactiveness → Non-financial Performance	0.09	0.059	-0.02	0.21	1.594	0.111
Risk-Taking → Non-financial Performance	-0.01	0.060	-0.13	0.11	-0.138	0.891
Profitability ↔ Growth Performance	0.34	0.061	0.22	0.46	5.489	< 0.001
Non-financial Performance ↔ Growth Performance	0.21	0.071	0.07	0.35	2.985	0.003
Profitability ↔ Non-financial Performance	0.25	0.054	0.14	0.35	4.619	< 0.001
Controls						
Firm Size ↔ Environmental Hostility	0.02	0.011	0.00	0.04	2.115	0.035
Firm Size ↔ Environmental Dynamism	0.02	0.010	0.00	0.04	2.207	0.027
Firm Size ↔ Environmental Munificence	0.04	0.015	0.02	0.07	2.913	0.004
Firm Size ↔ Environmental Complexity	0.03	0.013	0.00	0.05	2.150	0.032
Firm Size → Innovativeness	0.06	0.014	0.03	0.09	4.385	< 0.001
Firm Size → Proactiveness	0.08	0.015	0.05	0.11	5.384	< 0.001
Firm Size → Risk-Taking	0.06	0.015	0.03	0.08	3.716	< 0.001
Firm Size → Growth Performance	0.05	0.028	0.00	0.11	1.846	0.065
Firm Size → Non-financial Performance	0.16	0.046	0.07	0.25	3.416	< 0.001
Firm Age ↔ Environmental Hostility	0.00	0.009	-0.02	0.02	0.241	0.810
Firm Age ↔ Environmental Dynamism	-0.02	0.012	-0.04	0.00	-1.591	0.112
Firm Age ↔ Environmental Munificence	0.00	0.022	-0.05	0.04	-0.190	0.850
Firm Age ↔ Environmental Complexity	0.01	0.023	-0.04	0.06	0.458	0.647
Firm Age → Innovativeness	-0.03	0.014	-0.06	0.00	-1.896	0.058
Firm Age → Proactiveness	-0.03	0.019	-0.06	0.01	-1.389	0.165
Firm Age → Risk-Taking	-0.06	0.016	-0.09	-0.03	-3.743	< 0.001
Firm Age → Growth Performance	-0.08	0.026	-0.13	-0.03	-3.231	0.001
Firm Age → Non-financial Performance	0.16	0.030	0.10	0.22	5.312	< 0.001
Firm Size ↔ Firm Age	0.20	0.012	0.18	0.22	16.406	< 0.001
Model fit: χ^2 (12) = 66.651, p < 0.001; RMSEA = 0.006; SRMR = 0.038; TLI = 0.89; CFI = 0.98						

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRM = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path; ↔ = correlation.

Table 4. Post Hoc Analysis

Model	Additional Modifications	B	SE	ci.lb	ci.ub	z-value	p-value	Chi^2
Baseline	Independent Component-Level Model							66.65
1	Environmental Munificence → Growth Performance	0.17	0.032	0.11	0.24	5.41	< 0.001	39.68
2	Environmental Munificence → Growth Performance	0.18	0.032	0.11	0.24	5.47	< 0.001	28.30
	Environmental Hostility → Growth Performance	-0.10	0.029	-0.15	-0.04	-3.34	< 0.001	
3	Environmental Munificence → Growth Performance	0.18	0.032	0.12	0.25	5.73	< 0.001	17.81
	Environmental Hostility → Growth Performance	-0.10	0.029	-0.16	-0.04	-3.43	< 0.001	
	Environmental Munificence → Profitability	0.17	0.050	0.07	0.26	3.31	< 0.001	
4	Environmental Munificence → Growth Performance	0.19	0.031	0.13	0.25	5.97	< 0.001	10.95
	Environmental Hostility → Growth Performance	-0.10	0.029	-0.16	-0.04	-3.47	< 0.001	
	Environmental Munificence → Profitability	0.17	0.049	0.07	0.27	3.47	< 0.001	
	Environmental Munificence → Non-financial Performance	0.14	0,052	0.04	0.24	2.65	0.008	

Notes: B = unstandardized regression coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; → = directional path.

THE CHICKEN OR THE EGG? CAUSAL INFERENCE IN ENTREPRENEURIAL ORIENTATION–PERFORMANCE RESEARCH

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ABSTRACT

While entrepreneurial orientation (EO) seems to relate to many things, we lack robust knowledge of causal EO relationships. Addressing this gap is difficult, however, because EO is not something manipulatable in a laboratory. We explore the challenges of establishing causal relationships with a systematic review of EO–performance research. We then use a simulation to show how two popular research designs limit our ability to make causal claims. Lastly, we outline the research design considerations necessary to move from associational to causal EO–performance research. For transparency, we post all code and data on the *Open Science Framework* at http://bit.ly/2SVic1c.

INTRODUCTION

Most scholars agree that firms with an entrepreneurial orientation (EO) perform better than conservatively managed firms (Stam & Elfring, 2008). EO scholars base this agreement on a large body of observational research suggesting an *association* between EO and performance (Covin & Wales, 2019). EO research was, and remains, observational, perhaps because there is no practical—or ethical—way for a researcher to manipulate EO. As much as we would like, researchers cannot randomly assign one firm to a "being entrepreneurial" condition and another firm to a "being conservative" condition and see which one performs better. This is unfortunate, because ultimately what we want to know is whether EO *causes* a firm to perform better than its conservatively managed peer, and if so, by how much. Understanding whether EO causes a performance advantage is a critical step in building predictive theory (Goldfarb & King, 2016), and provides actionable insights for managers (Ghoshal, 2005).

Not being able to assign firms to an EO condition robs researchers of the single best tool to establish causal relationships, the randomized controlled experiment (Angrist & Pischke, 2008). Because EO researchers cannot utilize the laboratory, they must turn to alternative research designs and empirical approaches to attempt to recover causal estimates (Angrist & Imbens, 1995). Unfortunately, EO researchers rarely take this step (Rauch, Wiklund, Lumpkin, & Frese, 2009; Rosenbusch, Brinckmann, & Bausch, 2011; Rosenbusch, Rauch, & Bausch, 2013). The net result is a plethora of studies establishing associational relationships but little research establishing causal effects, which limits EO's usefulness (Covin & Lumpkin, 2011).

The purpose of our study is to help EO researchers move from associational research to causal research. We start with a systematic review of recent EO–performance studies published in top management journals. We use Shadish, Cook, and Campbell's (2002) causal

inference schema to evaluate the extent to which EO researchers adopt research designs and statistical tools to better establish a causal claim. We then discuss the pressing challenges EO researchers face to establish a causal effect of EO on performance. In doing so, this research responds to calls for a more robust consideration of causal inference in management research (Antonakis, 2017; Antonakis, Bendahan, Jacquart, & Lalive, 2010).

At the outset, we note that our discussion centers largely on the classic Miller (1983) / Covin and Slevin (1989) EO conceptualization. This conceptualization dominates empirical work in EO and is a useful perspective to ground this paper. There are other EO conceptualizations, which by definition change the importance of various threats to causal inference and their respective remedies, as discussed throughout the paper. We also address the question of causal inference when a researcher conceives of EO as predominantly behavioral, dispositional, or some combination thereof (Covin & Wales, 2019). This is an ongoing discussion in the EO literature and one that is difficult to resolve given the myriad ways in which EO can manifest (George & Marino, 2011). However, the applicability of various threats and their remedies vary depending on the ontological assumptions made by the researcher about EO.

Drawing from our review, we then use a simulation to show how two common research designs yield biased estimates under assumptions often found in EO–performance research. For parsimony, we focus on two designs found in the EO literature, although we encourage researchers to employ simulations in their workflow to evaluate model efficacy and the veracity of model assumptions (Gelman et al., 2013). We conclude by outlining the key considerations in designing an EO–performance study meant to estimate a causal effect. While we focus on EO, we also believe that our discussion is useful for strategic entrepreneurship and management scholars employing other broad, multidimensional constructs to capture organizational phenomenon (i.e., market orientation; Gupta, Atav &

Dutta, 2019). While researchers can find general discussions of causal inference and endogeneity in a variety of literatures, we believe a contribution of this paper is to highlight specific concerns that EO researchers, and scholars working with similar constructs, should pay attention to and remedy in their empirical work.

Our paper also sidesteps the conversation on whether observational research may yield causal claims (Pearl, 2009; Rubin, 2005). From our perspective, a well designed and executed EO study, with a strong theoretical rationale for the research model and accounting for omitted variables and other sources of endogeneity, moves the EO conversation from a descriptive to a predictive theoretical lens. We do not believe that there is a perfect EO study that will yield a perfectly unbiased and consistent estimate of a causal effect, as is also the case with other unobservables in management and organizational research. Our objective is not perfection, but rather advancement: to help EO scholars identify specific concerns and potential remedies that improve model efficacy, guide future EO research, and increase the usefulness of empirical EO studies (Anderson, Wennberg, & McMullen, 2019). For transparency, we post all code and data used in our simulations on the *Open Science Framework* at http://bit.ly/2SVic1c.

CHALLENGES TO ESTABLISHING CAUSAL EO RELATIONSHIPS

It is exceptionally difficult to establish causal relationships in social science (Morgan & Winship, 2007). Noisy, stochastic data and processes are an integral part of studying people, organizations, institutions, societies, and the complex interactions between them (Holland, 1986; Rubin, 1974). This is particularly true for strategic entrepreneurship research, which seeks to explain the causes and consequences of firm-level activities that organizations use to explore new markets and to exploit new innovations (Ireland, Hitt, & Sirmon, 2003).

