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KARINA PRETTO

Revisiting Competitive Advantage: Existence, Dynamics, and New Dimensions

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Campo de conhecimento: Gestão de Operações e Competitividade.

Orientador: Prof. Dr. Luiz Artur Ledur Brito

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DEDICATORIA

Dedico este trabalho à minha família,
fonte de amor incondicional.

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ABSTRACT

Despite the fact that Competitive Advantage is a cornerstone concept in Management, this theme is still an origin of debates about its meaning, measurement, manifestation, and relationship with financial performance. This work contributes with this debate advancing in conceptual, methodological and empirical aspects. Using a sequence of three papers, the concept of competitive advantage is revisited, proposing new dimensions, its existence is quantified using a Bayesian model, its dynamism is characterized, and, in the end, the new dimensions are empirically tested. The first paper contributes theoretically with the discussion of competitive advantage concept and its relationship with the financial performance based on the economic value creation approach. This paper offers a methodological contribution with the proposition of a Bayesian hierarchical bi-dimensional model to measure the existence of competitive advantage from financial performance data. It also offers a conceptual contribution with the proposition of two new dimensions (momentum and consistency). The second paper applies the model proposed in the first paper to a North American database covering the historical period from 1995 to 2011. This paper offers empirical contributions to the quantification of existence and dynamics of competitive advantage, describing its topography in a real world. Results indicate that the competitive advantage occurrence is not as rare as found in early studies, and rarity is dependent on the industry. The theoretical and practical implications relate to reviewing the industry's relevance when compared to theories that are focused on internal firms' resources, as the resourced-based view. Results also demonstrate and characterize how profitability and growth are conjointly necessary to evaluate the presence of competitive advantage, and influence in its dynamic in different ways. The third paper operationalizes the new dimensions of competitive advantage proposed initially in the first paper. It describes the pattern of occurrence of these new dimensions and tests its capability in foresee the competitive statuses mobility on a longitudinal view. Results indicate that the inclusion of new dimensions increase the capacity of prediction of firms future competitive status.

Key-words: competitive advantage, value creation, performance, bayesian.

RESUMO

Apesar da centralidade e relevância do conceito de Vantagem Competitiva em Administração de Empresas, o tema ainda é fonte de debate quanto ao seu significado, mensuração, manifestação e relação com o desempenho financeiro. Este trabalho contribui com esse debate avançando em vários pontos conceituais, metodológicos e empíricos. Por meio de uma sequência de três artigos, o conceito de vantagem competitiva é revisitado propondo-se novas dimensões, sua existência é quantificada usando um modelo Bayesiano, seu dinamismo caracterizado e, por fim, as novas dimensões propostas são testadas empiricamente. O primeiro artigo contribui teoricamente com a discussão do conceito de vantagem competitiva e sua relação com o desempenho financeiro a partir de uma abordagem de criação de valor econômico. Este artigo traz uma contribuição metodológica ao elaborar um modelo hierárquico Bayesiano bidimensional para medir a existência da vantagem competitiva a partir do desempenho financeiro e uma contribuição conceitual ao propor duas novas dimensões do conceito (momentum e consistência). O segundo artigo aplica o modelo proposto no primeiro a uma base de dados de empresas norte americana, cobrindo o período de 1995 a 2011. Esse artigo traz contribuições empíricas ao quantificar a existência e a dinâmica da vantagem competitiva oferecendo uma topografia do tema no mundo real. Os resultados indicam que a manifestação da vantagem competitiva não é tão rara quanto apontada em estudos anteriores e que o grau de raridade depende fortemente do setor. A implicação para a teoria e para a prática é uma revisão da importância do setor frente às teorias que focam os recursos internos da empresa, como a visão baseada em recursos. Os resultados também demonstram e caracterizam como lucratividade e crescimento são conjuntamente necessários para avaliar a presença da vantagem competitiva e influem na sua dinâmica de forma diferenciada. O terceiro artigo operacionaliza as novas dimensões do conceito de vantagem competitiva propostas no primeiro artigo e testa sua ocorrência e capacidade de prever a mobilidade do estado competitivo numa visão longitudinal. Os resultados indicam que a inclusão das novas dimensões potencializa a predição do status competitivo futuro das empresas.

Palavras-chave: vantagem competitiva, criação de valor, desempenho, bayesiana

LISTA DE ILUSTRAÇÕES[1]

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LISTA DE TABELAS[2]

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SUMMARY

1. Introduction

Despite the fact that Competitive Advantage is a cornerstone concept in Management (Sigalas & Economou, 2013), there is still significant debate in the field about the concept, including how to define and measure it, how it relates to financial performance, and what are its main causes or consequences. This work explores some of these questions contributing to competitive advantage research, using a sequence of three connected, but independent papers.

The first paper is a theoretical essay that revisits the competitive advantage definition and its relationship with financial performance, contributing to the theoretical discussion about competitive advantage conceptualization under a value creation perspective. Following previous work (Brito & Brito, 2012), firms' profitability and growth are measured conjointly in order to ascertain the existence and measure competitive advantage. The paper has two main contributions. First, it proposes two new dimensions for the Competitive Advantage construct: competitive momentum[3] and competitive consistency. Competitive momentum captures the trend in value creation over time while consistency captures the regularity of value creation over a certain time span. These additional dimensions expand and better characterize the firm's competitive status in a dynamic way beyond the simple static statuses of advantage, parity, and disadvantage. The new dimensions contribute to enhance the understanding of the adaptation process that a firm faces over time, and help to comprehend how and why firm or industry specific effects affect firms' performance (Short et al., 2006). The second contribution is methodological and extends Brito & Brito's (2012) model. Respecting the longitudinal and hierarchical nature of data, and the multidimensionality (Bentes, Carneiro, Silva, & Kimura, 2012; Matitz & Bulgacov, 2011) of the competitive advantage definition, a more robust and versatile methodological approach based on Bayesian hierarchical modeling is proposed.

The second paper applies the model developed in the first paper to an empirical set of North American firms from 1995 to 2011. The paper has empirical contributions

[3] Competitive momentum concept was first raised in academic discussions between professors Flávio Vasconcelos and Luiz Brito.

and implications for theory. The first empirical contribution is a finer grained and realistic picture of the topography of competitive advantage. Based on Bayesian inference, the rareness of competitive advantage manifestation is quantified and inferences based on probabilities of firms outperforming their industries are made. Results show that competitive advantage is not as rare as reported in previous studies (Brito & Brito, 2012; Wiggins & Ruefli, 2002), since close to 25% of all firms are classified in a competitive advantage status. Close to one third of firms in competitive advantage achieve single advantage only in growth dimension, confirming that competitive advantage assessed only focusing on profitability is an incomplete approach. The second empirical contribution relates to dynamics of competitive statuses. Results provide a picture of the persistence and dynamics between competitive statuses, and indicate that it is harder for firms to sustain advantage in growth than it is in profitability under the value creation approach. The third empirical contribution relates to differences on competitive advantage manifestation across industries. These results contribute to answer Wiggins and Ruefli's (2002) call against the paucity of such studies, indicating that the presence of competitive advantage is very dependent on industry type and conditions. Industry effects' relevance varies across industries. For instance, competitive advantage is rare or almost non-existent in highly regulated industries, as Water Supply and Natural Gas Distribution and frequent in innovative industries, as Pharmaceutical Preparations. This finding has theoretical implications contributing to the theoretical debate on how much industry and firms' idiosyncratic characteristics matter to performance heterogeneity. In this sense, RBV (Barney, 2001) and Porter's Five Forces (Porter, 1980) are both necessary and complementary to explain the influence of industry and firms factors over performance.

The final paper extends the debate around the dynamism of competitive advantage by testing the new proposed dimensions formulated in the first paper. A descriptive pattern of the new dimensions is presented and evaluated whether competitive momentum and consistency of firms' value creation over time help to explain competitive status movement in future time frames, adding a forward perspective into competitive advantage analysis. Findings indicate that although most firms experience the same competitive momentum as their industry average, the divergence on value creation evolution exists and is more frequently observed in competitive statuses associated to disadvantage. Analysis of consistency dimension

shows that low consistency is associated to changes in competitive status, corroborating Thomas & D'Aveni's (2009) argument, which states that during transient moments, firms can present higher volatility in their performance. Consistency and competitive momentum dimensions were tested as predictors of future competitive statuses, because incorporate prospective characteristics of value creation, which extends the dynamism analysis discussed initially in the second paper. Findings indicate that together with the current competitive status, the new dimensions (competitive momentum and consistency) are good predictors, improving prediction of migration across competitive statuses. There is, however, room for improvement on model's performance, especially regarding the use of other auxiliary variables related to industry and firms characteristics.

This document is structured as follows. The next three chapters present the three papers that constitute this dissertation. These chapters are written as self-contained and independent papers, so each has sub sections with its own introduction, literature review, results, discussion and conclusions. Since space limitation is not an issue, they tend to be longer and provide more information than a regular journal paper. The second paper has a shorter, journal version, in the appendices. It has been submitted to the Academy of Management Annual Conference (2014) and is under review. A short final chapter summarizing and integrating the findings of all three papers completes this document. References used in the whole document are provided at the end of this final chapter. Additional details about model outputs, performance measures, and support analysis are available in the appendices.

2. Paper I – Exploiting new dimensions of competitive advantage: A theoretical model

2.1. Introduction

Explain superior performance, seek for sources of performance heterogeneity, and identify its relationship with competitive advantage are common objectives of strategic management research. Competitive advantage is the cornerstone concept in strategic management (Sigalas & Economou, 2013), however, theoretical and empirical debates still exist about how to define and measure performance (Arend, 2003) and how superior performance is connected to competitive advantage.

The inability in operationalize competitive advantage led several researchers to treat superior performance as synonymous of superior financial returns (Miller, Washburn, & Glick, 2013; Rumelt & Kunin, 2003). In adopting that definition, most of studies limit the identification of competitive advantage to those firms with higher profitability (Barney, 1991; Wernerfelt, 1984).

One of the main criticisms about the association of superior returns to the superior performance is regarding the fact that the observation of superior returns does not necessarily mean that the firm has a competitive advantage (Coff, 1999; Powell, 2001), and therefore, other elements must to be considered into the analysis. According to Coff (1999, 2010), performance should be viewed as a matching between firms' development capability, and the dynamic of value appropriation conducted by employees, suppliers, and shareholders. Under this conception, the lack of higher returns does not mean that firm is not in competitive advantage, it means that the firms' stakeholders might be appropriating from this value, without reflecting it in financial returns statements.

From the 90's, the conception of competitive advantage started being discussed under value creation perspective, in which a firm is said to achieve competitive advantage when it creates higher value than its competitors (Brandenburger & Stuart Jr, 1996; R. Brito & Brito, 2012; Ghemawat & Rivkin, 1998; Ito, Junior, Gimenez, &

Fensterseifer, 2012; Peteraf & Barney, 2003). Despite the fact that the evaluation of competitive advantage under value creation give the impression of a convergence on theoretical debate, the lack of consensus on how to measure the advantage still persists.

Another limitation that is still present in competitive advantage characterization is directly linked to the timing of advantage manifestation. Existing formulations summarize competitive position of a company as a binary event, usually associated with results above average at a given length of time (Brito, 2005; Richard et al., 2009), ignoring the temporal trajectory drawn by firms towards the maturation of their strategy and time effect over the competitive advantage characterization (Chan, 2003; Pacheco-de-Almeida & Zemsky, 2007; Ployhart & Vandenberg, 2010; Priem & Butler, 2001). This view is a simplification of the realty, and it is highly susceptible to criticism, mainly because it is focused in the past, and it is indifferent to the future perspective of the strategic positioning of a firm, and the consistency of its movement presented over time.

Traditional point in time analysis, usually adopted in strategic management studies, ignores longitudinal time effects over value creation in competitive advantage characterization. When the comparison is done only based on average observed values, time trend, and future perspective are ignored. In this case, two companies with distinct time trends can be classified at the same competitive status, although their value creation perspective indicates to opposite trajectories.

This paper aims to fill these theoretical gaps presenting a new perspective of competitive advantage characterization complementing the average performance approach by the future perspective. To do that, two new dimensions are proposed: Competitive Momentum and Consistency. The primary role of these new dimensions is to capture the momentum experienced by firms and the consistency on how value creation evolves over time, improving competitive characterization, as they introduce a future perspective of firms' competitive status. Both dimensions contributes to enhancing the understanding of the adaptation process that a firm faces over time, and help to comprehend how and why firms or industry specific effects affect firms' performance over time (Short et al., 2006).

As a practical implication, by adopting the proposed dimensions, managers and strategic management researchers can take a wider view of firms' current position and

firms' value creation future perspective, supporting future decisions and strategic planning definitions.

This work begins with a brief description of competitive advantage concept's evolution and its convergence to value creation approach. Following sections discuss the new proposed dimensions to characterize competitive advantage and their theoretical implications. The last section brings some conclusions, and discussion of the benefits of an empirical application of these dimensions.

2.2. Competitive advantage under value creation perspective

Competitive advantage studies became popular in strategic management literature from the release of the Michel Porter's book entitled: "*Competitive Advantage: creating and sustaining superior performance*" (Porter, 1985). According to Porter, competitive advantage of a firm increases as its capability of creating value for its customers exceeds its production costs.

This is not the first work discussing competitive advantage; however it brought a more robust definition about it. Two decades before Porter published his work, Ansoff (1965) discussed competitive advantage by referring to the idea of competitive position, and firms abilities to spot opportunities before their competitors. Later on, focused on management, South (1981), described the process of strategic management by identifying, developing, and obtaining competitive advantage.

In both works, there is a strong influence of the Industrial Organizational (IO) theory on the definition of competitive advantage. The same influence is observed in other publications up to the 80's. From this perspective, the presence of competitive advantage is identified as a result of the company's strategic positioning (Caves, 1984), and it is interpreted by competitive superiority, being associated with higher profit as synonymous with superior performance (Caves, 1984; Peteraf & Barney, 2003; Vasconcelos & Brito, 2004).

In the early 90's, under the lens of Resource Based View (RBV), Barney (1991) emphasized that firms own resources are the determinants of competitive advantage, and, as a result of the presence of these valuable resources, firms are able to achieve higher profit levels (Barney, 1991; Peteraf, 1993). To Barney, a firm achieves competitive advantage status when it creates greater value than its competitors. Therefore, as a consequence of it, The firms superior performance is the way on how the advantage manifests.

