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MNC structure, complexity, and performance: Insights from NK methodology

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ABSTRACT

We introduce NK-simulation models to international business research and more specifically show how this methodology provides insights into the effects of MNC structure and internal complexity on performance. The interdependence of decisions made in different MNC-units is theorized as an underlying mechanism by which structure and complexity affect performance. The performance of three organizational structures, regional, matrix, and network, discussed in the IB literature is compared at the various levels of complexity. The results of our simulations show that the relationship between internal complexity and firm performance is an inverted U for all three organizational structures. Furthermore, at high levels of complexity the network structure has the best performance, followed by the matrix, with the regional last. However, at low levels of complexity the rank order of structure performance is reversed. In addition to these conclusions, this paper contributes to the international business research by demonstrating how the methodology's power can help scholars answer fundamental questions regarding other IB phenomena.

1. Introduction

A survey of global CEOs revealed the rapid escalation of complexity as the biggest challenge and more than half of them doubted their abilities to manage it (Berman, 2010). This finding should not be surprising to international business scholars who study MNC organizational structure. Given the definition of complex systems as those "being made up of a large number of parts that interact in a non-simple way" (Simon, 1962: 468), MNCs with their multiple product divisions, each having many interdependent and geographically dispersed subunits whose decisions are interdependent regarding operation and resource allocation, are the most complex of all organizational structures. For example, consider the complexity of Siemens with its 362,000 employees who work in 290 major production and manufacturing plants located in approximately 190 countries (Siemens, 2013).

NK-modeling is a simulation methodology that is widely used in the management literature to gain insights as to how complexity of organizations or systems affects performance (Levinthal, 1997; McKelvey, 1999). NK-methodology is prevalent in research on organization theory (Rivkin and Siggelkow, 2003), management cognition (Gavetti and Levinthal, 2000), and strategy (Ganco and Agarwal, 2009; Ganco and Hoetker, 2009). However, despite the ongoing IB research on MNC organizational structure and performance (Chi et al., 2004; Ceci and Prencipe, 2013), and the fact that NK-methodology lends itself to analyzing complex MNC structures, it has yet to be used in IB literature. Instead, most IB research that has enriched our understanding of the effect of complexity on performance is in the form of case studies (e.g., Ghemawat, 2005; Ghoshal and Bartlett, 1990; Malnight, 1996).

While case studies have their place, simulation is an especially powerful tool to model theory in situations where field studies are impractical because large matched samples are unobtainable, or the number of managerial and environmental control variables

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required to account for alternative explanations are too numerous (Davis et al., 2007; Lazer and Friedman, 2007; Venaik et al., 2004). Hence IB-research of MNC-complexity and structure's relationship with performance lies at a point between theory creating using multiple case inductive research and theory testing using field data and multivariate statistical techniques. Davis et al. (2007) call this the "sweet spot" for which simulation methods are particularly useful.

The NK-model of MNCs that we build in this paper makes it possible to investigate the relationships of interest in a controlled environment. The MNC is modeled as a network of units connected by linkages, which reflect the underlying pattern of decision-making interdependencies. These interdependencies affect overall MNE performance in that the contribution of a decision made in one unit to performance depends on the decisions made in other units. In addition to taking into account the interacting effects of decision linkages among units, the dynamic nature of the NK model allows one to study the MNC as it searches for better performance over time.

We have injected realism into our MNC-model to the degree that is possible given the technical specifications of NK-methodology. MNCs inherit their organizational characteristics through interaction with their environment and through strategic rivalry with their competitors. More specifically, the environmental conditions of international business become part of our model by constraining the managerial choices of structure and level of complexity. To demonstrate the power and validity of our model, we conduct a series of analyses examining the effect of structure and complexity on MNC-performance by having one of the two variables largely predetermined by characteristics of the MNC's environment and the other as a strategic choice of the MNC.

The results reveal that regardless of structure, a moderate level of complexity is optimal. They also show that MNC-performance comparisons across structures are meaningful only when the level of complexity is taken into account. Regional structures seem to be the best choice at low levels, matrix structures at medium, and network structures at high levels of complexity. The results are confirmed by conducting numerous robustness tests.

Our paper contributes to the international business literature in three ways. First, we introduce NK methodology to the IB field because this approach can provide researchers with insights for a variety of IB research questions for which empirical studies are difficult or impossible. The constructs of structure and complexity are particularly important to MNC performance and NK modeling enables us to examine their relationship in a controlled environment, by setting all other non-structural parameters equal. Second, we demonstrate the advantages of NK methodology by modeling comparable matrix, regional, and network organizational structures to answer our research question: how does the complexity of these structures affect performance? The literature studying structure and performance is conflicted at worst and inconclusive at best (Wolf and Egelhoff, 2010, 2012). Because of the limitations in case studies, researchers can only estimate firm performance for the type of structure design that a firm actually implemented. The results obtained by using NK methodology give insights into the effect of structure on performance are of both theoretical and practical importance and beyond what is discussed in previous IB case studies. Third, we further develop complexity theory (Eisenhardt and Piezunka, 2011) in the context of MNCs addressing the key management challenge from a complexity point of view, namely "finding the right balance of too much and too little structure" (p. 507).

The remainder of this paper is organized into eight sections. The next section discusses the problem statement and reviews the literature relating MNC-structure and performance. The third section explains decision interdependence as a theoretical mechanism by which structure and complexity affect MNC performance. We elaborate further in the fourth section by explaining basic concepts of NK-methodology in the context of MNCs. Next we explain in detail how we apply NK-methodology to answering the research question and illustrate all the technical steps by using examples. Subsequently, we present our findings and follow with a section describing the robustness tests and some extensions of the model. Further we discuss the managerial and practical relevance of the model and then conclude.

2. Review of the MNC structure and complexity literature

The study of organizational structures and how they affect performance in the field of international business began as an extension of the more general discussion of strategy – structure relationship in strategy (e.g., Egelhoff, 1982, 1988; Franko, 1976; Luo, 2002; Stopford and Wells, 1972). Stopford and Wells (1972) proposed that in the first stages of internationalization firms tend to bundle their foreign activities into a separate international division and then with increased international expansion move to a geographic or product division model, or to the more advanced matrix. Perlmutter (1969) distinguished among ethnocentric or home-country oriented, polycentric or host-country oriented, and geocentric or world-oriented designs, the latter being the starting point for an extensive discussion of network-based MNC designs (Bartlett and Ghoshal, 1989; Hedlund, 1986; Prahalad and Doz, 1987). Broadly speaking, the previous literature has identified formal organizational structures (regional, product, or matrix) and networks as two fundamentally different coordination alternatives found in all MNCs and has also discussed the performance implications. These types of structures that we often observe are those that have survived over time by matching successfully the variety of the challenges found in the external environment.

Among the formal structures, the geographical region structure is very common. Already in the 1980's the research (e.g., Egelhoff, 1982) described such structures that divided the world into regions, each with its own HQs responsible for all of the company's business within its geographical area. The interaction between a foreign subsidiary and domestic operations or a subsidiary in another region is low and the only mechanism for coordinating across regions is the corporate HQs (see also Egelhoff (1988); Wolf and Egelhoff (2002)). In terms of performance, this structure is best when "operations within a region are relatively large, complex, and sufficiently different from other regions that opportunities for specialization and economies of scale are greater within a region than they are along worldwide product lines" (Egelhoff, 1982: 441). Likewise, Rugman (2005) pointed out that the pattern of differences among countries along different dimensions creates regional selection pressures on MNCs by making cross-border transfer of knowledge and capabilities easier within regions than across them. Matrix organizational structures are an overlay of two elementary