While practically difficult, it is conceptually straightforward to identify the conditions under which a researcher may claim a causal association from one variable to another. Popular causal frameworks in the social science literature include the Rubin causal model (Angrist & Pischke, 2008; Rubin, 2005), and the structural causal model (Pearl, 2009). But the guidelines laid out by Shadish et al. (2002) are perhaps most familiar to entrepreneurship researchers. According to Shadish et al. (2002), there are three necessary and sufficient conditions to establish a causal relationship between the predictor, x, and the outcome, y: 1) temporal sequencing—a change in x must come before a change in y; 2) covariation—a change in x must result in a change in y; and 3) elimination of alternate explanations—there must not be any omitted variable accounting for the variation in y as x varies.

The heuristic-based approach of Shadish et al. (2002) provides a guide to evaluate the state of causal inference in EO–performance research. With our review, we sought to identify the ways in which EO scholars estimated causal effects and recovered consistent parameter estimates in their models. We also sought to highlight the challenges unique to EO research that hamper our ability to make a causal claim. Our intent is not to criticize prior EO research, but rather to illustrate that what we know about the EO–performance relationship may not be what we think we know (Adams, 2016). EO research, like other research using multidimensional constructs with competing conceptualizations and measurement models (e.g., market orientation; Gupta et al., 2019), has specific challenges in estimating causal effects, as we describe. Next, we evaluate the state of the EO-performance literature.

Literature Search and Selection

To evaluate the "state of the science" of EO–performance research, we conducted a comprehensive search for published studies in *Science Direct*, *EBSCO Host* and *ISI Web of Science.* In order to capture studies in which researchers employ the EO construct, but may

use a different label, we used three keywords—"entrepreneurial orientation"; "corporate entrepreneurship;" and "strategic posture"—yielding 694 potentially relevant studies.

From this set, we employed the following filter. First, we included studies that report a unidimensional and/or multidimensional measure of EO consisting of the three core dimensions (innovativeness, proactiveness, and risk-taking) as proposed by Miller (1983). The Miller (1983)/Covin and Slevin (1989) conceptualization of EO is the most frequently employed EO conceptualization and its three core dimensions generally feature in other EO conceptualizations in some manner (George & Marino, 2011; Rauch et al., 2009; Wales, Gupta, & Mousa, 2013). Second, we excluded studies that do not report an EO–performance hypothesis, and we excluded performance variables solely focused on international performance because these provide only fragmented or partial accounts of a firm's overall performance. Third, we excluded samples of nonprofit and public administration organizations because these organizations generally conceptualize EO and performance differently than for-profit firms (Morris, Webb, & Franklin, 2011). Fourth, we included those studies where EO referred to organizational strategy or an overarching firm-level strategic posture or attribute (Covin & Wales, 2012). Finally, we applied a journal quality filter consisting of the *Web of Science Journal Citation Reports Top-25 Journals* (from Business, Management and Applied Psychology); 4* and 4 rated journals from the *Chartered Association of Business Schools Journal Ranking List* (General Management, Ethics, and Social Responsibility / Organization Studies); and journals from the *Financial Times 50*.

We then constrained our sample to articles published in 2009 through the end of 2017. We began in 2009 because this was the year Rauch et al. (2009) published the first, and now widely cited, meta-analysis on EO–performance research. Starting in 2009 also allowed us to focus on studies with more modern research designs and empirical methods. We note that the Rauch et al. (2009) meta-analysis contains only observational studies, and is thus subject to

similar concerns about endogeneity and causal inference. Our filtering procedure yielded twenty-seven eligible studies, listed in Table 1. While this list is certainly not a complete census of EO–performance studies, using the quality of the journal as a proxy for the "state of the science" and by focusing only on recent papers, we feel comfortable that our review reflects current practice among EO scholars.

In Figure 1 we summarize the number of EO–performance studies in our sample over time, broken down by data source. This visualizes how EO scholars approach collecting data. As with Rauch et al. (2009), the vast majority of EO–performance studies draw from primary data (~ 70%), although there is a growing number of studies making use of secondary data or mixed-method designs. In Figure 2, we summarize EO–performance studies by the structure of the data (cross-sectional, lagged, and panel) and the measurement instrument used. Again, similar to Rauch et al. (2009), our review shows the literature dominated by studies employing the nine-item psychometric Covin and Slevin (1989) scale using cross-sectional survey designs. However, we do find five studies employing a lagged predictor, and three additional studies using some form of longitudinal data. Figure 3 summarizes how the reviewed studies reflect main threats to causal inference. While some studies address measurement error, discuss simultaneity issues, or include appropriate covariates, no single study considers these endogeneity threats jointly. In the following sections, we apply the heuristic of Shadish et al. (2002) to contextualize the implications of these challenges in EO research.

Insert Figures 1 and 2, and Table 1 about here

Temporal Sequencing Between EO and Performance

The first of the Shadish et al. (2002) criteria is, in some ways, the trickiest to meet. Temporal sequencing is a function of research design and data collection—the change in the

predictor, x, precedes the observed value in the outcome, y (Morgan & Winship, 2007, 2014). In an experiment, the researcher easily meets the criteria; the researcher randomly assigns participants to a manipulation and then records the outcome. But with observational research where the researcher measures both predictor and outcome, it is much harder to satisfy temporal sequencing. The driving issue is not necessarily collecting data on the predictor and outcome at different times, but rather establishing the temporal sequencing of the *change* in both variables.

Consider a researcher collecting data on a firm's EO and sales in year t, who then returns to the firm and collects sales data one year later, $t + 1$. The researcher calculates sales growth as the percentage change in sales from t to $t + 1$, and models the relationship between EO and sales growth as $Sales\ Growth\ Rate_{t+1} = \alpha + \beta_{EO_t} + \epsilon$. On the surface, it would seem that the researcher satisfied the temporal sequencing criteria—the measure of EO happened before the measure of sales growth—but this is an incorrect assumption. The problem is that the researcher did not measure a change in EO before observing the change in sales growth (Morgan & Winship, 2014). Temporal sequencing requires the *variation* in x happening before variation in y (Pearl, 2009). While the above design might illustrate an association (covariance) between the level of EO and the observed change in sales growth, it would not establish—nor would it help infer—a causal connection between EO and sales growth rate.

In our review, we did not identify an EO–performance study that captured a change in EO, and researchers relied on cross-sectional data for 19 of the 27 studies (~ 70%). Eight studies incorporated either a temporal lag between EO and performance (5), or used panel data (3) that would potentially allow for temporal separation. However, even in studies allowing this separation, EO researchers face two specific problems. First, across conceptualizations, EO researchers generally agree that in order to garner the entrepreneurial

label, a firm must exhibit a sustained pattern of entrepreneurial activities, as Covin and Lumpkin (2011: 858) noted, “In short, firms can engage in entrepreneurial behaviors but not be recognized as entrepreneurial firms if the entrepreneurial acts do not persist to some degree over time.” In practice, this means that EO is theoretically expected to vary little over time; EO is a reasonably stable firm trait (Covin & Lumpkin, 2011; Covin & Wales, 2012). Thus, a paradox in EO research: to establish a causal relationship between EO and performance a change in EO must happen before the observed change in performance, but a firm’s EO does not change much.

The second problem EO researchers face, even with temporal sequencing and if the researcher was able to observe a change in EO before measuring performance, for instance, EO is observed to “cycle” from low-to-high in response to an environmental exigency (Wales, Monsen, & McKlevie, 2011), is whether the specified lag for performance examined represents the “true” underlying temporal distance required for a change in EO to cause a change in performance (Bergh & Fairbank, 2002). The challenge of justifying the temporal distance between x and y is not unique to EO. Like other strategy and entrepreneurship constructs, the lag used by the researcher is often one of convenience (i.e., when data could be collected), or necessity (i.e., how the data was collected and stored) (Bergh & Fairbank, 2002). But justifying the lag requires EO researchers to confront a unique problem—the “correct” choice of lag depends heavily on understanding how, and when, EO theoretically should cause the outcome.

For example, Covin and Slevin (1991) argued that EO is a resource-consuming strategic posture such that generating and sustaining EO requires a firm to expend its resources. Extending this argument leads to the hypothesis that, over the short term, a high EO firm sacrifices short-term profitability. Over the long term, however, the firm expects investments in EO to result in sustained growth that generates new profits to fund further

entrepreneurial investments (Eshima & Anderson, 2017). Depending on when the researcher sets the lag, we might expect EO to have a negative effect on profitability, no material effect on profitability, or a positive effect on profitability. Absent accounting for these differences, and for potential confounding factors that may enter into the study window as time progresses, an EO researcher risks drawing an incorrect nomological conclusion about an EO–profitability relationship.

Covariation Between EO and Performance

The second criteria to establish a causal effect involves decisions in both the design and data analysis stage. The researcher's hurdle is to establish a non-spurious relationship between x and y—the observed covariation *must* occur consistently, or if the covariation depends on a moderator, the researcher must account for that moderator (Angrist & Pischke, 2008; Pearl, 2009). While we often think of establishing covariation in terms of a statistical relationship, covariation very much begins with a theoretical justification (Antonakis et al., 2010).

There is no shortage of research establishing a covariance between EO and various performance outcomes (Rauch et al., 2009). But the most significant theoretical consideration is the existence of three different—and in some ways, competing—EO conceptualizations (Covin & Wales, 2019). The most common conceptualization in empirical EO research broadly, and in our review specifically, is from Miller (1983) / Covin and Slevin (1989). Here, EO is the shared variance among three underlying dimensions—innovativeness, proactiveness, and risk-taking; what is common among the dimensions gives meaning to being entrepreneurial. Lumpkin and Dess (1996) offer a second EO conceptualization, viewing EO as a constellation of distinct firm-level attributes, and adding two further dimensions: competitive aggressiveness and autonomy. Anderson et al. (2015) offer a third EO conceptualization, viewing EO through a constructivist lens as formed by the total

variance in the firm's entrepreneurial behaviors and the attitude towards risk among its senior managers. As Covin and Wales (2019) noted, each conceptualization is logically and ontologically consistent and represents an appropriate and constructive way to define what it means for a firm to be entrepreneurial. Therein lies the first challenge—because each conceptualization approaches EO very differently, empirical models and estimates of causal effects are *not* directly comparable across conceptualizations.