In both approaches, IO and RBV, there is no consensus about what competitive advantage, and what relationship with superior performance, are. It is not clear if the higher performance is cause or consequence (Vasconcelos & Brito, 2004) of competitive advantage, or even if profitability metrics are able to fully capture it. This lack of consensus and clarity about competitive advantage and superior performance concepts lead to the interchangeable association between profits and performance in several studies. However, this approach is restrictive and partially captures the firms ability in achieve a competitive advantage status.

The higher than average returns approach brings some weakness on competitive advantage definition, once profitability itself does not capture the whole value created by a firm (Coff, 1999, 2010; Powell, 2001). As a way to overcome this limitation, most recently, the concept of superior performance is detached from higher profitability and started to be explored through the concept of economic value created by firms (Brandenburger & Stuart Jr, 1996; Ghemawat & Rivkin, 1998; Peteraf & Barney, 2003).

By assessing the manifestation of competitive advantage under value creation perspective, a firm reaches a competitive advantage status when it is able to manage complex network of relationships that permeate the entire value chain more efficiently than its competitors, generating a greater willingness to pay, and a lower cost associated with the production (Coff, 1999; Ghemawat & Rivkin, 1998). It means that firm is able to create more value than its competitors (Peteraf & Barney, 2003).

Even if there is no single definition on how economic value creation should be measured, there is a consensus among researchers that the analysis of competitive advantage through value creation is more comprehensive, and allows a better understanding about the dynamics between all elements involved in this process: suppliers, firm, customers, and competitors.

To Porter (1985), value creation is defined as the difference between production cost and the price of the product. Peteraf & Barney (2003), Hoopes et. al (2003), and Besanko et al (2009) proposed to measure the economic value as the difference between production cost and customers' willingness to pay. A different perspective of the value creation was introduced by Brandenburger & Stuart Jr (1996), in which the economic value is defined as the wedge between the customers' willingness to pay and the suppliers' opportunity cost. Figure 1 illustrates the differences between value creations proposed in the literature.

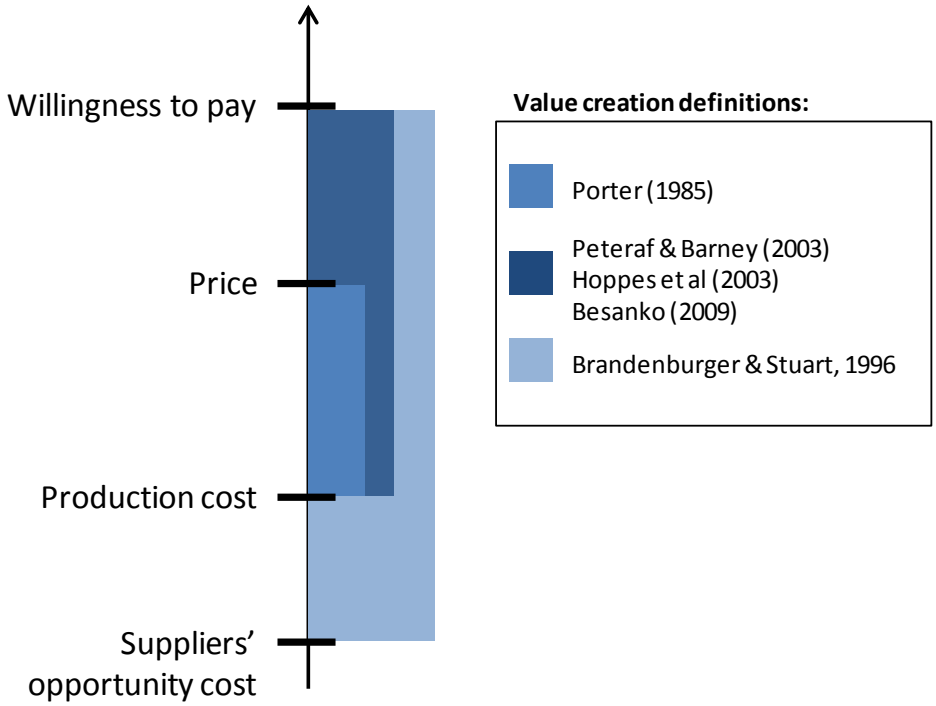


Figure 1. Economic value definitions
Source: Elaborated by the author based on previous literature propositions.

Brito & Brito (2012) presented an extensive review of value creation definition proposed by strategic management literature. Taking Brandenburger & Stuart Jr (1996) value definition as reference, the authors proposed a metric to assess competitive advantage evidence over financial indicators. More specifically, they propose to assess profitability and sales growth at once. Therefore, the better the supply chain management, the better the results obtained, the lower the production costs observed, and the higher the value perceived by clients (Ito et al., 2012). In this sense, profitability is only one possible manifestation of competitive advantage, but not the only one.

Linking competitive advantage propositions presented in Figure 1 to financial indicators, we see that Porter's (1985) value definition is directly associated to the profit generated by firms, as it is defined as the difference between production cost and the price of the product. Because of early criticism about the use of profit returns in competitive advantage, and it's limitation in capturing the overall dimensions aspects of competitive advantage (Coff, 1999; Durand, 2002; Rumelt & Kunin, 2003), this approach is not an option to be followed. An extension of Porter's (1985) definition is brought by Brandenburger & Stuart Jr (1996). It also extends Peteraf & Barney (2003), Hoopes et. al (2003), and Besanko et al (2009) definitions, proposing to measure the value creation from suppliers to buyers, encompassing all vertical chain players into the analysis (Brandenburger & Stuart Jr, 1996).

Thus, competitive advantage defined in terms of firms' capability in create superior value than their rivals (Peteraf & Barney, 2003) will be determined by the economic value created of firms, measured by the difference between clients' willingness to pay and suppliers' opportunity cost. Because as clients' willingness to pay and suppliers' opportunity cost are not directly captured in firms' transactions, the challenge here is to find alternatives to capture those metrics. One option is to break down the value chain taking into account stakeholders, and evaluate the existence of any impacts over financial indicators associated to each subset of the chain.

Figure 2 illustrates the main elements of value chain and the financial indicators proposed to translate the economic value creation effect. The share of value created which is directly perceived and reflected on firms' financials is the one related to the difference between price and production costs. This portion of value is associated to firm profits, or financial returns observed in firms financial statements.

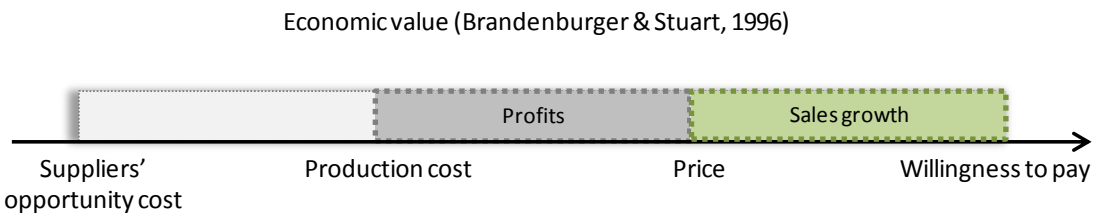


Figure 2. Economic value definition and related performance metrics

Looking the value chain under clients' perspective, the share of value created by them is given by the difference of their willingness to pay and the effective price charge

in the transaction. Notice that this share of value might not be directly measured, once clients' willingness to pay is a non-observable metric. However, the higher the advantage perceived by clients in transacting with one specific firm, most likely the transactions are going to be observed, which will reflect in higher level of firm's sales, which will push firm growth (R. Brito & Brito, 2012). Hence, although the share of value created by clients is not a straight metric, firms' financial indicators might be use to capture it's effects.

Peteraf & Barney (2003) explored this idea and, in their conception, economic value of firms can be created through the development of products or services with superior benefits, and similar costs to firm's competitors (competitive advantage based on differentiation), or with identical benefit and lower costs (competitive advantage based on efficiency). Realizing this benefit, customers attempt to purchase such products, stimulating firms to sell more products, maintained the margin provided by competitors (Newbert, 2008).

The last share of value is directly linked to suppliers. It probably has the less direct effect over firms' financial performance. Nevertheless firms can benefit from stronger relationships with suppliers (Dyer & Singh, 1998) in different ways. The benefit might be perceived in lower transaction costs (Dyer, 1996), and consequently impacting on firms' profitability. Customers' perceptions also might be positively affected by good relationships between suppliers and firms, impacting then clients' propensity in transacting with one particular firm.

Therefore, to capture the economic value created, in this work, profitability and sales growth metrics are going to be measured together in order to assess firm's competitive advantage.

Evaluating the relationship between supply chain elements exhibited in the Figure 3 in more detail, a trade-off between the proposed financial dimensions emerges. For instance, keeping production costs stable, there is a trade-off between total economic value amount captured by the firm and by its clients, considering the total value created in one specific transaction (Pitelis, 2009).

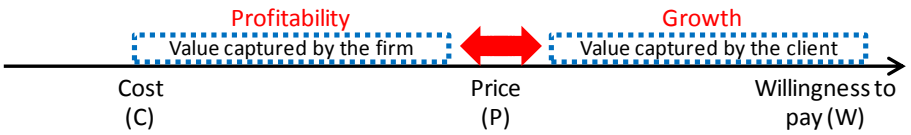


Figure 3.Trade-off between the total value amounts captured by the firm and by its clients

This trade-off exists as firms raise the price of their products to increase their share of value creation (profitability), interfering directly in the perception of value share of customers. On the other hand, to increase sales levels, firms can make their prices lower, which might commit their profits at pace with it drives to a higher market share position. Thus, the more effectively a firm is in creating economic value, the higher it's chances of achieving a competitive advantage status.

One good example of it is given by Apple's policy of selling the new version of its products at the same price as the older ones. This policy increases customer perception around benefits of buying a new product. As a result, Apple's sales growth rates are higher than its competitors, once that this policy increases the clients willingness to pay and creates the perception of a higher value captured by clients (Priem, 2007).

Thus, to assess competitive advantage under value creation perspective means to leave the one-dimensional analysis, usually associated to higher profitability, and introducing a multi-dimensional structure to characterize the topography of the competitive status (Brian K. Boyd, Gove, & Hitt, 2005; Richard et al., 2009; Venkatran & Ramanujam, 1986).

This migration from one to many dimensions requires more sophisticated structure to evaluate value creation components, and it is one of the main limitations of empirical studies, since they need to fit the conceptual definition of strategy research into a statistical framework structure (Venkatraman, 1989). Using multilevel modeling, Brito & Brito (2012) compared the deviation of the firms effect from the global average to characterize the topography of competitive advantage. Two separated models were estimated, one for profitability and another for firm's growth. Then, based on the deviation from the overall effect firms competitive advantage was characterize. Although that study innovated in the way on how competitive advantage is evaluated, its main gap is the fact that the methodological approach adopted did not treat the trade-

off existent between both dimensions, as showed in Figure 3. Moreover, they assume that all firms as the same variance component, and although the multilevel structure adopted try do isolate industry specific effects the comparison does not take firms position within industry context into account.

Clearly, the complexity introduced into the model is higher when two metrics are simultaneously evaluated. Under value creation approach competitive advantage might manifest in different ways, and propose one robust model to deal with this fact is one of the objectives of this work.

2.3. Time effect and value creation

A second aspect that should be included on competitive advantage definition is the longitudinal nature of value creation process (Rumelt & Kunin, 2003). From the moment that a company decides to develop a new product until sales results start being observed in its balance sheet, different status of competitiveness can be assigned to a firm. Depending on the time of observation, the same firm can be classified as presenting competitive advantage, parity or disadvantage, when compared to its rivals.

Each one of firms react differently depending on the influence of their own abilities (Barney & Arikan, 2001; Peteraf, 1993), the presence of environment effects (Dess & Beard, 1984; McGahan, 2000), and by industry life cycle stage characteristics (Karniouchina et. al , 2013). Depending on the combination of these factors, one firm can spend more time to start capturing value created until reaches a position of competitive advantage. In other words, results from decisions taken by a firm at the present moment will be reaped in some time in the future. In between, firms will work continuously to create the highest value as possible, without any significant changes in their financial indicators. Investigation about the dynamic in which this interactive process among all stakeholders (suppliers, employees, shareholders, clients) provide any effect over firms financial results is still in an incipient stage in strategic management research.

Although theoretical studies discuss the meaning of time effect over competitive advantage acquisition and its sustainability processes (Chan, 2003; Pacheco-de-Almeida & Zemsky, 2007; Ployhart & Vandenberg, 2010; Priem & Butler, 2001), some aspects, as trajectory designed by a firm over time, and the competitive position perspective are not explored enough by researches.

By adopting a longitudinal approach it is possible to include the time effect in the analysis, allowing researchers to look for evidence on how firms' characteristics affect performance over time (Short et al., 2006). Empirically, what is seen is that when time effect is included in the model, it has a secondary role in competitive advantage characterization (Richard et al., 2009). Richard et al. (2009) identified that almost 48% of all organizational performance papers published in main management journals[4] from 2005 to 2007 have used information covering different periods of time. However, methodological treatment adopted in those cases did not foresee any longitudinal treatment to accommodate the data structure. In only 30% (65 studies) of these studies, any time series methodological approach was considered, and from them, just 7.5% (16 studies) had considered multiple measures to characterize firms' performance.

Usually, the approach followed by most researchers was to describe firms' performance is the use average performance observed in a specific period in time, also called by cross-sectional approach. Under this approach, one firm is said to present competitive advantage over its rivals if its performance is higher than the average performance observed within the same period of time. Firms performance series are initially summarized by equidistant time windows covering all time frames (Brito, 2005; Brito & Brito, 2012; Richard et al., 2009), allowing the evaluation of the persistence of competitive status over time (Aveni, Dagnino, & Smith, 2010; Rumelt, Schendel, & Teece, 1991). The observation of consecutive events of competitive advantage will indicate which firms present a sustained competitive advantage over their rivals (as earlier defined by Ruefli e Wiggins 2002; 2005).

This approach helps researchers to understand the current competitive status in a fixed moment of time; however, it does not capture competitiveness perspective of firms, and it does not reflect the trajectory designed by a company, or even the consistency of it's movement over time. Just focusing on single averages comparison,

[4] Academy of Management Journal, Administrative Science Quarterly, Journal of International Business Studies, Journal of Management e Strategic Management Journal.

researches will identify firms current competitive status, however, they will dismiss several complex forces that affect firms' performance and do not include firms history results into their analysis.

Internally, the capacity of a firm to use its resources, improving its processes, or acquiring new resources based on the existent ones, generates a virtuous production and management cycle, leading the firm to better economic, financial, and operational results (Selove, 2012; Teece, Pisano, & Shuen, 1997; Wernerfelt, 2011). Externally, firms strategic market position, knowledge about the industry from where firms belong, or economic environment effects are factors that also influence firms' performance, and consequently, influence the way of how competitive advantage manifests.

In both cases, longitudinal effect contributes positively on the explanation of the dynamic of value creation, as well as on the understanding of how fast firms adapt to internal and external changes. Short et al (2006) explored this factor, and proposed different models that capture the evolution of corporate performance over time. The authors proposed the use of growth curve models that incorporate terms directly associated to performance trajectory, evaluating effects of explanatory variables, and interactions between auxiliary factors (Short et al., 2006; Short, 2007). This approach contributes to the study of temporal dynamics since they propose a specific treatment for longitudinal data structure.

Based on what was discussed earlier, there is a gap in competitive advantage definition presented by strategic management literature. It is regarding the absence of a dimension that enables researchers to capture the time trend of the trajectory designed by a firm over time, and thus, introduces a future perspective of this movement into competitive advantage analysis.

As a contribution to this discussion, the present paper aims to propose a model that incorporates the longitudinal view and as well allows researchers to in characterize competitive advantage introducing new dimensions regarding the future perspective of competitive position and consistency of firm's time trajectory.

2.4. Competitive momentum

The competitive momentum is the first dimension proposed in this paper. It summarizes the competitive trajectory of firms over time. Competitive momentum combines information of economic value captured by a firm, and its clients, during a certain period of time, comparing the average time trend observed in each firm with the trend observed in each respective industry.

Under industrial organization perspective, heterogeneity of firms' performance can be explained as the market position occupied by a specific firm (Ansoff, 1965; Porter, 1985). Also, higher performance is more likely to be observed among firms that are more capable to implement strategies that generate higher value than its rivals, or from the use of its own valuable and rare resources (Barney, 1991; Helfat & Peteraf, 2003a), or even by the fact of having particular capabilities that smooth the adaptation process when changes on internal, or external environment occur (Teece et al., 1997).

These factors lead firms to achieve more easily an advantage position in comparison with their rivals (Helfat & Peteraf, 2003b). Along with this, competitive advantage cannot be achieved in case of a misunderstanding in economic environmental conditions and restrictions (Dess & Beard, 1984; McGahan, 2000), requiring a longer period of time, that causes any interference in performance metrics adopted to measure advantage's manifestation.

In common, all approaches indicate the presence of a temporal factor that helps to explain the observed performance and that influences the final configuration of dynamic manifestation of competitive advantage of companies. By capturing the longitudinal effect in an appropriate way, the strategic management researchers can increase their knowledge about the dynamics of value creation within the existing business. This expands the understanding of the adaptation process that firms face over time. Through a longitudinal analysis, it is possible to show how and why factors linked to firm and/or to industry influence performance of firms (Short et al., 2006).

Time component must be seen as a complement to average performance comparison approach, which will enhance the comprehension about competitive status of a firm, and its future perspective.

2.4.1. Competitive momentum definition

Competitive momentum summarizes firms' competitive position in a given length of time. It adds to the average performance analysis introducing the intensity of how performance is affected over time. Figure 4 illustrates the properties that are translated by the competitive momentum dimension.

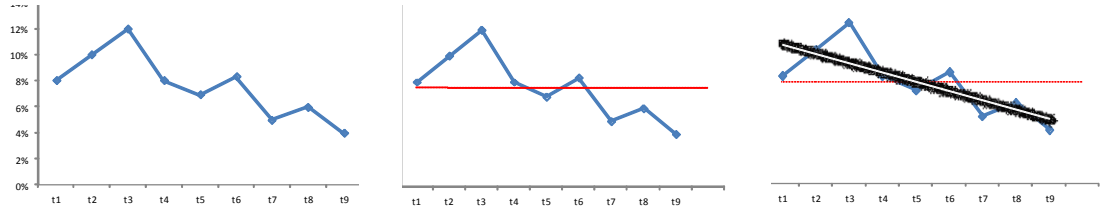


Figure 4. Competitive momentum components

The use of competitive momentum as an auxiliary dimension to characterize competitive advantage going further, and allows the differentiation in time trend of performance's trajectory. For instance, consider the performance evolution for two firms (A and B), as presented in the Figure 5. Note that both firms have same performance in average (expressed by the horizontal dotted line). Empirical studies usually will assume that because average performance values for both firms are quite close, firms are going to be classified at competitive parity position.

Figure 5. Example of a competitive momentum analysis

When competitive momentum is incorporated, the interpretation of competitive position for firms changes. They are not exactly the same. For instance, starting

evaluating the performance trajectory of Company B it is found that this firm tends to exceed the performance of its direct competitor in future.

It is important to keep in mind that, at this stage, the representativeness of performance results is highly associated to the time frame observed, coherence of the performance metric used (economic value definition), and also to the statistical methodology adopted to capture the longitudinal nature of this phenomenon (Ployhart & Vandenberg, 2010). Once that not all firms have same maturity time to reap the benefits of their strategies, it is important to observed firm's trajectory in order to better understand their competitive momentum and their understanding of their competitive position in a given length of time.

Returning to the example discussed earlier, when the time horizon is divided in two parts, a distinct average performance for each firm (A and B) is observed, as shown in Figure 6. Notice that in the first time frame (Time frame 1) the average performance of Company A is higher than Company B. This result shows that Company A has achieved a competitive advantage compared to its rival. However, when a temporal component is introduced, which is implicit in the Competitive Momentum dimension, the distinction on perspective of future competitive position emerges. Company A is experiencing a downward trend suggesting that its current advantage position is temporary, or, unlikely to be sustained in the future. On the other hand, Company B has a greater likelihood to reverse its situation even it has a competitive disadvantage position in terms of average performance in the moment of the observation.

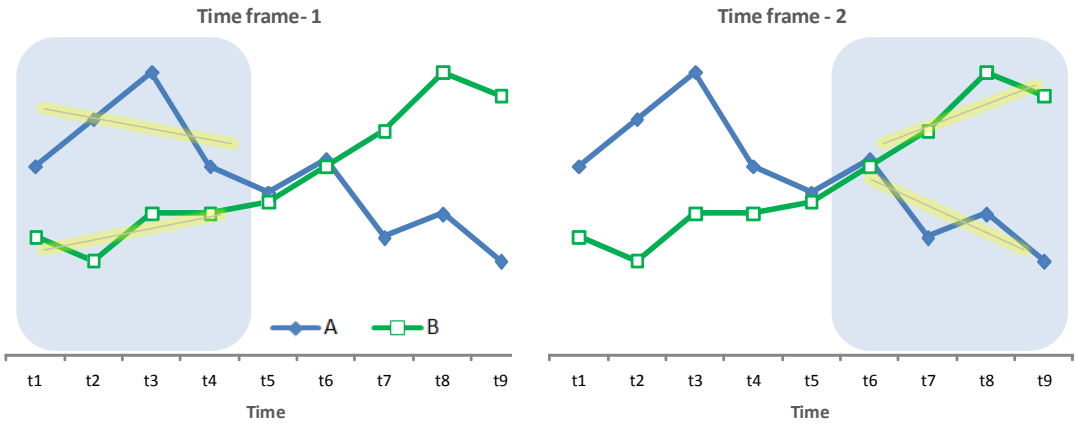


Figure 6. Adding the competitive momentum into the average performance analysis

Moving to the next time frame (Time frame 2), it is observed that the trend suggested by Competitive Momentum dimension in the past time window is confirmed. After experienced a competitive momentum towards advantage, Company B is now in a competitive advantage position, while Company A is in a disadvantage one.

Therefore, the use of competitive momentum analysis in conjunction with competitive status comparison becomes a more robust competitive advantage analysis, once it captures the future perspective of performance trajectory of firms. This new dimension is particularly important at those moments of reversion in a trend, once it can foresee changes in competitive status in advance.

Continuing exploring competitive dimension features, it is possible to differentiate firms' momentum based on the trend of observed performance. As presented in the previous example, Company A shows a descending trend in spite of the fact that it has an above the average performance behavior (Figure 7.a). In this case, although Company A status indicates that firm is going to face a transition period in its competitive status, and it is unlikely to sustain its advantage in a future time frame. Opposite transition movement is presented by Company B, which shows that firm is experiencing a momentum towards advantage (Figure 7.c), although competitive status suggests it is in disadvantage. In this case, it is also noticed that Company B temporary status of disadvantage could not be sustained over time.

In addition to the transition trajectories, two other situations could be defined, as illustrated by Figure 7.b and Figure 7.d. In case when firms present an advantage status over rivals, and they still present an ascending time frames (Figure 7.b), they are going to exceed their current competitive position in future sustaining the advantage status in future.

When firms are in competitive disadvantage (presenting performance under industry average), and the performance trajectory trend indicates that performance are going decrease in following time frames (Figure 7.d), meaning that this firm is unlikely to leave disadvantage status in future, and the persistence rate into that status is high, and the persistence rate into that stratus is high.

Finally, firms presenting trajectory similar to average of industry tend to keep same competitive status in future, and there are no clear perspective of changing their current competitive in a near future.

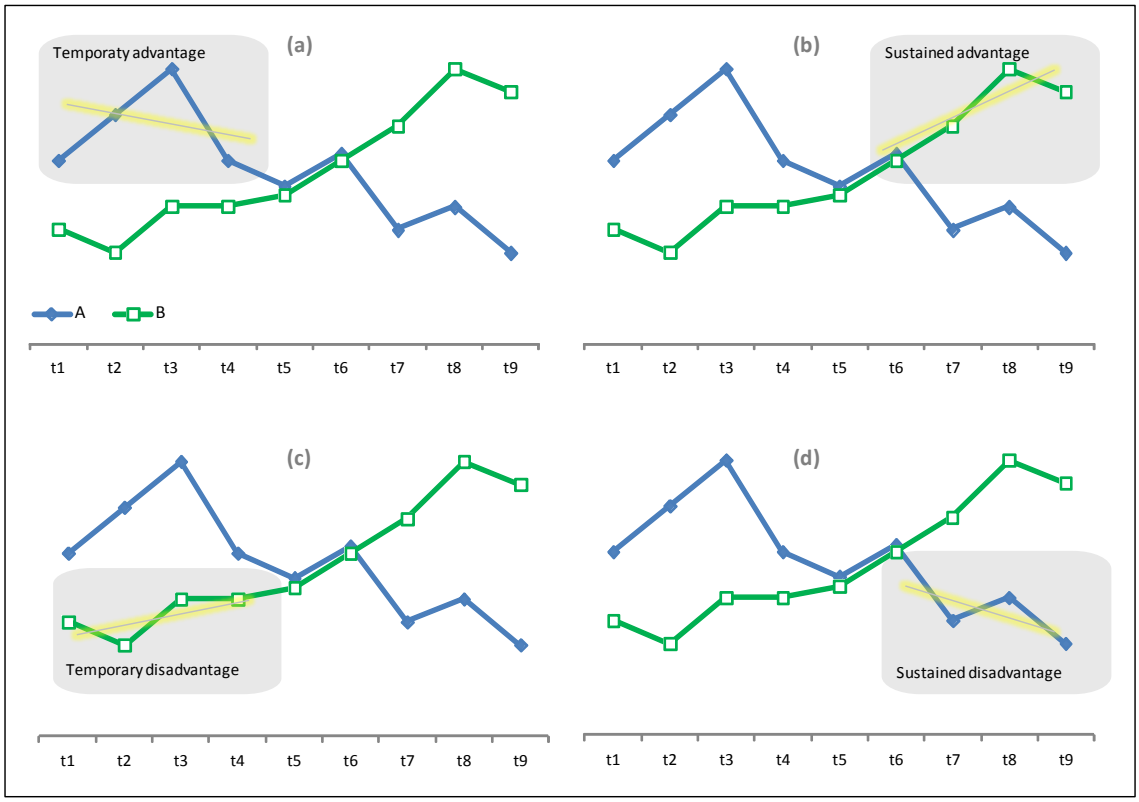


Figure 7. Introducing the competitive momentum into competitive advantage characterization
Transition moments: (**a**) and (**c**).Temporary advantage or maintenance: (b) e (d)

One additional benefit in adopting competitive momentum dimension to enhance competitive advantage characterization is the inclusion of future perspective of firms' performance trajectory, and incorporating and element able to capture competitive advantage dynamism over time.

As exemplified in the Figure 7, the transition or persistence of competitive status might be predicted by competitive momentum. Competitive momentum assists the characterization of competitive advantage position when there is a transition across competitive status. Based on the competitive momentum dimension, researchers can identify those firms that have more chances to sustain their advantage in a near future.

It is important to bear in mind that all competitive advantage assessment discussed above was conducted considering a one-dimensional approach to characterize firms' performance. However, under value creation, a multidimensional analysis is required, and, in this case, the analysis should cover all dimensions simultaneously.

If for one side more data and robustness to competitive advantage analysis is gathered, in the other one the complexity raises, requiring the adoption of more complex

statistical models. This existent trade-off between methodology complexity and improvement on performance's measurement is currently present in strategic management research (March & Sutton, 1997). In particular, taking as a starting point the adoption of profitability and sales growth as proxies of economic value created by a firm, a bi-dimensional model structure will be necessary to accommodate competitive advantage surface, allowing and accommodating the intrinsic correlation between both metrics.

Making an analogy to the example presented at the beginning of this section, the analysis of competitive momentum in a bi-dimensional view should consider simultaneously the time trend trajectories for growth and profitability dimensions. Interpretation leaves the on-dimensional plan and passes to be made through a surface, which increases the number of possible configurations for the manifestation of competitive advantage. The direct benefit of using this approach is a wider view of dynamics of competitive advantage manifestation, and its topography, being seen in a situation where the advantage can manifest through the increase of firms` profitability, or because there is an increase in market share (or sales growth), or in both metrics simultaneously.

2.4.2. Empirical examples of competitive momentum

Competitive Momentum can be better understood by observing a real example involving Dell Computers and IBM performance trajectories. Both firms present the same performance[5] within a given time frame. Performance is measured quarterly from September 2002 to March 2012. As presented in the Figure 8, during the time frame that encompasses the period from 2006 to 2009, both firms have, in average, returns on assets close to 10%.