Even within a single conceptualization, different measurement instruments for the same conceptualization may yield different empirical effects. As shown in Figure 2, among the cross-sectional studies, researchers measured EO in a total of eight different ways (the "Other" category included EO measures used in only one study), with most adopting the Miller / Covin and Slevin conceptualization. Now consider that among these studies, one identifies a curvilinear effect of EO on performance, another finds a null effect of EO on performance, and another yields a positive effect of EO on performance. Holding constant the differences in sampling variance, one or more studies—although impossible to know which one—is misspecified. The challenge is that, conceptually and empirically, the three studies are not directly comparable because they used different measures (Aguinis, Ramani, & Alabduljader, 2018).

Elimination of Alternate Explanations

The final criteria to establish a causal effect is by far the most difficult—eliminating alternate explanations for the observed covariation between x and y. In observational research, there is never a condition in which a researcher can assume away alternate explanations; the unobserved variables representing the "true" relationship that went unmodeled by the researcher (Angrist & Pischke, 2008). When omitted from a model, these variables induce bias in the estimate of the relationship between the observed x and y, a condition commonly referred to as endogeneity (Antonakis et al., 2010). For a general

introduction to endogeneity and potential remedies in the management literature, we refer readers to Antonakis et al. (2010) and Semadeni et al. (2014). We wish to focus here on three endogeneity issues of specific concern to EO researchers: selection effects, omitted covariates, and measurement error. These three issues individually are common in management research. But what makes them troubling for EO researchers is that all three are generally present in any given EO study.

Insert Figure 3 about here

Turning to Figure 3, there is a noticeable "0" in the space that would have contained the number of studies that included four key covariates (firm size, industry, firm age, and the firm's task environment, which we elaborate on below), discussed selection effects, and addressed measurement error. Ideally, this count would far outnumber the other combinations and would represent a strong understanding of EO's causal effect on performance. Unfortunately, our review revealed the opposite. Nine of the twenty-seven studies in our review of prior EO–performance investigations appearing in top journals—a full third, and the largest category—did not include the four key covariates, did not address selection effects, *and* did not address measurement error. We expand on each of these challenges below.

Selection Effects. There are two types of selection effects, both of which impact EO research. The first kind of selection effect is sample selection, where the researcher observes a non-random sample of the population of interest (Clougherty, Duso, & Muck, 2016). There are several forms of sample selection concerns present in EO research—for example, the practice of choosing to study firms in a high-technology sector because the researcher *a priori* expects these firms to exhibit higher levels of EO. The more pressing sample selection concern, as Wiklund and Shepherd (2011) note, is survivor bias. Generally, EO researchers

are not able to observe many firms that failed during the sampling window. Our systematic review revealed only one study explicitly including failed firms (Wiklund & Shepherd, 2011), and another that addressed potential bias from excluding failed firms (Wales et al., 2013). The net effect of observing only surviving firms is to upwardly bias the estimated effect of EO on performance; surviving firms are by definition stronger performers more likely to grow, and we do not account for high EO firms that failed as a result of their entrepreneurial activities (Wiklund & Shepherd, 2011).

The second selection concern is self-selection (Clougherty et al., 2016). Self-selection comes in many forms—for example, higher-performing firms may be more likely to respond to a survey, inflating the estimated effect of EO on performance. But the primary concern for EO researchers is that firms self-select into the EO condition itself (Shaver, 1998). While often characterized as exploratory, the decision to commit resources to building and sustaining an entrepreneurial strategic posture is very much a conscious strategic choice made by senior managers (Covin & Slevin, 1991). Logically, these managers chose an entrepreneurial posture with the *a priori* expectation that being entrepreneurial will improve performance (Eshima & Anderson, 2017). This type of self-selection manifests as a specific endogeneity problem called *simultaneity*, or simultaneous correlation (Antonakis et al., 2010). That is, the expected performance outcome influenced the level of EO, rendering EO endogenous to performance (Rocha, van Praag, Folta, & Carneiro, 2019; Shaver, 1998). Unfortunately, failing to account for self-selection into the EO condition itself also biases the estimated effect of EO on performance.

Omitted Covariates. Best practice dictates the inclusion of all theoretically relevant covariates in a statistical model (Antonakis et al., 2010; Spector & Brannick, 2011). The challenge is identifying *all* important covariates. By covariates, we include variables correlating with both EO and performance; for example, operating in a hostile environment

(Eshima & Anderson, 2017). From our review and drawing on previous EO meta-analysis (Rauch et al., 2009; Rosenbusch et al., 2013; Saeed, Yousafzai, & Engelen, 2014), we identified four key covariates: firm size, industry, firm age, and the firm's task environment (dynamism and hostility), each of which has been found to covary with EO and with performance.

In our review, only eight studies (~ 30%) included all four covariates, although each study included at least one. Naming these covariates as "key" is, admittedly, subjective. But this subjectivity is the point—the researcher bears the responsibility for identifying theoretically and empirically important covariates to include in a study (Bernerth & Aguinis, 2016), and these covariates are well known and well established in the EO literature (Covin & Lumpkin, 2011; Covin & Wales, 2019; Rauch et al., 2009). Because an estimated effect size varies in a multivariate model as a function of the other variables in the model, omitting these covariates demonstrably lowers the ability to draw nomological conclusions across different studies.

Measurement Error. Across conceptualizations, scholars consider EO as a latent—not directly observable—trait, or feature, of a firm (Covin & Wales, 2019). Like all latent constructs, error exists between how the researcher defines the construct's conceptual space and its indicators (MacKenzie, Podsakoff, & Podsakoff, 2011). But for EO researchers, the source and impact of measurement error vary substantially across EO conceptualizations. Consider a study adopting the Miller / Covin and Slevin EO conceptualization, and measures EO by taking the mean score of the nine psychometric indicators drawn from Covin and Slevin (1989). Here the researcher defines EO as the shared variance across the three dimensions (Covin & Wales, 2012). In this case, there are multiple sources of error. Error exists at the indicator level because indicators are not perfectly reliable (Bollen, 1989). Error also exists at the dimensional level, because the researcher cannot assume that the indicators

are perfectly valid measures for their intended dimension (MacKenzie et al., 2011). Error also exists at the higher-order EO level, because there is residual variance in each dimension not shared with the others (Edwards, 2001).

Researchers can deal with conceptual sources of measurement error through clearly defining the construct's conceptual space, and when possible, specifying unidimensional, first-order measurement models (Anderson, Eshima, & Hornsby, 2019; Anderson et al., 2015). At the indicator level, researchers may use structural equation modeling (SEM), errors-in-variables models, and related techniques to address measurement error. Unfortunately, we found that 22 of the 27 studies (~81%) in our review did not take any steps to address measurement error. Because the majority of studies in our review made use of psychometric indicators, SEM is an easy "fix" (Bollen, 1989). Notably, secondary data sources, such as content-analytic measures, often exhibit higher measurement error than psychometric measures, and necessitate further consideration (McKenny, Aguinis, Short, & Anglin, 2018).

To summarize our review, we did not find any studies recovering a causal effect of EO on performance, and the majority of studies did not address any of the three threats to causal inference in a systematic manner. While this finding should give EO researchers pause, it is important to note that scholars face multiple challenging problems when designing a causal EO–performance study. Some of these problems are not unique to EO or strategic entrepreneurship research, but what makes these problems salient for EO researchers is that they tend to happen in combination and as inherent to the EO research design process. Going unaddressed, these threats significantly bias EO model results, as we explore next.

SIMULATION MODELS

We created two simulations of common EO research designs identified in our systematic review: a survey design with psychometric indicators, and a longitudinal design drawing from secondary data (e.g., a content analysis of a firm's annual reports). To be clear, we are not advocating for these designs as inherently superior in EO research; we focus on these designs because they are common. We simulate the conditions found under the category of eliminating alternate explanations discussed previously, including selection effects, omitted covariates, and measurement error. We model these conditions because even in the presence of temporal sequencing and a clear specification of EO conceptualization, these conditions represent substantive empirical threats to model efficacy. It is important to note that while these conditions are, in our opinion, among the most important to address, additional concerns such as measurement model misspecification (George, 2011) and structural model misspecification (George & Marino, 2011) merit attention by EO researchers.

Simulation 1: Survey Design

Our first simulation mimics a survey-based design, where the researcher collects psychometric EO measures, often the nine-item Covin and Slevin (1989) scale, from the senior-most executive of a business unit. For our outcome, we use a continuous, normally-distributed variable ($Y \sim N(0,1)$) to simulate performance. For this design, there are at least two selection effects: 1) we cannot assume a random draw from the population because we cannot observe all possible firms (e.g., firms that had high EO and that failed); and 2) respondents self-selected into their level of EO. There are numerous possible covariates, but in the EO literature, we focus on the four most common (i.e., firm size, industry, firm age, and the firm's task environment) discussed previously. Measurement error in this design comes from the inherent noise in any psychometric measure and from prior research

demonstrating less than perfect reliability among the Covin and Slevin (1989) indicators (Anderson, Eshima, et al., 2019).