Focusing the analysis only in average comparison, researchers will conclude that both firms have the same competitive status, and therefore, will assume they are in

[5] For illustration purposes of the competitive momentum value captured by a firm will be exemplified in only one dimension. In this case Return on Assets (ROA) is used as a proxy of the value created by firms.

parity position. Nevertheless, when competitive momentum dimension is introduced, clear differences between firms capability in creating economic value is identified. DELL shows a decreasing trend in its performance over time while IBM presents an ascending one.

The ascendant trend observed in IBM performance trajectory put it check the sustainability of current competitive parity position in a near future, and indicates that firm is moving towards advantage.

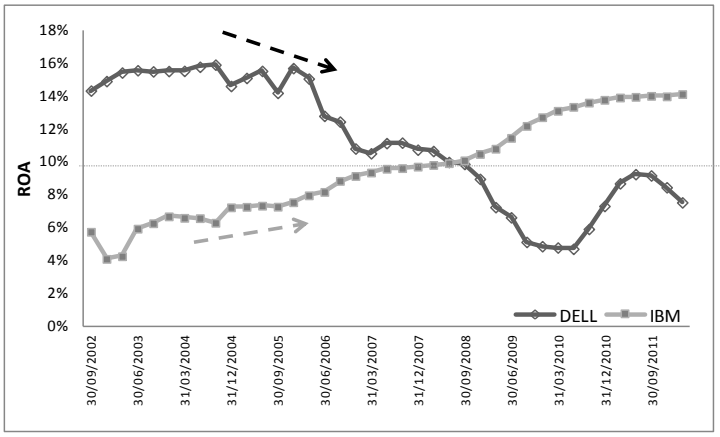


Figure 8. Performance time series for Dell Computers and IBM
Source: Data extracted from YCHART[6].

Additionally, splitting the time frame in two new ones, the descendent trend of Dell Computers says that this firm is experiencing a momentum different from IBM, moving towards disadvantage. These opposite trajectories suggest that firms are going to switch-over their competitive status.

The opposite trend is presented by IBM. Although the value captured by IBM is below the observed mean (disadvantage status), it is experiencing a competitive momentum towards advantage, suggesting that the disadvantage observe is temporary, and cannot be sustained in future.

This example clarifies the understanding about competitive advantage dynamics by the introduction of competitive momentum into the analysis. Indeed, under economic value approach, it is expected to enhance the capacity of strategic management

[6] www.ychart.com

researchers to evaluate the impact over performance's metrics caused by the complex relationships within and between firms, resources, and environment (Priem & Butler, 2001).

As an effort to demonstrate how Competitive Momentum can be captured when a bi-dimensional approach is adopted, suppose that sales growth rate of a specific firm is measured by the total assets variation observed in two subsequent time frames. As presented in the Figure 9, by comparing profitability and sales growth time series simultaneously it is possible to see how both trajectories vary over time. Notice that, in the later period, DELL presents lower profitability but higher growth rates than IBM, suggesting that depending on the dimension of value created that is observed, the competitive position of a specific firm will change.

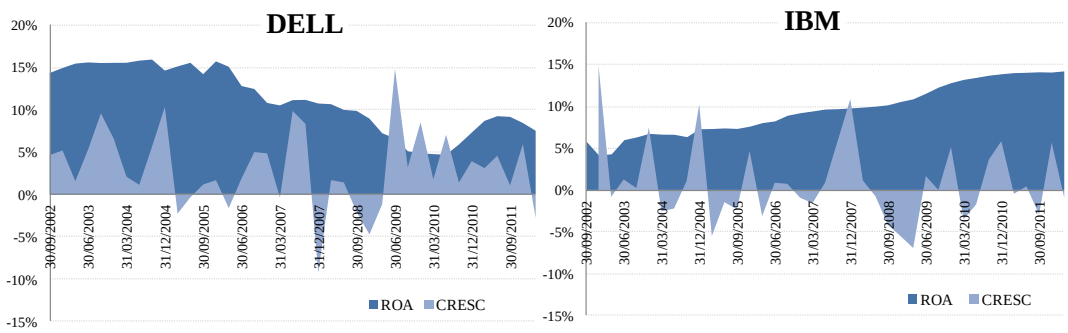


Figure 9. Simultaneous behavior of profitability (ROA) and growth (total assets variation) for DELL and IBM from 2000 and 2012
Source: Data extracted from YCHART.

When competitive momentum is evaluated, the underperformance trend observed in the profitability dimension is offset by the outperformance trend in sales growth dimension, suggesting that competitive advantage does manifest under the portion of value created by clients, but not by the portion of value created by the own firm. In this case, competitive advantage is still observed, not in abnormal profits, but due to higher sales. For IBM, competitive advantage appears in a different direction, being identified in the profitability dimension.

Another empirical example of how conjoint analysis of profitability and sales growth, supported by competitive momentum evaluation can bring valuable information about competitive positioning of a firm. The Figure 10 brings the observed metrics for

return on assets (ROA), and sales growth for Apple and Microsoft. Their results were compared covering a period from 2002 to 2012. It is evident that Microsoft has a superior profitability indicator, and it is experiencing a momentum towards advantage. This suggests that Microsoft is likely to sustain its advantage status in a subsequent time frame. On the other hand, Apple has upward trend and prospects for superior profitability. Note also that in the whole period under analysis, Apple grew at higher rates than Microsoft (in average) suggesting that the manifestation of competitive advantage is done through the value captured by Apple's clients. Apple also experienced competitive momentum towards advantage in profitability metrics, suggesting that, in future time trends, it is going to achieve a competitive advantage status.

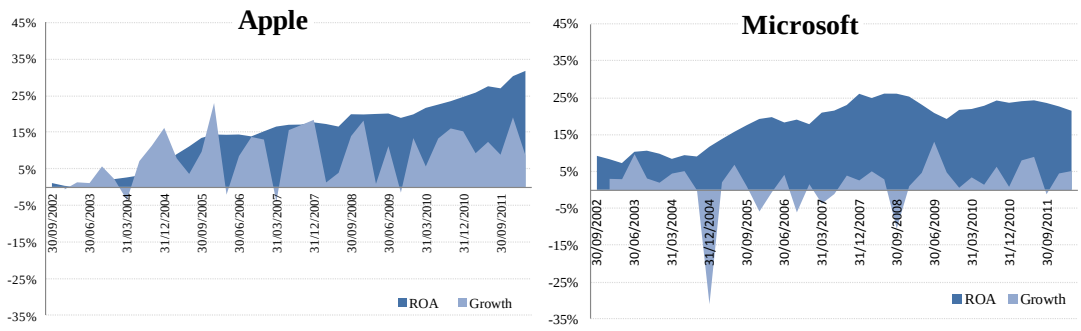


Figure 10. Simultaneous behavior of profitability (ROA) and growth (total assets variation) for Apple and Microsoft from 2002 and 2012
Source: Elaborated based on YCHART data.

Thus, by including the bi-dimensional perspective under economic value approach, and by incorporating the time perspective brought by Competitive Momentum, competitive advantage analysis becomes richer. The examples presented in this section suggest that through longitudinal analysis of value creation, the introduction of competitive momentum in the characterization of competitive advantage is a powerful tool. Based on this approach, researchers can track different movements done by a firm over time, and search for its causes. Factors as internal reorganization of its resources, by movements of its competitors (Adner & Zemsky, 2006), or even by changes on industry maturity stages (Karniouchina et al., 2013) explored at this stage.

Another advantage brought by incorporating the monitoring of longitudinal effect is the assessment of changes in the levels of firms' performance that occur

between different periods of observation, still preserving the uniqueness of the trajectory taken by companies (March & Sutton, 1997; Richard et al., 2009; Short et al., 2006).

2.4.3. The proposed model: Bi-dimensional multilevel statistical model

This section presents an operationalization of competitive momentum aiming to solve the existent gaps on methodological approach adopted in previous study, the proposal metric is generated from a statistical model that must:

- Incorporates the longitudinal nature of the metrics used to capture firm's economic value multidimensionality;
- Models the hierarchical data structure, isolating firm, industry and time effects;
- Allows the simultaneous estimation of model's parameters;
- Be flexible to accommodate different probability distributions, respecting heavy tails, or non-Gaussian probability distributions;
- Be able to deal with intrinsic trade-off and correlation structure among performance's metrics adopted by researchers to model economic value;

Initially, starting by the observation of the nature of the data, and based on prior beliefs, it is proposed to adopt a multilevel approach, allowing isolating the effects of industry over firms performance (Hofmann, 1997). Within this hierarchical structure, firms' effects are seen as possible realizations of industry's effects.

Also, the model should accommodate the information captured for both metrics (profitability and sales growth) for each on firms over time, which requires the adoption of a bivariate distribution.

Dealing with two dimensions simultaneously (growth and profitability), the lowest level of the proposed model should contain combined information of both response variables. At the next level, each response variable is described by a hierarchical structure, containing at its lowest level observations from repeated measurements over time. In the following hierarchical level, firm effect is incorporated,

and, finally, the industry effect is added. Following paragraphs describes in more detail the mathematical expression for each one of hierarchical levels, starting by the lowest one.

According to Snijders and Boskers (1999, pg 200), the description of a multivariate multilevel model starts with a definition of the expression vector comprising all responses evaluated. For the case of *m* response variables, the model is expressed by (1):

$$Y_{htij} = \sum_{h=1}^{m} \pi_{htij} d_{htij} + \mathrm{r_{hij}} \quad (1)$$

The vector containing the answers proposed in this work has two dimensions, and it describes as (2):

$$Y_{htij} = \pi_{1tij} d_{1tij} + \pi_{2tij} d_{2tij} + \mathrm{r_{1ij}} + \mathrm{r_{2ij}} \quad (2)$$

Where Y_{htij} is the dependent vector, composed by the economic value created by the firm, and by its clients. It is measured by profitability and sales growth indicators; *h* identifies the dependent variables (*h*=1,...,*m*); Time of observation is represented by t index (t= 1,...,*T*), *i* is the *f*irm index (i= i,...,*n*), and *j* reflects industry index (j=1,...,*s*).

Firm effect for dimension h, measured at *t*-time, and for firm *i* within industry sector *j* is measured through the π_{htij} parameters. The indicator d_{htij} is the dummy variable associated to the dimension h measured at *t*- time for firm *i* in industry *j*. Random firms error, also called as model residual are represented by r_{hij}.

One advantage of using a bivariate multilevel model raised by Snidjers & Bosker (1999, pg. 101) is the joint estimation of parameters effects considered in the model. When estimation is done jointly, significance tests[7] of parameters are even more powerful, since they already incorporate the correlation between observations. This contributes to obtain a more robust statistical model (B. K. Boyd, Takacs Haynes, Hitt, Bergh, & Ketchen, 2012), than when a single test on the significance of the model is carried out.

Furthermore, Snidjers & Bosker (1999, pg. 101) cite as an advantage the fact that through multivariate models it is possible to check whether the effect of an explanatory variable is higher in one of the variables used in model's answers. That is, if incorporated some explanatory variable in one of the levels of the model, such as an

[7] Under Classical inference approach

indicator of organizational slack or company total assets, it would be possible to ascertain whether measures of growth or profitability is also impacted by the change in factor assessed.

Moving forward on the model definition it is time to incorporate into the model the longitudinal structured. It is done in the second level of hierarchy of the proposed model. At this stage, model specification is similar to that one followed in the one-dimensional hierarchical models. It is assumed that the following levels are also shown for both variables that make up the response vector (h = 1, 2). The level which describes longitudinal component is defined in the expression (3):

$$\pi_{htijk} = \beta_{h0jk} + \beta_{h1jk}t + e_{hijk} \quad (3)$$

Where e_{hjk} is the random error of this level. This component measures the firm's residual over time. By investigating these values, researchers can identify firms with abnormal performance. The residual variability, given by σ_e^2, reflects a firms' variability over time; and β_{h0jk} and β_{h1jk} represent, respectively, the average value expected for the dimension *h*, and the time variation, for same dimension.

The structure of the proposed model should also reflect the intrinsic correlation between groups of firms under the same industry. This structure reproduces the effect of economic conditions, environmental barriers, and restrictions that affect all firms simultaneously within the same industry. Thus, as proposed in other multilevel models in the strategic management literature, the hierarchical structure for model coefficients is added. To do that, each model coefficient (intercept and slope) are considered as random coefficients, and are measured as a function of a superior level. They are seen as realizations of a higher hierarchical structure.

Next hierarchical level encompasses firm's effect, and can be seen as the expected average effect over all firms ($\gamma_{h00k}, \gamma_{h01k}$), as presented by the Equation (4).

$$\beta_{h0jk} = \gamma_{h00k} + u_{hojk}$$

$$\beta_{h1jk} = \gamma_{h10k} + u_{h1jk} \quad (4)$$

Where:

γ_{h00k} is represents the average expected value for all firms within the same industry.

γ_{h10k} represents the average expected time trend for all firms within the same industry.

u_{hojk} represents the residual value, or the deviation from the average value, including all firms to the value predicted to a specific firm.

Greater versatility is included into the model by defining $\gamma_{h00k}\, and\, \gamma_{h01k}$ coefficients as random effects. In doing it, it is assumed that different industries have different effects over firms' value creation. If they are considered as fixed effects, the model loses flexibility, once it is assumed that time affects all firms and industries in the same way. The inclusion of those

The highest level of the model depicts the effect of industry in which a firm operates, being also described as a random effect. The terms $\eta_{h0000}\, and\, \eta_{h1000}$ represent respectively the average effect value observed by industry and its time influence. The parameters $\omega_{h0k}\, e\, \omega_{h1k}$ are the residuals (or random errors) and represents the deviations found between the mean observed considering all industries and observed average for a specific industry *k*. The expressions are showed below:

$$\gamma_{h00k} = \eta_{h0000} + \omega_{h0k} \tag{5}$$

$$\gamma_{h10k} = \eta_{h1000} + \omega_{h1k}$$

This model configuration considers a linear relationship between time and value indicators; however, other relationships could be adopted, as, for example, quadratic, exponential or whatever better fits to researchers prior believes. Also, depending on the variable used to capture economic value created by firms and clients, the hierarchical levels should be adjusted, to accommodate the dependence between firms and industry effects.

Given the flexibility of the model, the inclusion of explanatory variables in all levels is allowed, as for example, firms total assets, slack at firm level, and economic indicators, or even industry indicators at the industry hierarchical level. In including those variables, researches can explore causal relationships of firms' internal factors and value creation.

Since model configuration is more complex, once it involves a bi-dimensional model structure and at least three levels of hierarchy in each dimension, estimation also will require a more complex inference procedure. Up to now, the proposed model just

deals with model configuration description, aspects as estimation methods, and probabilistic random coefficient distributions are going to be discussed deeply in the second part of this work, when an empirical study are going to be presented.

2.4.4. Linking competitive momentum interpretation to model parameters

As discussed earlier, the complexity of dealing with two dimensions simultaneously is greater than it is in one-dimensional approach. This goes further than the higher demanding computing and estimation methods, since it requires a conjoint view of firms' performance trajectory in each one of the observed dimensions. It deals with the dynamism of competitive advantage, its time trajectory evolution within a multi-dimensional scenario, and several possibilities of advantage configuration over time.

In this sense, Competitive Momentum definition should compile the information brought by growth and profitability dimensions simultaneously. One way to do that is observing the deviations (residuals) from de grand mean to each one of the dimensions, individually (Brito & Brito, 2012).

It is proposed to compare the individual firms' time effect (firm's slope) to their respective industry time effect (industry slope). In doing it, it is assumed that firm is experiencing same momentum as industry when both effects are similar enough. When firms' time effect is greater than industry it is going to be assume that firms are experiencing a momentum greater than industry, driven firm to outperform industry in future. When the firms' time effect is lower than industry, it is going to be assuming that firms are experiencing a momentum towards disadvantage.

An empirical application of this concept is presented in the chapter 3. By using posteriori distribution of firms' individual parameters probability of firms to outperform industry average are estimated, and then, firms' competitive momentum are classified.

Therefore, through the introduction of the competitive momentum dimension in competitive advantage analysis, it is possible to incorporate a future perspective of firms' competitive status. This longitudinal component contributes to build a broader definition, and interpretation, of competitive advantage, in addition to the single average performance comparison. Additionally, the proposed model provides a methodology treatment suitable for existing methodological gaps, incorporating the joint estimation for the effects of value creation measured by the use of a two-dimensional view: growth and profitability.

2.5. Consistency: another dimension of competitive advantage

One second aspect that is unexplored in the competitive advantage analysis is given by the uncertainty analysis of firms value creation process. While some firms create value over time consistently, other ones don't have the same capability. Seeking to explore the differences and uncertainties on how firms create value over time we propose a new dimension. It is expected that the higher the capacity of capturing economic value generated in one transaction, the higher the firm's capability in absorbing changes (internal or external), and the more homogeneous the observed trajectory over time.

The inclusion of the consistency evaluation into competitive advantage characterization is still in an incipient approach in Strategic Management. While empirical studies aim to define the portion of performance's variability occurred in the past, trying to understand the main sources of heterogeneity (Thomas & D'Aveni, 2009), other areas, as Finance and Risk Management, have explored the past and present volatility effects over firm's assets in order to define future strategies.

At this moment, aiming to extend the acquaintance over competitive advantage construct under economic value creation perspective, and being inspired by the use of volatility in Finance, complementary dimension that assess the consistency of firm's performance trajectory over time is proposed to be explored.

One advantage about incorporating heterogeneity analysis into competitive advantage characterization is the possibility of differentiate firm's performance, even when they have the same performance in average. This differentiation contributes towards the extension of the theoretical debate on Strategic Management field, especially regarding the definition of competitive advantage.

Consider, for example, the performance trajectory of two firms as shown at Figure 11. Both firms have the same average performance and same temporal trajectory, within a fixed time frame. Notice that Company Y presents a more volatile performance than Company X. This lack of consistency in Company Y performance leads to less consistent results over time than its rival.

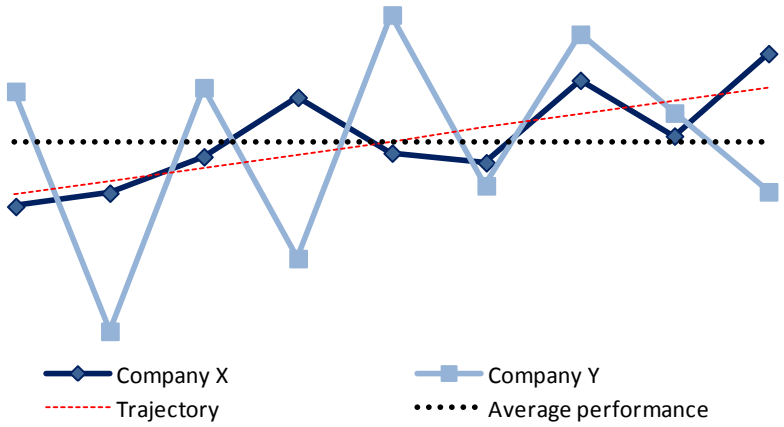


Figure 11. Consistency dimension example.

Based on this, some questions arise:

- Although the average performance is very similar between firms, is it reasonable to say that both of them have same perspective to sustain their competitive position in future?
- What dimension could be incorporated into the characterization competitive advantage such that it would be possible to differentiate firms in terms of their performance volatility, as presented in the Figure 11?

The use of the mean as a summary measure for assessing firms performance is recurrent in Strategic Management area (Richard et al., 2009). As well as recurrent are studies about decomposition of variance are. Their main objective is to explain firms

performance heterogeneity by assessing the effects of industry, country, or economic crisis (Brito, 2005; Goldszmidt, 2010; Goldszmidt, Rafael, 2007; McGahan & Porter, 1997; McGahan & Porter, 2002; Rumelt et al., 1991).

These studies are focused on evaluating the heterogeneity of firms' performance across industries, aiming to explain the observed performance in the present moment, without paying attention to the intrinsic variability of firms' performance. During transient moments firms can be more susceptible to present higher volatility in their performance(Thomas & D'Aveni, 2009), and thus, it could be one additional dimension to be added into competitive advantage characterization.

According to previous studies, heterogeneity in firms' performance can be caused by different factors, including:

- New entrants, and hence increased competition (Porter, 1991);
- How structured is firm's relationship with suppliers (Miguel, 2012);
- Firm's ability to manage their resources and develop new skills over time (Helfat & Peteraf, 2003a),
- The environment's influence in which a firm is embedded (Bourgeois, 1985; Dess & Beard, 1984; McGahan, 2004), or
- Changes on the nature of competition (Thomas & D'Aveni, 2009).

The threat of new entrants and their influence on the performance of the firm, discussed earlier by Porter (1991), can directly affect firms ability in creating value, and therefore, could reflect a greater instability (low consistency) on firms performance over time. That occurs because firms should encourage their clients on a perception of value created superior to that one offered by new competitors, and thus maintain or increase their market share, and consequently, their growth. When rivals begin to generate a perception of superior value to customers, firms may face losses in market share.

In line with the definition of value creation adopted in this work, a way to increase the customer's perceived value would be done by the reduction of price of sale, which in turn may result in changes in financial indicators related to profits when production costs remain constant. As a result of this process, greater instability in results could be generated.

On example of how changes in environment can affect direct, or indirectly, economic value captured by a firm, is the increase of volatility presented by Dell Computers from 2004 and 2007. At that time, Dell competitors (Hewlett-Packard e Accer) threatened the market leadership, affecting directly the consistency of results presented by Dell during this period. After 2009 a new instable period is observed, caused by new acquisitions done by Dell and by new products development focused on security solutions. Both periods are highlighted in the Figure 12.

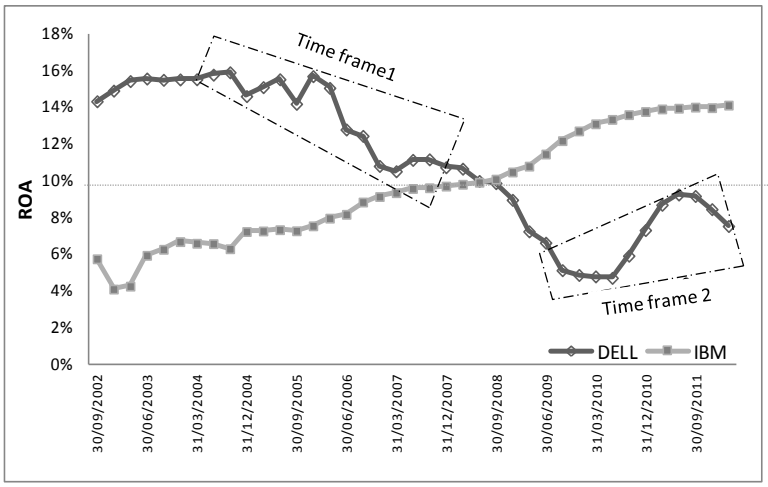


Figure 12. Consistency analysis of DELL and IMB profitability series.
Source: Elaborated by the author from YCHART.

According to Thomas & D'Aveni (2009), changes in competitive landscape had increased the volatility in the US manufacturing firms results from 1950 to 2002. Industries extensively impacted by new and more dynamic competition presented higher levels of internal volatility, and higher intra-industry heterogeneity.

To Lamberg et al. (2009), no one company can achieve competitive advantage stage in the long run without presenting consistency in its primary actions, with quick adaptation to changes in environment. To the authors, consistency is the direct result of firms' capability to adapt themselves to a new environment, susceptible to changes caused by new entrants, or by economic environment factors (Lamberg et al., 2009). This capability requires firms to develop new resources and capabilities from the existent ones (Wernerfelt, 2011), being active in resources management (Helfat & Peteraf, 2003b), connected to market conditions (McGahan, 2004), and connected to clients and suppliers (Miguel, 2012).

2.5.1. Assessing the consistency dimension

Some consistency metrics available in literature associate consistent trajectory with a lower uncertainty about future perspective of firms performance (McGahan, 2000). Other ones associate lower volatility to lower probability of abrupt changes in firms' trajectory over time (Lamberg et al., 2009). No one of them has associated firms' consistency results with their competitive positioning.

Lamberg et al. (2009) proposed a metric to evaluate the consistency of firms' performance based on the distance between two subsequent points in time. In this case, the lower the variation, the higher the consistency observed, and the greater the probability of a company to keep same results in a nearby future.

Anita McGahan, in the book *How Industries Evolve* (2000, pg. 35), uses the volatility related to average values observed for assets and operational profit to characterize the structural changes (architectural changes) occurred in a specific industry in during a fixed period of time. To the author, the higher the volatility related to the observed mean, the lower the consistency of the observed results and, thus, the greater the uncertainty regarding the future perspective for a given firm (McGahan, 2000).

Both metrics discussed above are fragile in moments where there are changes in the trajectory designed by the company, and then, other approaches to measure the consistency of a firm's performance should be adopted. In this work, one alternative approach is proposed to evaluate the consistency of firms' value creation, in which consistency is assess by the deviation of observed values from the expected trajectory. Where expected values reflect the average expected trajectory for each firm over time, and can be derived from the estimates obtained from a statistical model.

For instance, consider two trajectories described in the figure below. Trajectory reported in the left show more consistency, since observed, or realized values are close to the expected or predicted ones (represented by the dotted line). Less consistent trajectory is found in the right chart. In that situation, the values created over time show higher deviation from the average expected trajectory predicted to that firm.

The deviation can be calculated in different ways, as for example by using the Root Means Squared Error (RMSE), Mean Average Percentage Error (MAPE), or Mean Absolute Error (MAE). In all cases, the dispersion from performance observed to model predicted values are evaluated, nevertheless, one advantage of using RMSE instead of MAPE or MAE is that the first metric gives a relatively high weight to large errors.

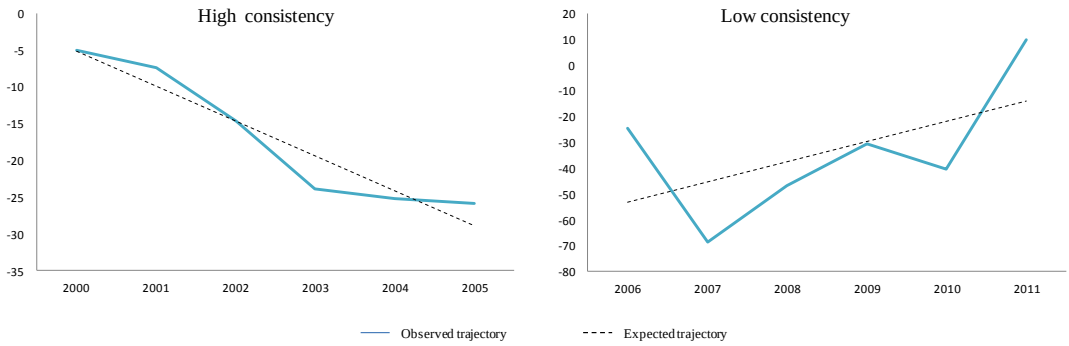


Figure 13. Consistency measurement example

Higher RMSE values indicate that the observed performance trajectory is erratic and volatile. The RMSE values can be calculated as follows:

$$RMSE_i = \sqrt{\frac{\sum_{t=1}^{n}(Observed_{it} - predicted_{it})^2}{(n\ of\ observations)}} \qquad (6)$$

Where

$Observed_{it}$: is the observed value created by *i* firm at *t* time.

Predicted $_{it}$: is the predicted, or the expected value created by *i* firm at *t* time.

Calculating the RMSE for firms' trajectory presented in the Figure 11, it is found that Company X presents lower volatility (or higher consistency), RMSE = 1.41. Company Y, on the other hand, presents higher values for RMSE metric, almost three times higher (RMSE = 4.47). Thus, while both firms present close averages performance, and close performance trajectory trend, the way how they perform over time is quite different. Company X presents a more consistent performance, than its direct rival, Company Y, and therefore, it is more likely to sustain its performance in future.

Similar conclusion is drawn from the RMSE values found in Figure 13. Left trajectory presents RMSE= 2.4 while right trajectory has RMSE over 18.7.

Consistency, as presented in this section is a new dimension that adds value to competitive advantage assessment. By including this metric into competitive advantage analysis, scholars can differentiate firms based on the consistency of how they perform. Firms with consistent trajectories tend to presend more credible results in the present and in future, which adds more confident whithin the competitive advantage evaluation.

2.6. Conclusion

In this paper two new dimensions are proposed to be introduced into competitive advantage characterization. They seek for enhancing the characterization of competitive advantage based on performance evolution encompassing elements linked to performance trend and consistency. Both metrics challenge the existent approaches, which are only based on the simple average comparison, and focused on the identification of the main sources of performance heterogeneity.