We draw from the EO literature for our simulation parameters. Following Rauch et al. (2009), we assume a "true" effect of 0.25 of EO on our outcome measure, reflecting that EO explains roughly 5% of the variance in firm performance. For our nine EO indicators, we use the same lambda parameters (factor loadings) as George (2011). The George (2011) EO simulation parameters yield an internal consistency reliability (Cronbach's alpha) of .94 for the simulated EO scale, which is higher than typically found in EO research (Rauch et al., 2009), and has the effect of lowering the impact of measurement error on our model. For our omitted covariate we chose environmental munificence, often considered as the inverse to environmental hostility (Dess & Beard, 1984). Following the Rosenbusch et al. (2013) meta-analysis, we set our estimated effect of munificence on EO at 0.46, and the effect of munificence on performance at 0.16. Lastly, while the EO literature does not quantify unobserved selection effects, we set our selection parameter to 0.35, assuming that the two selection biases would result in an upward bias on both the level of EO and on observable performance. Deviating substantively from EO research, we set our sample size at 100,000 to illustrate that threats to causal inference are independent of sample size—a researcher cannot "power" out of an endogeneity problem.

Insert Figure 4, Tables 2 and 3 about here

We specified three models in Simulation 1, highlight the results of those models in Table 2, and graphically depict the different models in Figure 4. In our correctly specified model, we include our variables for a selection effect and for environmental munificence in a structural equation model that has all nine EO indicators loading on a first-order reflective construct, and treat performance as an observed variable. As reported, the effect of EO on

performance in our correct model, β = 0.247, was virtually indistinguishable from our assumed true effect. We see the effect of endogeneity in our naive model. The naive model is also a structural equation model where we account for measurement error in EO's indicators, but we omit the selection effect variable and our environmental munificence variable. The naive model mimics a researcher that took no steps to address selection problems and failed to include a measure of the firm's task environment as a covariate. The estimated effect of EO on performance jumps by 55% to β = 0.439. Both of these models exhibited excellent fit to the data: χ^2 = 44.526, *df* = 52, p = .760; and χ^2 = 26.133, *df* = 35, p = .861, respectively, highlighting that even well-fitting models may still be causally misspecified (Kline, 2015).

In our third model, we created a summated EO score by taking the mean of the nine indicators. This model assumes an error-free EO variable, and we specify a simple linear regression of performance on EO, again omitting our selection effect and environmental munificence variables. This model exhibits a 52% bias (β = 0.425), highlighting the suppressive effect of measurement error on structural parameters (McKenny et al., 2018). Note also the small change in the standard error. This highlights that endogeneity problems deal with the consistency of parameters (effect sizes) as opposed to the consistency of inference (standard errors) (Antonakis et al., 2010). There is no correction for bias in the standard errors that will address an endogeneity problem and biased effect sizes; correcting the standard errors of a model with endogeneity only yields a more precise estimate of an incorrect effect.

Simulation 2: Longitudinal (Panel) Design

For our second simulation we chose a design growing in popularity among EO researchers—using secondary indicators for EO with panel, or longitudinal data, most often from content analysis of publicly traded firm's letters to shareholders or annual reports (McKenny et al., 2018). Again, we model the relationship between EO and a continuous,

normally-distributed outcome variable ($Y \sim N(0,1)$) to simulate performance. We specified EO as a unidimensional composite variable, analogous to summing or taking the mean of individual indicators for innovativeness, proactiveness, and risk-taking. As with simulation 1, we set the true effect of EO on performance at 0.25 (Rauch et al., 2009). We set the number of firms to be 1,000, and simulate an unbalanced panel design (i.e., varying number of observations per firm), which would be similar to a field setting. We set the mean number of observations per firm to 10, which yielded 99,598 observations, very similar to the 100,000 observations in simulation 1, and chosen to demonstrate again that statistical power does not influence endogeneity. We represent this model with a standard panel equation:

$$Performance_{ij} = \alpha \quad + EO_{ij} + Munificence_{ij} + u_i + \varepsilon_{ij} \qquad \text{Eq. 1}$$

In Eq. 1, we observe the Performance, EO, and Munificence of firm i over repeated observations, j. For this design, a key threat to causal inference is unobserved heterogeneity—the presence of non-random factors at the entity level disturbance term (Level 2,u_i) that impact the relationship between observed variables at Level 1 (y_{ij} and x_{ij}) (Certo, Withers, & Semadeni, 2017). In this case, the unobserved heterogeneity represents a selection effect. Multilevel models and the most common estimators to evaluate these models (e.g., mixed effects models, hierarchical linear models, GEE models, and so forth) generally assume no correlation between the Level 1 predictor and the Level 2 disturbance term ($Cor[x_{ij}, u_i] = 0$) (Antonakis et al., 2010). Violating this assumption biases the estimate of β_x (Certo et al., 2017). For our simulation, we set the correlation between EO_{ij} and u_i at 0.8, reflecting the self-selection into the firm's level of EO, and that this relationship is likely to be very stable over time (Rocha et al., 2019). As in simulation 1, we used environmental munificence as an omitted variable and set the covariance of munificence on EO at 0.46, and munificence on performance at 0.16 (Rosenbusch et al., 2013). Lastly, we drew from

McKenny et al. (2018) to explore the impact of measurement error, as we will explain shortly.

We specified three models for Simulation 2, with our results presented in Table 3. Our correct model recovers our estimate of EO on performance perfectly (β = 0.250). The correct model uses a fixed effects specification to control for the correlation between EO and the Level 2 disturbance term, and represents the single most efficient approach to dealing with this threat to causal inference (Certo et al., 2017). Our correct model also includes environmental munificence as our omitted covariate. Once again, we see the effect of endogeneity in our naive model, with a 43% bias (β = 0.387) in the EO–performance relationship. The naive model uses random effects ignoring the unobserved heterogeneity problem, and also omits environmental munificence.

In our third model, we drew from McKenny et al. (2018) to simulate the effect of measurement error in the context of other threats to causal inference. In their online supplementary material, McKenny et al. (2018, Appendix F) report reliabilities for a content-analytic measure of EO. Using their reported coefficients of equivalence and stability for innovativeness (0.67), proactiveness (0.45), and risk-taking (-0.07) yields an expected reliability of 0.35 for our EO measure—roughly 65% of the measure being random noise (McKenny et al., 2018). We see the effect of measurement error in the final model—a 23% difference from our true effect size (β = 0.198). This model is also a random effects model and omits environmental munificence; what is notable about the measurement error problem is the instability it created in the estimated effect. The three threats to causal inference jointly *depressed* the effect of EO on performance, demonstrating the compounding nature of the endogeneity problem.

While the simulations provide insight into how easily bias influences model results, they do not provide guidance on how to resolve these problems. For EO researchers, there is

no simple tool or quick fix to address endogeneity and other threats to causal inference, and we want to be clear that this should not be an expectation. In the next section, we outline a series of steps for EO researchers to move away from associational and towards causal EO research.

MOVING TOWARDS CAUSAL EO–PERFORMANCE RESEARCH

EO researchers should assume that multiple threats to causal inference exist in any EO research project intended to test a theoretical model; the question is how to deal with those threats (Anderson, Wennberg, et al., 2019). We acknowledge that it is exceptionally challenging, and depending on one's perspective, impossible, to unequivocally establish a causal relationship using observational data. As a research community, we will never truly solve the riddle of whether EO causes firms to perform better. We can do better, however, and there is value in moving the conversation closer to the ideal. Firms expend substantial resources on entrepreneurial initiatives to improve their performance (Ireland et al., 2003). Improving model efficacy improves our theoretical understanding of EO and provides more accurate guidance for practice (Ghoshal, 2005). We next outline steps to advance the conversation.

Step 1: Determine the EO Conceptualization

We cannot stress this point enough—for EO researchers, the single most important decision, and the first step in the process, is the choice of EO conceptualization. As mentioned previously, the three EO conceptualizations carry very different ontological and epistemological assumptions (Covin & Wales, 2019). A research design and statistical approach to estimate the causal effect of EO on performance for one conceptualization will not be appropriate for another, nor would it be appropriate to shift conceptualizations after data collection (Aguinis et al., 2017). As Covin and Lumpkin (2011: 863) noted, the issue for

EO researchers is not whether one conceptualization is better, but rather "...explicitly recognizing and defending the particular conceptualization being employed in their research." In other words, EO researchers should first decide on the EO conceptualization appropriate for the research question at hand and ground the theoretical basis for the research question in the appropriate EO literature. For example, if a researcher is interested in modeling the relationship between EO's constitute dimensions and performance, it would not be appropriate to draw from research modeling EO as a composite.

The choice of EO conceptualization bears on the choice of measurement, and at a deeper level, the epistemological connection between EO and the way we measure it. Consider the Covin and Slevin (1991) conceptualization, where a firm's strategic posture exists along a continuum ranging from conservative to entrepreneurial. Presumably, the scale anchors represent "purely conservative" and "purely entrepreneurial", respectively, with the middle being a blend of each extreme or not delineable as either conservative or entrepreneurial. In contrast, from the Anderson et al. (2015) conceptualization there is no such distinction between conservative and entrepreneurial; a firm is simply low EO to high EO, with all firms having at least some degree of EO. From the Lumpkin and Dess (1996) perspective, because EO's dimensions form dynamically as a function of strategic choice, the level of EO is situational. EO itself means different things under different conceptualizations, and how we define EO changes how we estimate a causal effect; the conceptualization effectively defines the parameters under which we may model and interpret a causal effect.

The debate over conceptualizing EO as behavioral, dispositional, or some combination thereof bears on the ability of a researcher to make a causal claim. In some ways, identifying whether a specific behavior or set of behaviors induces a change in an outcome variable represents a clearer path for researchers. For example, Kreiser et al. (2019) propose an EO measurement model that identifies corporate-level financial allocation

decisions representative of investments in entrepreneurial behaviors. The measurement model would allow an EO researcher to observe a firm changing these investments relative to specific firm outcomes; a behavioral predictor modeled against an observed financial outcome. Effectively, this approach is a straight behavioral model, aiding in the interpretation of relationships and findings.