Among the benefits in adopting competitive momentum, and consistency as auxiliary metrics of competitive advantage is the introduction of a future perspective of firms' performance. Through competitive momentum analysis, the future perspective of firms' performance trajectory is added to, covering the existent gap resulting from the cross-sectional approach usually adopted in strategic management studies (average performance focused). From consistency dimension use, researchers might explore the uncertainty about future, looking for a better comprehension about performance stability and sustainability over time.

Both dimensions are derived from the proposed statistical model estimates, which quantifies firms' competitive advantage based on economic value creation definition and accommodates a bi-dimensional data structure enabling to capture the competitive advantage manifestation in a broader way.

Different from previous studies, the proposed model takes advantage of a multilevel structure, and incorporates the hierarchical dependency between firms and

industries being flexible enough to capture the longitudinal effect over firms' performance.

Academically, this paper contributes with the theoretical debate about competitive advantage definition; once it proposes new dimensions that are able to capture the dynamism of competitive advantage. Managerially, my purpose offers a broad understanding about how competitive advantage manifests over time, helping on the definition of strategic actions by managers and investors.

Further studies can focus on empirical investigation of theoretical dimensions proposed, and on the inclusion of explanatory variables linked to firm and industry levels aiming to explore the causality of competitive advantage.

3. Paper II – Measuring the competitive advantage: Introducing a Bayesian perspective into the debate.

3.1. Introduction

Strategic management debates about competitive advantage not reaching a consensus on what is competitive advantage, and how it can be assessed. Although a theoretical debate about competitive advantage is converging to be defined in terms of value creation (Peteraf & Barney, 2003), empirical works still adopt different metrics to characterize the presence of advantage (Richard et al., 2009).

Under economic value creation perspective, the focus on single dimension has been moved towards a multi-dimensional structure, addressing concerns about using a single indicator of performance (Brian K. Boyd et al., 2005; Richard et al., 2009), which cannot capture the complete effect of competitive advantage on performance. Economic value is defined as the wedge between the customers' willingness to pay and the suppliers' opportunity cost (Brandenburger & Stuart Jr, 1996). This approach separates value creation from value appropriation and it becomes possible to conceive the situation of a firm having competitive advantage and not enjoying superior performance (Coff, 1999, 2010).

In this paper, Bayesian hierarchical bi-dimensional model is proposed to infer the presence of competitive advantage under a value creation perspective to each firm individually. The model proposes that two metrics (profitability and growth) are simultaneously necessary to ascertain the presence of competitive advantage, improving the concepts initially proposed by Brito & Brito (2012).

Results also provide a picture of the topography of competitive advantage, quantifying its rareness, and determining the probabilities of its sustainability. This part of the results helps to answer Wiggins and Ruefli (2002) call against the paucity of empirical studies in this field.

Also, the traditional comparison between firms performance within the same industry is revisited, and making use of the posteriori probabilities distributions, a new perspective of competitive status identification is discussed. Results also add to the industry-firm debate indicating that the presence of competitive advantage is very dependent on industry type and conditions, corroborating Nelson's (1991) idea that "firms differ" is highly context dependent. In certain industries there are virtually no firms in competitive advantage (or disadvantage) condition. In these industries, firms do not differ much and industry effects determine performance. The most relevant theoretical lenses are the models like Porter's five forces (Porter, 1980). In other industries, competitive advantage (and disadvantage) is highly ubiquitous with a sizable number of firms exhibiting competitive advantage and competitive disadvantage. In these industries, firms do differ substantially and the resource-based theory is most relevant.

The next section presents a brief literature review about competitive advantage under economic value approach. It is followed by the description of the methodological approach, and then by the reporting of empirical results encompassing the topography of the competitive advantage, its sustainability, and industry influence over competitive advantage manifestation. This paper ends with a conclusion section summarizing the main findings and contributions of this empirical work.

3.2. Competitive advantage under lens of economic value creation

Many empirical studies refer conceptually to competitive advantage, but treat it as simply an equivalent to superior financial performance (Newbert, 2008). This approach has been criticized by different scholars (Brito & Brito, 2012; Coff, 1999; Rumelt & Kunin, 2003), and the association between higher financial performance with competitive advantage is losing space for the definition of competitive advantage seen by lens of economic value creation (Peteraf & Barney, 2003).

Under economic value perspective, the focus on higher returns is replaced by a multi-dimensional structure which allows identifying competitive advantage manifestation by different dimensions. This new conception of competitive advantage has emerged as a more robust theoretical approach once it sees higher profitability occurrence as one possible manifestation of competitive advantage, but not the only one (Coff, 1999, 2010).

This calls into question the comprehensiveness of research practices in the field since most studies use a single indicator of performance (Brian K. Boyd et al., 2005; Richard et al., 2009) and cannot capture the complete effect of competitive advantage on performance.

According to Brandenburger & Stuart Jr (1996), definition of total economic value created by a firm (V) is defined based on the total value created by the supply chain participants (suppliers, employees, shareholders, and buyers). It is defined as the difference between willingness of buyers to pay (W) and firm's production costs (C). This approach separates value creation from value appropriation and it becomes possible to conceive the situation of a firm having competitive advantage and not enjoying superior performance (Coff, 1999, 2010). The expression (7) shows the mathematical representation of the economic value calculation:

$$V = W - C \tag{7}$$

As discussed in the previous paper, this definition encompasses internal and external sources of influence, as for instance, firms' capability in manage their supply chain more efficiently than their rivals, being able to provide greater value perception for its customers, which leads to greater competitive advantage (Ito et al., 2012).

This new definition has several advantages. First, it clearly differentiates the notions of competitive advantage and superior performance. Competitive advantage refers to creating more value in an enterprise's product market while performance is affected by value capture and by industry effects. Second, it integrates all effects of firm resources, since the value created results from the combination of all firm resources. Either a firm has a competitive advantage or has not. The previous definition allows for the understanding of several competitive advantages as discussed by Powell (2001) and the co-existence of competitive advantages and competitive disadvantages.

Competitive advantage status is achieved when created value is higher than the marginal, breakeven competitor (Peteraf & Barney, 2003). Thus, the advantage is observed when the value created by firm is higher than the mean of value created by rivals as the reference point or an equivalent centrality measure. This captures the essence of the term "competitive" as proposed by Arend (2003). A firm is in a competitive advantage status if it creates more value than its rivals within a given time frame; it is in competitive parity if it creates a similar amount of value than its rivals; and it is in competitive disadvantage if it creates less. Industry mean can be a proxy of this reference point, even with the limitations in industry definition.

The value created by a firm, can be divided into three main portions. The difference between the average customers' willingness to pay and the average price is a value portion left to the customers as an incentive for them to transact with the firm. This value portion is similar to the use value of Bowman & Ambrosini (2000). The difference between price and cost is the value portion directly created by the firm, and finally, the portion between the price and suppliers' opportunity cost is a value portion also created by the focal firm, but left to its suppliers. These three value portions can affect different aspects of firm's financial performance through different mechanisms. Next, the economic value dimensions are explored.

3.2.1. Dimension 1 – Share of value created by firms

Analyzing the economic value definition proposed by Brandenburger & Stuart Jr (1996), the difference between the average price and economic cost is the firm's share. This difference can also represents firms' profit created in one specific transaction. Notice that it is directly impacted by firm-suppliers relationship (Toledo & Bandeira-de-Mello, 2013), specially because of production costs element.

Thus, the higher the firm's capability in create this portion of value in its transactions, the higher the impacts in profitability. Therefore, this perspective sustains the hypotesis that a firms' superior performance is a consequence of having a greater

capacity in generate value than their rivals (Ito et al., 2012), but not a cause of this phenonmenon.

Thereby, it is necessary to adopt a metric that captures transaction returns, already discounting the costs associated to the production. In other words, it is necessary to define a metric that captures firms' ability in manage its production costs efficiently. In strategic management literature, different metrics are used to capture firms' profitability returns. Empirically studies usually uses return on assets (ROA) and operational returns on assets (OPROA). The second metric presents some advantages when compared to the frist one. Other metrics can also be used, however, one direct benefit in using OPROA is that its numerator is directly impacted by operational costs, and thus it captures any weaknesses in supply chain management. Other benefits in adotping OPROA is that it is less subjected to accounting conventions differences across industry sectors (McGahan & Porter, 1997). Therfore, operational return on assets is going to be adopted to measure value created by firms in their transactions.

Operational return is calculated from the ratio of net pofit and total assets, as reported by the expression (8). The numerator of that expression is directly impacted by operational costs. It means that, keeping the production at the same level, lower values of net profit shows weaknesses in supply chain, with greater values associated to production costs.

$$OPROA = \frac{Net\ Profits}{Total\ Assets} \tag{8}$$

3.2.2. Dimension 2 – Share of value created by customers

Other value portions (customer's and supplier's share) can also have an impact on financial performance through different mechanisms, and manifest themselves in other dimensions of financial performance. If a firm creates larger customer's share than its rivals it will be a preferred option and tend to grow at faster rates than its rivals. The firm will possibly have superior firm effects in growth. The effect can be moderated by

the firm's capability to economically increase capacity but the effect does exist, especially if the time frame used to define competitive advantage is long enough.

Conceptually, this dimension captures competitive advantage manifestation in cases where intrinsic willingness to pay of buyers is greater than the price of that acquisition. Or in other words, when there is a greater perception of value left to the client appropriation (Priem, 2007).

Since this part of value is a subjective dimension, because willingness to pay is not measurable, a proxy variable should be adopted. It is reasonable to assume that competitive advantage perceived by clients, materialized when they buy firm's products effectively. When this happens, there is a direct impact on firms' financial indicators, especially in those related to sales, or in market share (Brito & Brito, 2012). Therefore, it can be said that firms presents a competitive advantage when it is able to offer to its buyers a higher perception of value captured than its rivals.

Net Sales financial indicator is adopted in this empirical study, representing the total sales (from all transactions done by buyers) reduced by the discounts, or any other effects that arise from the benefits given to customers. The growth rate of net sales captures the firm's capacity in attract customers and expands its market position higher than industry, which is a way of how competitive advantage can happen.

Previous econometric studies discussed the effect of firms' size over the growth rate (Dunne, Roberts, & Samuelson, 1988; Hall, 1987). They found that the dispersion of growth rate is lower for firms with high size. This effect can also be associated to industry restrictions and characteristics.

The operationalization of the growth rate adopted in this work is given by the assumptions that the growth rate can be expressed as the ratio between the amounts of sales (**S**) observed between two subsequent time periods, as follows:

$$g_{jt} = \frac{S_{jt} - S_{j(t-1)}}{S_{j(t-1)})} \tag{9}$$

Where $\mathbf{S}_{jt}$ is the net sales observed for firm ***j*** at time ***t***.

Rewriting this same expression in terms of net sales amount observed in the present moment (*t*):

$$S_{jt} = g_{jt} \times (S_{jt} - S_{j\,(t-1)}) \tag{10}$$

Where,

$\mathbf{S_{jt}}$ represents the observed net sales at time $\boldsymbol{t}$ (in years), and

$\mathbf{g_{jt}}$ represents firms' growth rate observed for firm $\boldsymbol{j}$ between present moment and the moment right before. This dimension assumes the observed variation in sales growth rate is unique within the firm.

Expanding this expression to different periods and assuming that growth rate can be seen as an average within the observed period, the expression (10) is written as (11):

$$S_{jt} = S_{j0} \times (1 + \boldsymbol{g_j})^t \quad (11)$$

Linearizing the expression (5) by applying a logarithmic function, the expression can be given by:

$$logS_{jt} = logS_{j0} + t \times log(1 + \boldsymbol{g_j}) \quad (12)$$

Where,

$logS_{jt}$ is the natural logarithm[8] of total net sales at the moment $\boldsymbol{t}$ for firm $\boldsymbol{j}$.

$\mathbf{g_j}$ represents the average effect of the growth rate within the observation period for firm $\boldsymbol{j}$. This is the parameter that translates firms' capability of providing to customers a higher perception of value captured. The growth rate gives a dynamic view of the management ability in use the available resources to create and expand value to a firm (Brito & Vasconcelos, 2009; Edith Penrose, 1959), while the average rents captured by the first dimension presents a static view of the value created.

As managers use available firm's resources, they stimulate the firm's expansion affecting the growth's rate. This expansion cycle also stimulates the developing of new resources that, together with the existent ones, promotes a new growth cycle (Edith Penrose, 1959; Wernerfelt, 2011).

When both dimensions are aggregated, it can be said that if a firm has superior profitability or superior growth rate relative to its rivals, or both, there is an indication that it creates more value than its rivals and, therefore it is in a competitive advantage status. If a firm has inferior profitability or growth rate relative to its rivals, or both, there is an indication that it creates less value than its rivals, and therefore it is in a competitive disadvantage status. If a firm has equivalent profitability and growth rate

[8] Natural logarithm is the logarithm with 10 basis, or $\log_{10}$.

relative to its rivals it most likely creates an equivalent amount of value and is in competitive parity. Finally, if a firm has superior performance in one dimension and inferior performance in the other one there are no judgment about the value created, so the status has to be classified as undetermined.

3.3. Methodological approach

The methodological approach to characterize competitive status must be robust and flexible enough to make inference using its model's outcomes, and must account for firms individual differences. Bayesian inference emerges as an alternative, and the direct benefit of adopting it is the fact that it allows researchers to introduce their previous belief in model estimation (Hansen, Perry, & Reese, 2004; Kruschke, Aguinis, & Joo, 2012; Zyphur & Oswald, 2013).

Bayesian inference is more versatile, because it is not limited to point, or an interval inferences (Hahn & Doh, 2006; Hansen et al., 2004; Perry, Hansen, Reese, & Pesci, 2005), as it is under Classical approach. Inference using Bayesian models allows researchers to make probability statements based on posteriori probability distributions, enhancing inferences about events of interest (Paulino, Turkman, & Murteira, 2003, Chapter 1). One example of Bayesian inference used in management research is the Hansen et al. (2004) work. They developed and explained a measure of competitive advantage that goes beyond comparisons of economic performance, making meaningful probability statements about specific, individual firms and the effects of the administrative decisions.

The next section starts with a description of the proposed model, its main components, and the underlying priori probability distributions. Next, criteria to characterize competitive statuses are conceptually defined, and an operationalization based on posteriori distribution is proposed. In the last section, sample design definition is described and some descriptive statistics are presented.

3.3.1. The Bayesian model

Model structure conception is based on value creation definition (Brandenburger & Stuart Jr, 1996) in which firms that create more value than industry, in average, have more propensity to reach a competitive advantage status. As discussed in the previous chapter, value creation can manifest either by profitability or by growth dimensions, which requires an adoption of a bi-dimensional model structure.

Also, according to existent literature value creation can be influenced by firms, or industry specific effects. These effects usually modeled in different levels of hierarchy, within a multilevel model structure. The primarily objective of previous studies was to estimate the effects on firms' performance variability, measured by variance components, related to firms, industry or time levels (Brito & Vasconcelos, 2009; Brito & Brito, 2012; McGahan & Porter, 1997; McGahan & Porter, 2002).

Different estimation methods were adopted in strategic management, like the Maximum Likelihood or the Restricted Maximum Likelihood (Snidjers & Bosker, 1999). Those methods are already deployed in the most popular statistical software for one-dimensional models; however, they present some restrictions, especially regarding the assumptions related to random errors' distributions.

At this work, an alternative estimation method was adopted, based on Bayesian philosophy. One direct advantage of using a Bayesian approach is the fact that it allows the incorporation of researchers' previous beliefs in model estimation. In other words, this means that researchers' prior knowledge about the model effects distribution and configuration can, in somehow, be part of modeling process. Thus, the existent restriction in classic inference approach is overcome, and a more versatile model is presented.

Under Bayesian approach, hierarchical modeling (also known as multilevel modeling) groups each observation according to a similar characteristic (as firms are grouped by industry) and each specific observation priori is seen as a possible realization of one random distribution of a superior hierarchical structure. Each firm effect is measure as a function of hyper parameters associated with the distribution that consolidates information from all firms within the same industry sector.

The Bayesian estimation procedure adopted to generate the posteriori distribution of the model's parameters is based on Monte Carlo Markov Chain Methods (MCMC). WinBugs[9] V1.4 was used to run the MCMC estimation. MCMC generates more accurate posteriori distributions, even when more complex models are adopted, being based on stochastic simulation. This flexibility in model estimation drove Bayesian Inference to a prominence position in different fields of study (Ntzoufras, 2009, pg 36 e 37).

The two most popular algorithms used in MCMC simulation are the Metropolis-Hastings and Gibbs Sampling (Gilks, Richardson, & Spiegelhalter, 1996). Alternative methods using numeric algorithms can also be adopted; however they tend to need more effort to generate the final results. In this work Gibbs Sampling was adopted since it presents the best cost-benefit relationship.

Moving to the model structure description, it is time to match the priori belief about competitive advantage manifestation under economic value creation approach with technical specificities required to estimate parameters effects. Model specification is defined on strategy a concept that aims to fit two related variables associated to variable creation, without any anchor variable (Venkatraman, 1989).

The lowest level of the proposed model is described by the joint distribution of the two dependent dimensions: Profitability (measured by OPROA) and Growth (measured as a function of Log of Net Sales). The prior probability distribution follows a Bivariate Normal (BN) distribution with average μ_j and covariance structure represented by Σ, as given by the expression (13). Both metrics are measured in different moments in time, allowing the inclusion of the time effect over those measures within each firm.

$$Y_{jt} = (Y_{1jt}, Y_{2jt}) \sim BN(\mu_j, \Sigma) \qquad (13)$$

Where, Y_{jt} is the dependent vector observed at the ***t*** time for firm ***j***. It is composed by: (a) Y_{1jt} which represents the profitability dimension; and (b) Y_{2jt} which represents the dimension related to the growth of firms.

Profitability is quantified based on operational return on assets (OPROA), calculated dividing firm net profits by total assets. The growth of the firm, introduced in

[9] More information is available at: http://www.mrc-bsu.cam.ac.uk/bugs.

the second dimension of the proposed model, is calculated based on the average growth rate of net sales within each time frame as explored earlier.

The set of parameters μ_j is represented by a (2x1) matrix in which each component represents the average effect of Y_{jt} (profitability and growth rate) for a specific firm ***j*** within a specific period of time. As the dependent vector Y_{jt}, the μ_j parameter also distributes as Bivariate Normal probability distribution (see equation 8).

The components of μ_j associtated to the average effect are defined as following a Normal distribution (univariate distribution) with average μ_{1j} (profitability) and μ_{2j}(sales) as described by the Expressions (15) and (16).

$$\mu_j \sim \mathrm{BN}\left(\begin{bmatrix}\mu_{j1}\\ \mu_{j2}\end{bmatrix}, \Sigma_\mu\right) \quad (14)$$

$$\mu_{1j} = \pi_{10j} + \pi_{11j} \times \mathrm{time} \quad (15)$$

$$\mu_{2j} = \pi_{20j} + \pi_{21j} \times \mathrm{time} \quad (16)$$

Where, $\boldsymbol{\pi_{10j}}$ and $\boldsymbol{\pi_{11j}}$ represents firms average and time effect over the profitability dimension, observed for firm **j**. In particular, $\boldsymbol{\pi_{10j}}$ measures the firms' effect over the profitability dimension. Values higher than industry average for $\boldsymbol{\pi_{10j}}$ indicate that the firm **j** performs better than its rivals. Firms' profitability time trend is captured by $\boldsymbol{\pi_{11j}}$ effect. This component is associated to future performance perspective of firm **j**.

Time effect was measured using centralized variables with five different grades (-2, -1, 0, 1, 2). In using this approach, firms' effect represents the average value observed within the time frame for each firm individually. The adoption of the linear relationship to measure the time effect is a tentative to fit the mediation time effect influence over value created (Venkatraman, 1989).

To the second dimension, responsible to capture the growth rate effect, the interpretation of models parameters changes. There is no direct interpretation of π_{20j}, unless to measure the average firm's size and segregate small from big firms. The main parameter of this dimension which is associated to the growth rate of the firm is derived from $\boldsymbol{\pi_{21j}}$. By decomposing this effect using Expression (12), it is possible to get the average growth rate for each firm, as follows:

$$\pi_{21j} = \log(1 + \mathbf{g_j}) \rightarrow \mathbf{g_j} = 10^{\pi_{21j}} - 1 \quad (17)$$

Therefore, to compare the average performance of a firm to its rivals using this bi-dimensional approach, necessarily the average firms' effects on profitability ($\boldsymbol{\pi_{10j}}$) and growth rate ($\mathbf{g}_j$), have to be compared simultaneously with the correspondent components in an industry level.

All models parameters ($\boldsymbol{\pi_{10j}}, \boldsymbol{\pi_{20j}}, \boldsymbol{\pi_{11j}}$ and $\boldsymbol{\pi_{21j}}$) are defined as random components, which add more flexibility in capturing individual firm's trajectories. Under this configuration, the role of covariance matrix $\boldsymbol{\Sigma_\mu}$ becomes more important. Because $\boldsymbol{\Sigma_\mu}$ measures co-variation, or correlation, between the average components it helps on accommodating the intrinsic trade-off between value creation components.

Following the hierarchical, or multilevel, model structure, in which each firm is subjected to its industry regulation, or economic conditions, average and time effects can be expressed as realizations of hyper distributions that encompass the whole industry effect. Mathematically they are expressed by (18):

Dimension 1: $\pi_{10j} = \gamma_{10k} + u_{10k}$ and $\pi_{11j} = \gamma_{11k} + u_{11k}$

Dimension 2: $\pi_{20j} = \gamma_{20k} + u_{20k}$ and $\pi_{21j} = \gamma_{21k} + u_{21k}$ (18)

Where $\boldsymbol{\gamma_{10k}}$ represents the average effect of the dimension 1 (profitability) associated to industry $\boldsymbol{k}$, and the $\boldsymbol{\gamma_{11k}}$ measures time effect for the same dimension. Similarly, $\boldsymbol{\gamma_{20k}}$ and $\boldsymbol{\gamma_{21k}}$ parameters capture the average effect of Dimension 2 (growth) and time, respectively. The other term of the model for each equation represent random errors, or model's residuals ($\mathbf{u_{11k}}$ and $\mathbf{u_{21k}}$).

To estimate this parameter, Normal probability distribution is defined (see expression 19) as priori distributions of model parameters to be run in MCMC algorithm.

$$\pi_{10j} \sim N(\gamma_{10k}, \sigma^2_{u_{10k}}), \ \pi_{11j} \sim N(\gamma_{11k}, \sigma^2_{u_{11k}}),$$

$$\pi_{20j} \sim N(\gamma_{20k}, \sigma^2_{u_{20k}}), \ \pi_{21j} \sim N(\gamma_{21k}, \sigma^2_{u_{21k}}) \quad (19)$$

Assuming that there is a global dependence between industry sectors, and this dependence is defined by an overall dependence structure that is common to all sectors, an additional level of hierarchy is added to the model. This level, express each one of

average industry effects described early as a function of a global parameter that encompasses all firms, as given by the expression (20):

$$\text{Dimension 1: } \gamma_{10k} = \eta_{100} + \omega_{100} \text{ and } \gamma_{11k} = \eta_{110} + \omega_{110}$$

$$\text{Dimension 2: } \gamma_{20k} = \eta_{200} + \omega_{200} \text{ and } \gamma_{21k} = \eta_{210} + \omega_{210} \quad (20)$$

Where $\boldsymbol{\eta_{100}}$, $\boldsymbol{\eta_{110}}$, $\boldsymbol{\eta_{200}}$, and $\boldsymbol{\eta_{210}}$ measure the global effects associated to average and time components of the proposed model. The remaining terms (**ω**'s) are random errors.

Since each firm has its own trajectory over time, all model coefficients were defined as random, and therefore, the correlation effect between them must be added in model specification. By modeling this correlation effect, possible bias in model estimation is avoided (Snidjers & Bosker, 1999, pg. 67).

For instance, observing the Dimension 1, as described in the Expression (15), the covariance structure between intercept and slope is modeled as follows:

$$\begin{pmatrix}\pi_{10j}\\ \pi_{11j}\end{pmatrix} \sim \text{BN}\left(\begin{bmatrix}\mu_{\pi_{10j}}\\ \mu_{\pi_{10j}}\end{bmatrix}, \begin{bmatrix}\sigma^2_{\pi_{10j}} & \rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}}\\ \rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}} & \sigma^2_{\pi_{11j}}\end{bmatrix}\right), \text{ for } j=1..., J \quad (21)$$

Where $\boldsymbol{\sigma^2_{\pi_{10j}}}$, $\boldsymbol{\sigma^2_{\pi_{11j}}}$ represent respectively the variance components for intercept and slope for dimension 1 of the proposed model. The covariance between them is given by $\boldsymbol{\rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}}}$. An analogous structure is used for the second dimension described in the Equation (16).

For estimation purposes using MCMC, non informative hyperprioris were defined[10]. The iterative process used by Gibbs sampler replicates Markov Chain realization for each parameter up to the equilibrium status is observed. Inferences about model's parameters are done based on observed results of stochastic chain. Which is supposed to be long enough to ensure that auto-correlation between its observations is non-significant (Paulino et al., 2003, pg. 319).

In this study, the stochastic chain was originally estimated using 51,000 observations, with a burn-in period[11] of 1,000 cases. A thinning rate of 50 is used to avoid auto-correlation effect (Paulino et al., 2003). As a result, a sample of 1000 observations of the posteriori distribution is obtained for each one of model's parameter.

[10] Hyperprioris are reported in Appendix A of this document.
[11] The burn-in period is also known as the period that the chain takes to achieve the convergence.

Convergence of the chain is evaluated by applying the Geweke Convergence Method (Geweke, 1991). This method splits the final chain in two parts with n and m observations in each one of them, and compares the equality of observed averages in both subsets by applying a T-Test hypothesis test for means comparison (Geweke, 1991). The convergence is found when there is no significant evidence that means are different. Additional metrics, as for example, auto-correlation plot and time series analysis of chain's elements were also evaluated, given support in convergence analysis.

3.3.2. Sample design

Data was extracted from COMPUSTAT (North America) data base and covers the historical period from 1995 to 2011. Firms from Financial and Governmental industries were excluded from this sample selection. As presented by the Figure 14, five time frames were created, covering a five-year cycle in each one of them.

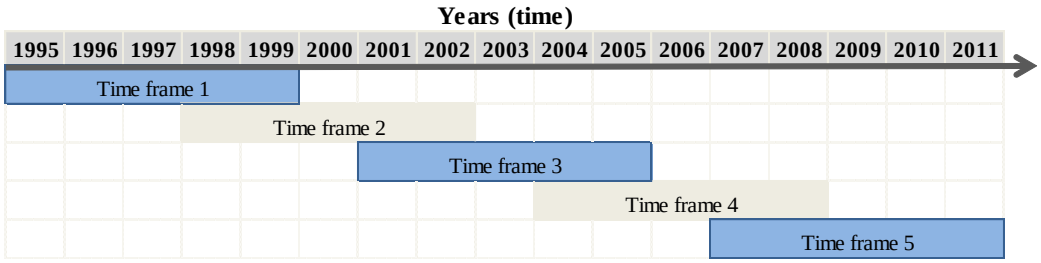


Figure 14. Sample design.

A five-years time frame covers enough time usually adopted by firm in strategy definition including also executive tenures, and planning horizons (Powell, 2003), and therefore, it is a reasonable time frame to observe and compare the value created between firms. In addition, to minimize the impacts of abnormal events over firms' performance, an overlapping of two years between two subsequent time frames is also adopted (Keats & Hitt, 1988; Short, 2007; Wiggins & Ruefli, 2002). In doing it, it is possible to compare firms with different stages of maturity (growth, mature or decline)

within the same time frame (Miles, Snow, & Sharfman, 1993), and then it is possible to evaluate how competitive statuses evolves over time.

Although Bayesian inference has no restriction in terms of sample size some sample selection criteria were applied:

- Only active firms in at least four from five years within each time frame;
- Average turnover (Net Sales) within each time frame is greater than USD 10 million;
- Available information for Operational Return on Assets (OPROA) and Net Sales;
- In order to control the industry effect, the final sample contains just industries[12] that present at least 20 observations each one;

Also, an individual analysis was performed to evaluate extreme cases. Exclusions of cases was conservative, eliminating only those cases that do not represent the phenomenon of interest as, for instance, operating returns higher than 1000%, or lower than -200%.