In the case of a dispositional perspective, or a combination of behavioral and dispositional, identifying a causal connection between EO and outcome variable is less clear; a firm's behavior is likely to change at a different rate than a firm's disposition towards entrepreneurship (Kreiser et al., 2019). This would be particularly likely in the case where the researcher conceives of EO as representative of a cultural disposition or climate (Anderson, Covin, & Slevin, 2009; Kang, Matusik, Kim, & Phillips, 2016). In moving towards causal EO research then, it may be easier to focus on a behavioral EO perspective. Regardless though, EO researchers must take the time to carefully consider the EO conceptualization that aligns with the research question under study.

Step 2: Observing a Change in EO and the Role of Time

The next step for EO researchers is conceiving of a change to EO and the role of time for both the EO conceptualization and the performance outcome under study. Across conceptualizations, EO generally refers to an enduring strategic trait of a firm (Covin & Wales, 2019). To garner the "entrepreneurial" label, the firm must be exhibiting entrepreneurial behaviors with regularity (Covin & Slevin, 1991). The result is a type of chronic EO state—firms are generally consistently entrepreneurial or conservative, allowing for some variance around these chronic conditions, and the possibility that EO behaviors, and/or EO dispositions, may change at different rates (Covin & Lumpkin, 2011). This reality challenges researchers to consider isolating EO behavior or dispositions, and to clearly conceive of the manner in which a firm changes it's EO condition. Such a change may come

from internal strategic considerations or from exogenous environmental shocks, or some combination of the two (Ireland, Covin, & Kuratko, 2009). Nonetheless, EO researchers must define, in a manner specific to their chosen conceptualization and research question, how they will observe a change within a firm's EO condition over time when firms rarely change or "cycle" their EO state (Wales, Monsen, & McKelvie, 2011).

Recognizing that firms have a chronic EO state and defining how to observe a change in EO carries notable implications for the specification of the temporal distance between EO and the performance outcome under study. The key consideration for EO scholars is to imagine that *if* the firm changed its EO condition, what would be the most reasonable time frame that the firm would experience a corresponding change in its performance? Answering this question depends, in no small part, on the choice of performance outcome, along with considerations such as the firm's industry and market environment. It is reasonable to assume, for example, that changing from a low EO condition to a high EO condition necessarily entails consuming substantial slack resources and making new strategic investments (Bradley, Wiklund, & Shepherd, 2011). As such, in this case, we might expect that the causal effect of EO on firm profitability is negative in the short-term period following the change to EO. For EO research, there is an inseparable connection between time, the outcome variable, and the specification of a causal effect. The challenge for researchers is not simply to create a lag between EO and the performance outcome but to specify why the chosen lag theoretically aligns with the choice of EO conceptualization and the specific performance outcome.

Step 3: Specifying the Expected Covariance Between EO and Performance

As the EO conversation moves towards a prescriptive theoretical lens, a generic perspective that EO positively relates to performance obscures the underlying differences between different EO conceptualizations and different performance outcomes, and the role of

time in translating a change in EO to a change in performance (Bergh & Fairbank, 2002). As mentioned previously, it is not appropriate to directly compare two EO–performance studies with different EO conceptualizations, different EO measurement models, and different performance outcomes. These are fundamentally different studies, and even in the case of small methodological differences, we should not draw sweeping nomological conclusions given that even small differences may result in substantially different parameter estimates (Amrhein, Trafimow, & Greenland, 2019). This challenges EO researchers then to be specific in the EO–performance conversation they wish to join and to draw from the specific literature that aligns with their EO conceptualization and performance outcome.

It is also important to note that EO scholars generally acknowledge some degree of reciprocal causality between EO and performance, which should be considered in both the theoretical development and empirical approach in a study. Like all strategic choices, firms set their level of EO under the expectation of a desired performance outcome (Rocha et al., 2019). Further, firms base the expected future performance outcome, in part, on the firm's prior performance, which itself is a function of its even earlier strategic posture (Eshima & Anderson, 2017). Thus, we can conceive of the EO → performance → EO relationship as analogous to a cycle or spiral, where prior strategic action resulted in a performance outcome that in turn informs a future strategic choice (Shepherd, Patzelt, & Haynie, 2010). This simultaneity *always* renders EO endogenous to performance and creates a condition where firms that realized their expected performance are more likely to maintain their level of EO rather than make a change (Levinthal, 2011). The net result is a bias towards the status quo—firms most likely to benefit from adopting an entrepreneurial strategic posture have already done so, and firms most likely to benefit from adopting a conservative strategic posture have already done so (Morgan & Winship, 2014). As aptly illustrated by Hambrick (1983: 7), "prospectors tend to want to continue prospecting." In considering the covariance between

EO and performance, researchers must account for simultaneity, or risk bias in their model results.

Further, it is also worthwhile to note the likely presence of an intervening variable—or variables—translating a change in EO to a change in performance. Consider a simple model where a firm increases its EO, which in turn increases its sales growth rate, which in turn increases its stock market performance. Here the true model is EO → Sales Growth Rate → Market Value, but a model of EO → Market Value would potentially upwardly bias this estimated direct effect because the sales growth rate positively correlates with EO and with market value. Empirically, there are identification strategies that address omitted mediators (Morgan & Winship, 2014; Pearl, 2009). The broader challenge is that there may be a complex causal chain that, gone unaccounted for, may lead to inaccurate nomological conclusions.

One solution is to model proximal performance outcomes, versus those more distally related. As Gupta, Niranjan and Markin (2019) noted, EO scholars have long suggested multiple intervening variables in the EO–performance relationship. What we are suggesting, however, is to consider specific performance outcomes with a shorter temporal distance to a change in EO. For example, rather than a sales growth rate, which is impacted by a number of internal and external factors, a new product adoption rate might be a possibility, or net promoter score. We are not arguing that these outcomes are better, but rather that we might be more likely to observe a robust direct connection between EO and more proximal outcome measures, and we are more likely to solve complex endogeneity problems when we shorten the temporal distance between EO and the focal performance outcomes (Wales, 2016).

Step 4: Addressing Selection Effects, Necessary Covariates, and Measurement Error

As discussed previously, EO researchers face two critical selection effects. The first of which is survivor bias, wherein we only observe firms operating at the time of data

collection (Wiklund & Shepherd, 2011). Further, we are also likely to only observe firms who experienced a positive performance outcome from their selected level of EO. Relatedly, if we were able to observe a firm changing its EO condition, we would also be more likely to observe those firms realizing a performance improvement. The change could have been from conservative to entrepreneurial or the converse, but the key point is that we are likely to observe those firms where the change in EO improved performance, as opposed to those that changed their EO condition and then experienced a *negative* performance outcome. Ultimately, these selection effects would overestimate the effect of EO on performance (Angrist & Pischke, 2008).

Unfortunately, there are few easy solutions to address selection problems. To an extent, instrument variables and selection models (e.g., Heckman) can help to alleviate the empirical effect of simultaneity and other selection concerns (Certo, Busenbark, Woo, & Semadeni, 2016). Regarding survivor bias, Wiklund and Shepherd's (2011) study on the joint effect of EO on growth and on failure provides one model for EO researchers to consider when seeking data sources that include failed and ongoing businesses. Another approach is to use designs that explicitly capture multiple observations of EO and performance over time but in such a way as to account for firms that left the sample through failure, acquisition, or other reasons.

Concerning including omitted covariates well known in the EO literature, we highlight four that we argue constituent a minimum required set: firm size, industry, firm age, and the firm's task environment (dynamism and hostility). In addition to these covariates, we recommend that EO researchers more clearly identify and articulate variables that represent theoretically plausible alternative explanations to the specific EO–performance relationship under study (Spector & Brannick, 2011). With regards to measurement error, SEM provides the most robust way to address indicator-level error, and we submit its notable advantages

within psychometric EO research (Bollen, 1989). For EO designs with secondary indicators, researchers should pay careful attention to the ways in which error may be biasing model results (Loken & Gelman, 2017). To some extent, instrument variable approaches or more informed prior distributions in the case of Bayesian modeling may help diminish this error (Gelman et al., 2013). Nonetheless, we concur with McKenny et al. (2018) that EO researchers using secondary measures face substantive concerns in dealing with measurement error.

Step 5: Addressing Remaining Alternate Explanations

The final step in the process is to consider the best method, given the decisions reached in the previous steps, to deal with remaining alternate explanations and a general omitted variable problem. This is the catch-all consideration, in the sense that researchers working with observational designs are never in a position to completely rule out unobservable factors that may be the true source of the model's variation (Morgan & Winship, 2014). Directly manipulating a firm's EO condition is not feasible, nor is there a realistic expectation to observe a change in a firm's EO during a random sampling window given that most firms maintain a chronic EO state. Further, the complex nature of the selection effects and the breadth of omitted variables renders regression-based approaches predicated on collecting a sufficient set of control variables unfeasible. In a similar way, matching-based approaches such as propensity scores are not likely feasible, because these techniques assume that observable covariates embed the key matching criteria to recover a causal estimate—an assumption unlikely to be met in EO research (Angrist & Pischke, 2008; Morgan & Winship, 2014). This leaves, effectively, two empirical approaches most likely to yield a causal estimate of EO on performance.

The first design likely to yield a causal effect is a natural experiment, where a source of observed exogenous variation induces a firm to change its EO condition (Shadish et al.,

2002). When the researcher is able to show that the exogenous factor causally changed the variable of interest and the factor was exogenous to the outcome variable, a natural experiment is a powerful tool to estimate a causal effect (Angrist & Pischke, 2008), a tool that deserves greater attention and employment within future EO research. For example, Davidsson and Gordon (2016) exploit the recent global financial crisis to evaluate the effect of changing macroeconomic conditions on nascent entrepreneurial activity. In another example, Flammer and Kacperczyk (2016) exploit state-level policy changes to evaluate the causal effect of a stakeholder orientation on firm-level innovation. Relevant natural experiments are, unfortunately, rare (Morgan & Winship, 2014). As such, it is important that EO scholars are opportunistic toward future possibilities as they arise.

The second research design most likely to yield a causal effect—and the one most feasible for EO researchers desiring to test a specific causal hypothesis—is an instrument variable approach. There is a well-developed literature on instrument variables, and we refer readers to Angrist and Pischke (2008), Morgan and Winship (2014), and Pearl (2009) for detailed treatments of relevant methods and estimators. However, while the theoretical considerations of an instrument variable design for EO researchers have yet to be systematically explored, we offer a series of considerations below.

The validity of an instrument depends on its causal relationship to the focal endogenous variable, and its exogeneity to the final outcome of interest (Angrist & Pischke, 2008). Taking a nonparametric perspective from Pearl (2009), an instrument, i, is valid if it causally induces change in a variable, x, but then imparts no causal effect on the outcome variable, y, other than its indirect effect through x. In this way, we can view an instrument variable model as a causal chain: $i -> x -> y$, where x fully mediates the relationship between i and y (Pearl, 2009). By creating a change in x independent from any other factors that may be confounding the relationship between x and y, the instrument serves as an

exogenous source of variation that recovers a consistent, and depending on the research design, causal effect of interest.

Identifying an instrument that meets the preceding criteria is challenging regardless of the model, but EO researchers face another hurdle—the validity of an instrument is very much a function of the EO conceptualization the researcher chooses, including whether a researcher adopts a perspective that is behavioral, dispositional, or some combination thereof. We argue that the clearest path to identifying a valid instrument is possible when researchers conceive of EO from a behavioral perspective. As Anderson, Eshima et al. (2019) note, a behavioral lens narrows the conceptual space, which has the advantage of minimizing measurement error at the conceptual level, while avoiding the tricky problem of identifying an instrument that predicts both a firm's behavior and a firm's disposition or culture in the same direction and magnitude, and at the same time. This is, admittedly, a practical consideration. Identifying valid instruments is devilishly difficult, and the easier the researcher can make the task by using clearly defined and narrow conceptual spaces, combined with careful attention to measurement, the easier it will be to identify a strong instrument for EO that is exogenous to the outcome.

Practices to Avoid

Lastly, it is worth discussing research practices that remain common in EO–performance research, but that should be avoided because of their weaknesses in recovering causal estimates. We refer readers to Anderson, Wennberg et al. (2019) for a more detailed discussion but wish to note that the prevalence of certain practices, including in recent EO research as our review showed, should give us pause when evaluating model results. Collecting same-source primary data, collecting single-wave cross-sectional data, and failing to account for measurement error are design and analysis choices supplanted by current methodologies and should be avoided.

CONCLUSION

The biggest hurdle for EO researchers interested in causal relationships does not lie in statistical estimation and data analysis, but at the research design stage. The harder problems for EO researchers to tackle require a deep understanding of: a) EO and the EO conceptualization chosen; b) The outcome variable of interest; and c) The theoretical mechanisms connecting EO to the outcome. These factors inform research design and the design's theoretical rationale, and set the parameters for a study to estimate a causal effect. This is a challenging bar to cross, and it is not surprising our review did not identify a study estimating the causal effect of EO on performance. There is not, nor can there ever be, a "perfect" study of EO. Perfection should not be our standard, and mixed methods approaches, exact and conceptual replications, and combining exploratory and confirmatory methodologies are valuable approaches to improving a study's overall quality while addressing the limitations of specific empirical approaches (Anderson, Wennberg, et al., 2019; Wennberg & Anderson, 2019). However, given the maturity of the field and the popularity of the EO construct, we also feel that the time has come to constructively push EO scholars towards research designs that maximize causal inference. We hope that this paper aids EO researchers in designing studies that move the causal EO conversation forward.

APPENDIX

Table 1. Articles Included in Review

EO–Performance Studies (2010-2017)

Anderson BS, Eshima Y. 2013. The influence of firm age and intangible resources on the relationship between entrepreneurial orientation and firm growth among Japanese SMEs. Journal of Business Venturing 28(3): 413–429.

Chirico F, Sirmon DG, Sciascia S, Mazzola P. 2011. Resource orchestration in family firms: investigating how entrepreneurial orientation, generational involvement, and participative strategy affect performance. Strategic Entrepreneurship Journal 5(4): 307–326.

De Clercq D, Dimov D, Thongpapanl N. 2010. The moderating impact of internal social exchange processes on the entrepreneurial orientation–performance relationship. Journal of Business Venturing 25(1): 87–103.

Engelen A, Gupta V, Strenger L, Brettel M. 2015. Entrepreneurial orientation, firm performance, and the moderating role of transformational leadership behaviors. Journal of management 41(4): 1069–1097.

Engelen A, Kube H, Schmidt S, Flatten TC. 2014. Entrepreneurial orientation in turbulent environments: The moderating role of absorptive capacity. Research Policy 43(8): 1353–1369.

Engelen A, Neumann C, Schmidt S. 2016. Should Entrepreneurially Oriented Firms Have Narcissistic CEOs? Journal of Management 42(3): 698–721.

Gupta VK, Batra S. 2016. Entrepreneurial orientation and firm performance in Indian SMEs: Universal and contingency perspectives. International Small Business Journal 34(5): 660–682.

Keil T, Maula M, Syrigos E. 2017. CEO Entrepreneurial orientation, entrenchment, and firm value creation. Entrepreneurship Theory and Practice 41(4): 475–504.

Kollmann T, Stöckmann C. 2014. Filling the entrepreneurial orientation–performance gap: The mediating effects of exploratory and exploitative innovations. Entrepreneurship Theory and Practice 38(5): 1001–1026.

Li Y, Wei Z, Liu Y. 2010. Strategic orientations, knowledge acquisition, and firm performance: the perspective of the vendor in cross-border outsourcing. Journal of Management Studies 47(8): 1457–1482.

Lomberg C, Urbig D, Stöckmann C, Marino LD, Dickson PH. 2017. Entrepreneurial orientation: The dimensions' shared effects in explaining firm performance. Entrepreneurship Theory and Practice 41(6): 973–998.

Matsuno K, Zhu Z, Rice MP. 2014. Innovation process and outcomes for large Japanese firms: Roles of entrepreneurial proclivity and customer equity. Journal of Product Innovation Management 31(5): 1106–1124.

Menguc B, Auh S, Ozanne L. 2010. The interactive effect of internal and external factors on a proactive environmental strategy and its influence on a firm's performance. Journal of Business Ethics 94(2): 279–298.

Messersmith JG, Wales WJ. 2013. Entrepreneurial orientation and performance in young firms: The role of human resource management. International Small Business Journal 31(2): 115–136.

Miller D, Le Breton–Miller I. 2011. Governance, social identity, and entrepreneurial orientation in closely held public companies. Entrepreneurship Theory and Practice 35(5): 1051–1076.

Morgan T, Anokhin S, Kretinin A, Frishammar J. 2015. The dark side of the entrepreneurial orientation and market orientation interplay: A new product development perspective. International Small Business Journal 33(7): 731–751.

Patel PC, Kohtamäki M, Parida V, Wincent J. 2015. Entrepreneurial orientation-as-experimentation and firm performance: The enabling role of absorptive capacity. Strategic Management Journal 36(11): 1739–1749.

Real JC, Roldán JL, Leal A. 2014. From entrepreneurial orientation and learning orientation to business performance: analysing the mediating role of organizational learning and the moderating effects of organizational size. British Journal of Management 25(2): 186–208.

Schneider M, Engelen A. 2015. Enemy or friend? The cultural impact of cross-functional behavior on the EO–performance link. Journal of World Business 50(3): 439–453.

Tajeddini K. 2010. Effect of customer orientation and entrepreneurial orientation on innovativeness: Evidence from the hotel industry in Switzerland. Tourism Management 31(2): 221–231.

Tang J, Tang Z, Cowden BJ. 2017. Exploring the relationship between entrepreneurial orientation, CEO dual values, and SME performance in state-owned vs. nonstate-owned enterprises in China. Entrepreneurship Theory and Practice 41(6): 883–908.

Van Doorn S, Jansen JJP, Van den Bosch FAJ, Volberda HW. 2013. Entrepreneurial orientation and firm performance: Drawing attention to the senior team. Journal of Product Innovation Management 30(5): 821–836.

Wales WJ, Patel PC, Parida V, Kreiser PM. 2013. Nonlinear effects of entrepreneurial orientation on small firm performance: The moderating role of resource orchestration capabilities. Strategic Entrepreneurship Journal 7(2): 93–121.

Wales W, Wiklund J, McKelvie A. 2015. What about new entry? Examining the theorized role of new entry in the entrepreneurial orientation–performance relationship. International Small Business Journal 33(4): 351–373.

Wang T, Thornhill S, De Castro JO. 2017. Entrepreneurial orientation, legitimation, and new venture performance. Strategic Entrepreneurship Journal 11(4): 373–392.

Wiklund J, Shepherd DA. 2011. Where to from here? EO-as-experimentation, failure, and distribution of outcomes. Entrepreneurship Theory and Practice 35(5): 925–946.

Zhao Y, Li Y, Lee SH, Bo Chen L. 2011. Entrepreneurial orientation, organizational learning, and performance: Evidence from China. Entrepreneurship Theory and Practice 35(2): 293–317.

Table 2. Simulation 1 Summary

Model	EO → Performance Parameter	Standard Error	Percent Difference
Correct Model	0.247	0.003	1%
Naive Model	0.439	0.003	55%
Measurement Error Model	0.425	0.003	52%

Table 3. Simulation 2 Summary

Model	EO → Performance Parameter	Standard Error	Percent Difference
Correct Model	0.250	0.002	0%
Naive Model	0.387	0.002	43%
Measurement Error Model	0.198	0.002	23%

Figure 1. Data Source for EO–Performance Studies (2010-2017)

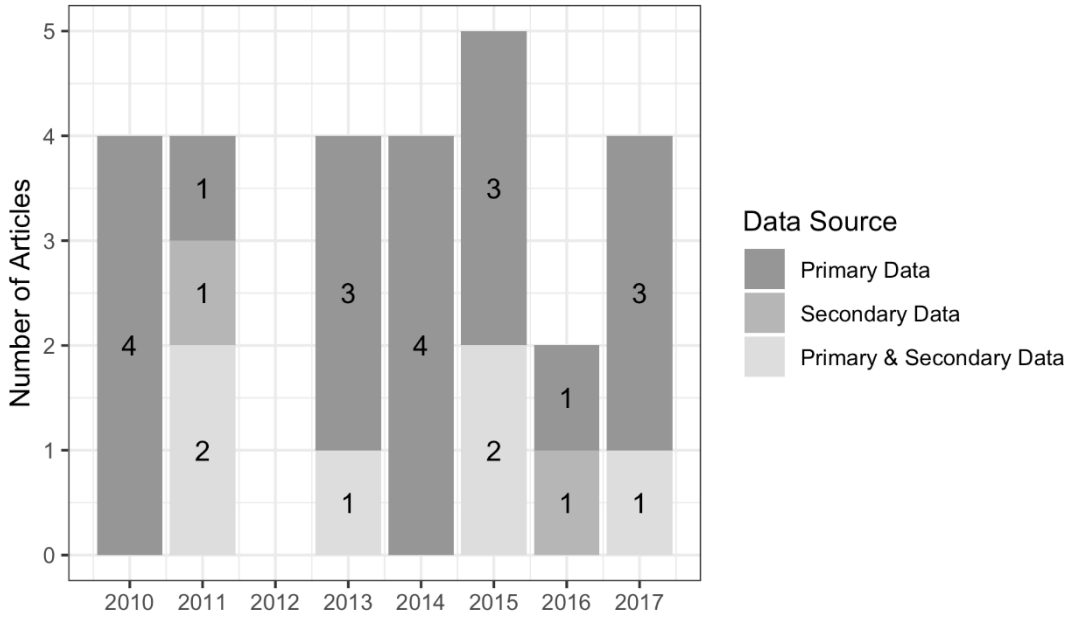


Figure 2. Data Structure and EO Measures in EO–Performance Studies (2010-2017)

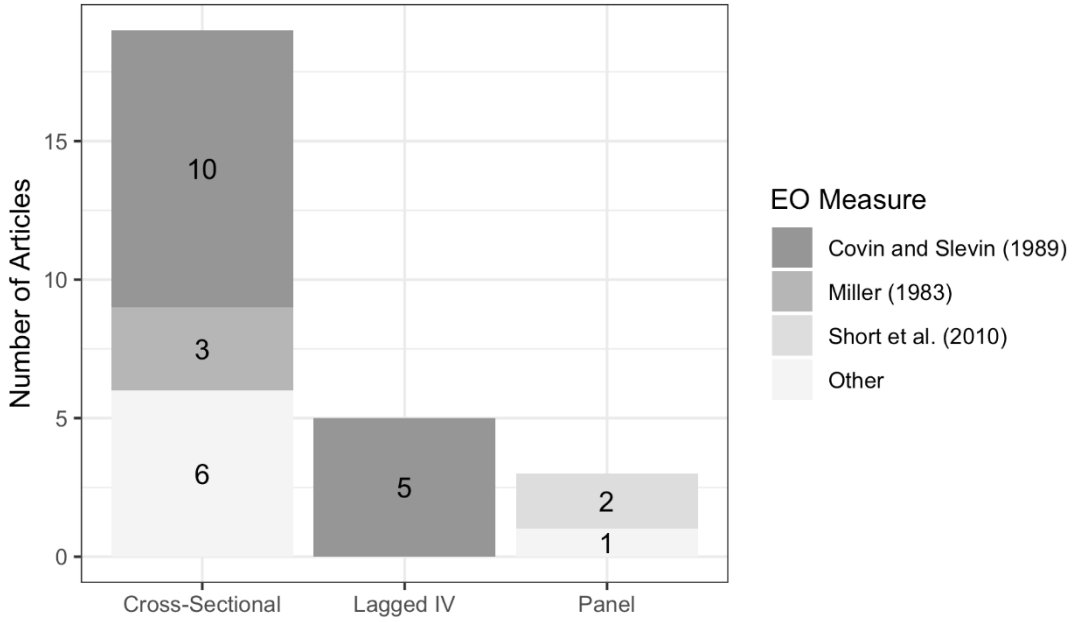


Figure 3. Threats to Causal Inference in EO–Performance Studies (2010-2017)

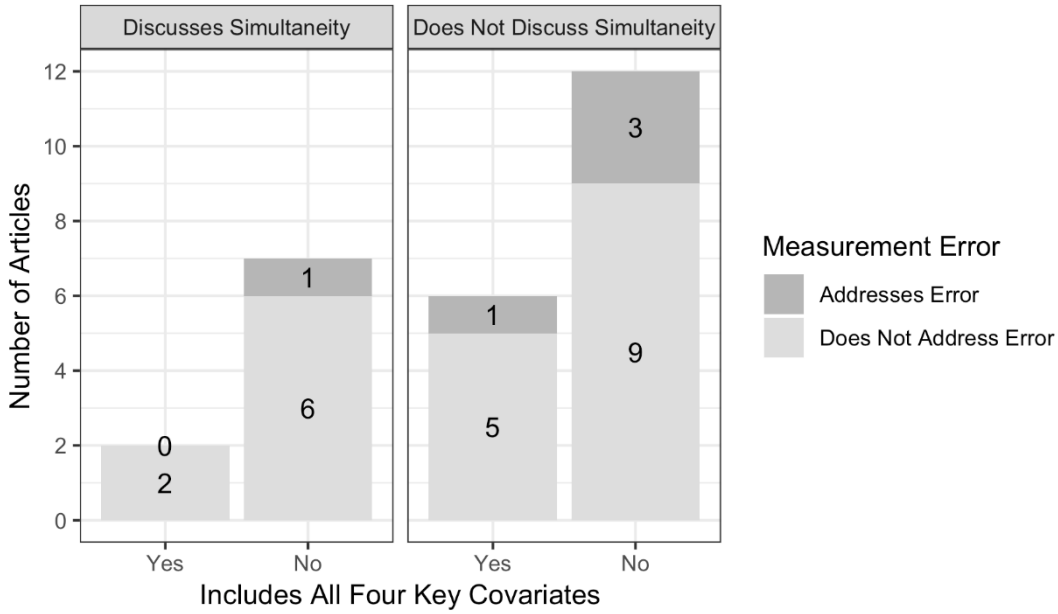
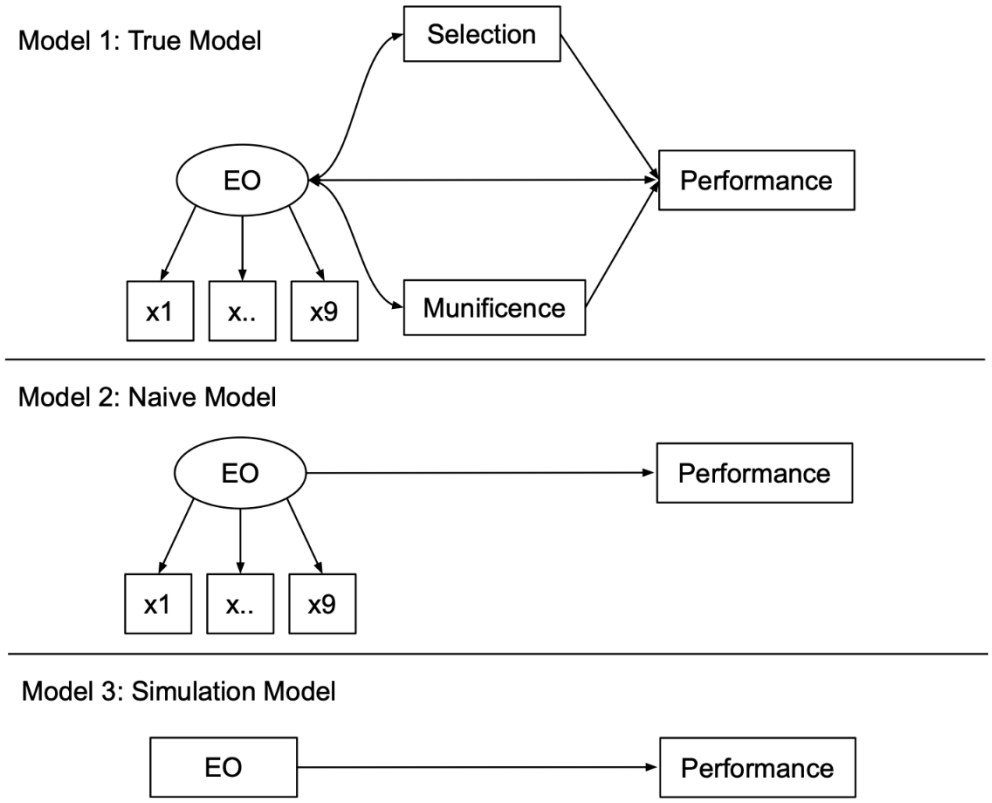


Figure 4. Simulation 1 Models



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CONCLUSION

The aim of this cumulative dissertation was to address recent and long-standing debates in the EO-performance literature pertaining to a lack of consistency in variable choices and ensuing modelbuilding considerations, conceptual ambiguities that are embedded in the very foundation of the construct, and how to move from associational research towards establishing causal estimates. In doing this, this dissertation seeks to help the EO literature to move forward with greater clarity, comprehensive modeling approaches, and more robust research designs. For this purpose, four different research projects were pursued.

The first paper, entitled ***"A Midlife "Transparency" Crisis? Entrepreneurial Orientation in its Forties"***, showed that in contrast to the plethora of studies with a singular focus on the EO-performance relationship, far fewer studies provide important insight pertaining to EO's drivers. Moreover, potential antecedents of EO are often modeled inconsistently across studies and there seems to be little consensus in regards to what variables should conceptually be perceived as antecedents. While firm performance is predominantly modeled as an outcome of EO, the literature explored potential mediators of the EO-performance relationship more frequently (Wales, Gupta, & Mousa, 2013). However, it becomes also apparent that these are rarely included jointly within a single study, which might entail serious endogeneity threats (Aguinis, Ramani, & Alabduljader, 2018; Antonakis, Bendahan, Jacquart, & Lalive, 2010). Furthermore, innovativeness is frequently modeled as an immediate outcome of EO e.g. the rate of new products and successful commercialization of new products, but researchers need to better ensure that there is no conceptual overlap with EO's innovativeness dimension (Covin & Wales, 2019). Next, considering that only about 15% of the reviewed 182 samples do concurrently consider the environmental-, organizational-, and individual-level, it is due time for future research to draw more comprehensively on these three levels of analysis and to employ more complex structural

models in which antecedents of EO and more immediate outcomes that mediate the EO-performance relationship, are considered (Covin & Lumpkin, 2011; Covin & Wales, 2019; Miller, 2011; Wales, 2016). In this vein, a comprehensive meta-analysis identified 23 potentially relevant variables and their typical roles were assessed. Drawing on this insight, a baseline structural EO-performance model that encompasses both potentially relevant antecedents of EO and more immediate outcomes, was proposed and researchers are encouraged to adjust it in accordance with their research questions and applied theories. Finally, a review on control variables demonstrated that EO-performance studies seem to routinely control for variables that do not appear to be linked, at least in an empirically meaningful way, to EO and/or performance. Thus, future studies should explicitly argue for why the included controls are expected to affect focal variables, to measure these with less distant proxies, and to discuss their empirical findings (Bernerth, Cole, Taylor, & Walker, 2018; Spector & Brannick, 2011).

The second paper, entitled ***"Revisiting Risk-Taking? Meta-Analytic Insights, Modeling Comparisons, and Component-Level Relationships in Entrepreneurial Orientation Research"***, addressed important conceptual questions that originate from the potential for component-level differences that are embedded within the very foundation of the EO construct (Miller, 1983, 2011). This research offers substantial evidence that risk-taking, as presently operationalized in terms of managerial attitudes, operates differently from entrepreneurial behavior (innovativeness and proactiveness), and more significantly, explains performance through its indirect, motivating effects on entrepreneurial behavior. This lends support to past presumptions about managerial attitudes towards risk-taking helping ensure that firms' entrepreneurial behavioral patterns are stable over time (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015; Covin & Lumpkin, 2011). Based on these findings, several ways in which risk-taking might be treated in future EO research are discussed. First,

collective works suggest that risk-taking is implied and evidenced when firms are observed engaging in entrepreneurial behavior (Hoskisson, Chirico, Zyung, & Gambeta, 2017; Miller, 1983; Miller & Bromiley, 1990; Simon & Houghton, 2003). Hence, future studies of EO may choose to focus on strategic entrepreneurial behavior, leaving managerial risk-taking implied. Second, the causally proximal outcome of managerial attitudes towards risk-taking could actually be entrepreneurial firm behavior as opposed to a somewhat nebulous higher managerial attitude, higher firm performance linkage. This causal chain is reinforced by the observation that managerial risk-taking unfolds at a different level of analysis from firm behavioral actions (managerial- vs. firm-level) (Hambrick, 2007; Wang, Holmes, Oh, & Zhu, 2016). Studies interested in exploring the effects of managerial risk-taking (and gambling on bold actions, perhaps to understand hubris or overconfidence) on entrepreneurial behavior and firm performance, are encouraged. Third, the EO instrument was constructed over 40 years ago and principally captures risk-taking only in terms of potential downside loss, rating "[...] the degree to which managers are willing to make large and risky resource commitments—i.e. those which have a reasonable chance of costly failure." (Miller & Friesen, 1978: 923). However, large investments as evidence of downside risk, do not always or seamlessly align with past descriptions of how entrepreneurial actors behave (March & Shapira, 1987; Sarasvathy, 2001; Stevenson & Gumpert, 1985). Hence, it may be time to consider risk from the perspective of "missing the boat" or upside-potential in EO research given its alignment with how entrepreneurially oriented firms behave in the pursuit of new opportunities for growth (Hoskisson et al., 2017; Janney & Dess, 2006).

The third paper, entitled ***"Revisiting the Mediating Role of Entrepreneurial Orientation in the Task Environment-Performance Relationship: A Finer-Grained Replication"***, performed a finer-grained replication of Rosenbusch, Rauch, and Bausch's (2013) meta-analytic investigation of EO's mediating role in task environment to firm

performance relationships. This study provided cumulative evidence that the three core dimensions of EO are likely to unfold unique effects with antecedents and consequences. That is, depending on internal and external configurations, these dimensions could be differently manifested within firms (Miller, 2011). Therefore, firms that share comparable aggregate levels of EO might vary in their levels of innovativeness, proactiveness, and risk-taking. In turn, this component-level variation could lead to variations in how aggregate EO is related to antecedents and outcomes across these firms. Certainly, EO can still be theorized as a "catch-all" construct as initially intended (Miller, 2011), but failing to report findings also at the component-level arguably carries too high a cost to be ignored. Moreover, in contrast to the findings of Rosenbusch et al. (2013), the presented results suggest that EO is not a full mediator between all elements of the task environment and firm performance. While EO seems to fully mediate the performance relationship of environmental complexity and dynamism, the picture is different for hostility and munificence. First, EO only seems to partially mediate the relationships between environmental munificence and firm performance, suggesting that resource and opportunity-rich environments appear to be beneficial for firm performance, irrespective of a certain level of EO. It might be interesting for future studies to investigate to what degree EO is helping firms to get the most out of such environments. While hostility is unrelated to EO, it appears to have a negative direct effect on growth performance, suggesting that unfavorable environmental conditions are challenging or even impossible to mitigate, at least with EO. This is relevant for future studies that plan to assess environmental hostility as a moderator on the EO--growth performance relationships. While hostility might seem to have a negative effect on the posited relationship, it is not because hostility is attenuating EO but because of its direct effect on growth, suggesting that hostility should be modeled as a predictor of performance and not as a moderator.

The final paper, entitled ***"The Chicken or The Egg? Causal Inference in Entrepreneurial Orientation-Performance Research"***, explored the challenges of establishing casual EO-performance relationships. Considering that firms cannot be assigned into EO conditions or studied in the laboratory, EO research remains observational and researchers must turn to alternative research designs and empirical approaches to attempt to recover causal estimates (Angrist & Imbens, 1995; Angrist & Pischke, 2009). Therefore, multiple threats to causal inference do exist in any EO research project (Anderson, Wennberg, & McMullen, 2019). Overcoming these threats is exceptionally difficult, and it is not surprising that the review of empirical EO-performance studies could not identify a single study establishing a causal effect of EO on performance. The biggest hurdle for EO researchers interested in causal relationships does not lie in statistical estimation and data analysis, but at the research design stage. Tackling these problems requires a deep understanding of: a) EO and the EO conceptualization chosen; b) The outcome variable of interest; and c) The theoretical mechanisms connecting EO to the outcome. First, the debate over conceptualizing EO as behavioral, dispositional, or some combination thereof bears on the ability of a researcher to make a causal claim. In some ways, identifying whether a specific behavior or set of behaviors induces a change in an outcome variable represents a clearer path for researchers (Kreiser, Anderson, Kuratko, & Marino, 2019). Second, EO researchers must define, in a manner specific to their chosen conceptualization and research question, how they will observe a change within a firm's EO condition over time when firms rarely change or "cycle" their EO state (Covin & Lumpkin, 2011; Wales, Monsen, & McKelvie, 2011). If the firm changed its EO condition, what would be the most reasonable time frame that the firm would experience a corresponding change in its performance? Answering this question depends, in no small part, on the choice of the performance outcome, along with considerations such as the firm's industry and market environment.

Third, it is important to consider the likely presence of an intervening variable—or variables—translating a change in EO to a change in performance. Not considering such intervening variables would, would bias the direct effect of EO on the outcome e.g. it would be an upward bias if the missing variable is positively correlated with EO and the outcome. There is not, nor can there ever be, a "perfect" study of EO but mixed methods approaches, exact and conceptual replications, and combining exploratory and confirmatory methodologies are valuable approaches to improving a study's overall quality while addressing the limitations of specific empirical approaches (Anderson et al., 2019; Wennberg & Anderson, 2019). Given the maturity of the field and the popularity of the EO construct, the time has come to constructively push EO scholars towards research designs that maximize causal inference.

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RESUMÉ

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