Table 1 brings the description of the total number of firms considered in each one of the time frames. It also reports the amount of firms that were excluded by each one of the sample selection criteria. The total number of firms considered in each time frame increases over time, starting with 1,690 in 1995/1999, and achieving 3,023 firms in 2007/2011 time frame. After applying all selection criteria the final database contains from 67% to 78% of total number of firms initially extracted from COMPUSTAT.

Table 1. Sample selection criteria by time frame

Sample selection criteria	Time Frame				
	1995/1999	1998/2002	2001/2005	2004/2008	2007/2011
Initial extraction	2,517	3,031	3,535	3,712	3,875
Net Sales > USD 10 M	2,171	2,647	2,890	3,231	3,491
Active companies	1,750	2,196	2,502	2,888	3,163
Final Sample	1,690	2,132	2,408	2,751	3,023
% of firms in the final sample	**67%**	**70%**	**68%**	**74%**	**78%**

Source: Elaborated based on data extracted from COMPUSTAT database (S&P, 2013).

[12] Industry identification is based on the 4-digits of the SIC CODE.

Table 2 brings some descriptive statistics for the final sample covering all time frames. It is seen that to Operational Return on Assets (OPROA) decrease over time in terms of the average observed values between 1998 and 2005. After that, a slightly positive trend is observed. More stable values are observed for the second dimension considered in the model. Average net sales also increases over time, from USD 2,115 million to USD 3,491 million, in average.

Table 2. Descriptive statistics and total number of cases considered in the final sample

Drivers	Time frame				
	1995/1999	**1998/2002**	**2001/2005**	**2004/2008**	**2007/2011**
(1) **Total Assets (USD m)**	2,543	3,030	3,712	4,034	4,454
(2) **Net Sales (USD m)**	2,115	2,397	2,863	3,302	3,491
(3) **Return on Assets (OPROA)**	4.80%	0.03%	1.23%	1.88%	1.42%
(4) **Correlation (OPROA x Log Net Sales)**	43%	49%	46%	49%	47%
(5) **Total number of SIC CODE**	162	180	194	210	216
(6) **Total number of firms**	1,690	2,132	2,408	2,751	3,023
(7) **Total observations**	8,423	10,608	12,001	13,703	15,042

* Indicators from (1) to (3) are expressed as average observed values.

Source: Elaborated based on data extracted from COMPUSTAT database (S&P, 2013).

Different from Brito & Brito (2012) the statistical model proposed here estimates conjointly profitability and growth effects. A direct benefit can be obtained in the model's predictive power when compared to the estimation procedure considering both metrics in separated models (Snidjers & Bosker, 1999), especially when they are correlated. Results presented at Table 2, show correlation over 40% between dependent variables in all time frames, varying from 34% to 49%. Besides the differences in the estimation method, in this work from 162 to 216 industries are considered to measure industry effect, which is higher than the 40 different industries tested by Wiggins & Ruefflli (2002) and close to the numbers used by Brito & Brito (2012).

3.3.3. Competitive status characterization under Bayesian approach

This section presents the methodology followed to characterize the competitive statuses based on economic value created by a firm in a given length of time.

Taking advantage of the posteriori probabilities distributions of firms' average effects for profitability ($\boldsymbol{\pi_{10j}}$) and growth rate ($\mathbf{g_j}$), it is possible to infer about the probabilities of firms outperform (or underperform) industry average. The probability of the firm presenting a competitive advantage status over its rivals is obtained by comparing the posteriori distribution of firm's effect with the industry effect, as presented by the shadow area in the Figure 15.

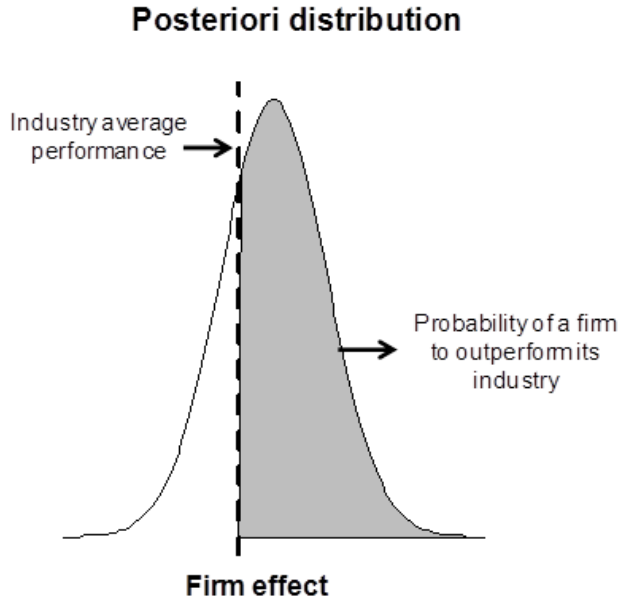


Figure 15. Graphical representation of competitive advantage probability calculation

Industry average values were obtained from a secondary model, with similar structured of the proposed model except by the fact that no firm's level is applied in the model definition. The parameters are also estimated considering MCMC, with 33,000 interactions and a burn-in period of 3,000 observations. Average industry effect value is calculated as the arithmetic average from a sub set of final chain with thinning rate of 30 cases. Convergence was checked using the Geweke Convergence Metric (Geweke, 1991). Codes used for this model development are reported in the Appendix A.

Posteriori probability values were calculated to each one of the firms, and for both of the dimensions. The competitive advantage probability was calculated based on probability of event theory (Ross, 1997, pg.1), taking into account the fact that the advantage can manifests by either one of the dimensions (profitability, or growth). Let:

P(profitability): is the probability of the firm achieving a higher profitability performance than the industry average.

P(growth): the probability of the firm achieving a higher growth than the industry average growth rate.

Then, the competitive advantage probability is defined as:

$$P(Competitive\ Advantage) = P(profit) + P(growth) - P(profit\ and\ growth) \quad (1)$$

Analogous, procedure was adopted to calculate the probability of disadvantage. Doing it for all firms, it is possible to plot the level curve of the joint probability of competitive advantage. Taking the most recent time frame (2007/2011) as an example, the level plot of joint probability of competitive advantage is given by Figure 16.

All firms with high joint probability of having competitive advantage over their rivals are located above of the last level line (represented by the lightest color in the graph). Notice that those firms with high probability of achieving the competitive advantage in both dimensions are concentrated in the top right corner of the level plot. Those firms in which the competitive advantage manifests in only one dimension concentrate in the right (growth) and upper (profits) borders. Firms with low probability of achieving advantage are located in the bottom left corner. Plots for the remaining time frames are available in the Appendix B.

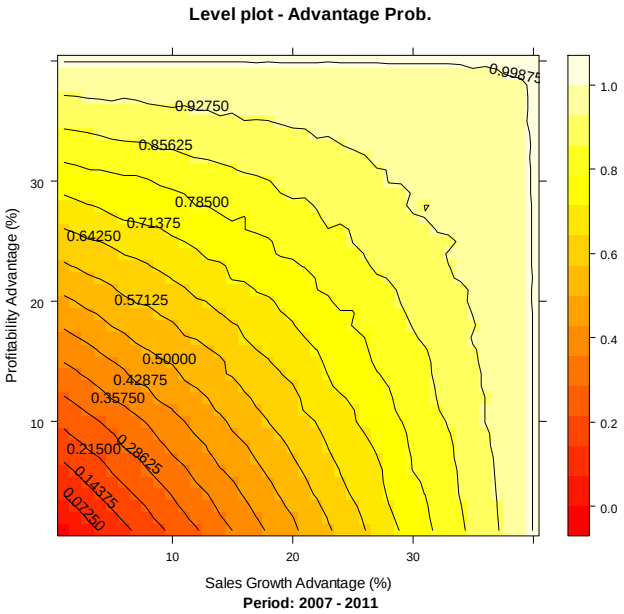


Figure 16. Level plot for conjoint probability of competitive advantage – Time frame 2007/2011

The graphical representation of joint probability distribution of competitive advantage brings a different perspective of advantage's manifestation. It leaves the limited comparison of interval approach, to be seen as a continuous surface, adding more flexibility into the analysis.

Because of the bi-dimensionality of the proposed model, competitive advantage (or disadvantage) of a given firm can be expressed in different ways. Firms can outperform in only one dimension at once (profitability or growth), in both dimensions simultaneously, or in none of the dimensions. Based on the probability of competitive advantage and competitive disadvantage nine different statuses are identified according to the schema presented in Figure 17.

Upper right corner of Figure 17 is populated by firms with probability to outperform their industry average in both dimensions simultaneously (growth and profitability). Those firms are said to be achieve a double advantage status in a given time frame. Firms that outperform industry in one dimension without underperforming in another one are classified in single advantage statuses. Single advantage in growth, for instance, is observed when the firm presents higher probability to outperform its industry in growth rate dimension without outperforming or underperforming in profitability. The same rationale is applied to single advantage in profitability.

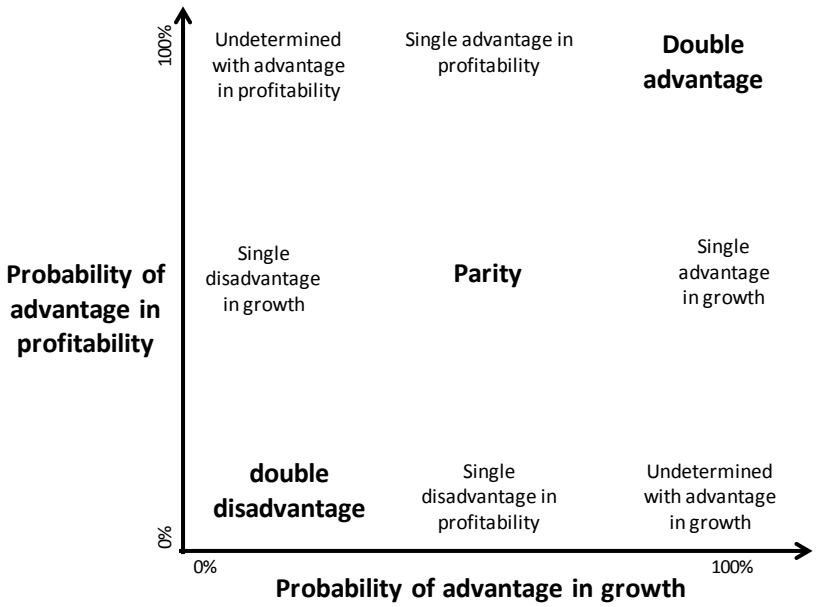


Figure 17. Competitive Status identification map

Disadvantage status focuses on the opposite direction of performance. It is characterized by higher probability of firms to underperform industry average. Indetermination statuses are found when the firm outperforms in one dimension at the same time it underperforms in the other one. For example, the indetermination with advantage profitability status occurs when a firm has higher probability to be in an advantage status in profitability and, at the same time, it presents higher probability of presenting disadvantage in growth dimension. Full description of competitive statuses and the probability thresholds adopted in this classification are presented in

Table 3.

Table 3. Description of competitive status

Description	Competitive stages classification
Parity (G1)	Firms with performance in growth and profitability similar to the average of the industry.
Double advantage (G2)	Higher probability to outperform industry in growth and profitability simultaneously. $P(\ OPROA_{firm} > \mu_{OPROA_{indus}}\ and\ Growth_{\ firm} > \mu_{growth_{indus}}) \geq 0.80$
Single advantage growth (G3)	Higher probability to outperform its industry in growth without outperforming in profitability. $P(Growth_{\ firm} > \mu_{growth_{indus}}) \geq 0.90$ $AND\ \ 0.2 \leq\ P(OPROA_{firm} > \mu_{OPROA_{indus}}) < 0.9$
Single advantage profitability (G4)	Higher probability to outperform its industry in profitability without outperforming in growth. $P(OPROA_{firm} > \mu_{OPROA_{indus}}) \geq 0.90$ $AND\ \ 0.2 \leq\ P(Growth_{\ firm} > \mu_{growth_{indus}}) < 0.9$
Double disadvantage (G5)	Higher probability to underperform industry in growth and profitability simultaneously. $P(\ OPROA_{firm} < \mu_{OPROA_{indus}}\ and\ Growth_{\ firm} < \mu_{growth_{indus}}) \geq 0.80$
Single disadvantage growth (G6)	Higher probability to underperform its industry in growth without underperforming in profitability. $P(Growth_{\ firm} < \mu_{growth_{indus}}) \geq 0.90$ $AND\ \ 0.2 \leq\ P(OPROA_{firm} < \mu_{OPROA_{indus}}) < 0.9$
Single disadvantage profitability (G7)	Higher probability to underperform its industry in profitability without underperforming in growth. $P(OPROA_{\ firm} < \mu_{OPROA_{indus}}) \geq 0.90\ AND$ $0.2 \leq\ P(Growth_{firm} < \mu_{Growth_{indus}}) < 0.9$
Undetermined with advantage in growth (G8)	Higher probability to have advantage in growth and disadvantage in profitability. $P(Growth_{firm} > \mu_{Growth_{indus}}) \geq 0.80$ $AND\ P(OPROA_{\ firm} < \mu_{OPROA_{indus}}) \geq 0.80$
Undetermined with advantage in profitability (G9)	Higher probability to have advantage in profitability and disadvantage in growth. $P(OPROA_{firm} > \mu_{OPROA_{indus}}) \geq 0.80$ $AND\ P(Growth < \mu_{Growth_{indus}}) \geq 0.80$

3.4. Results

This section presents the results of the topography of competitive advantage under a Bayesian perspective. Initially, a point in time analysis is performed in order to explore the topography of competitive statuses for different time frames. Next, competitive statuses transitions rate are evaluated aiming to explore the sustainability of competitive advantage over time. At the end, some insights about industry effects are presented, looking for more evidence about how much industry effect matters in terms of competitive advantage manifestation.

3.4.1. Exploring the topography of competitive statuses

Using the definition of competitive statuses presented in the previous section, the topography of competitive advantage is explored. When firms are plotted into the competitive status map (as exhibited in Figure 17), a graphical representation of firms competitive position can be visualized.

Figure 18, shows the map corresponding to the time frame from 2077 to 2011. Notice that most of them are located in the central region of the map, which indicate that most of firms are in a status of parity. Same pattern of distribution is observed in the other time frames, and details can be found in the Appendix C in the end of this work.

The correspondent frequencies of firms classified in each one of the competitive statuses are reported in Table 4. This table brings the results for all time frames explored in this empirical study. It is observed that most of firms (from 37 to 54%) are concentrated in parity status, which is expected given the nature of competition where over performing firms tend to be imitated and lower performing firms correct their deficiencies.

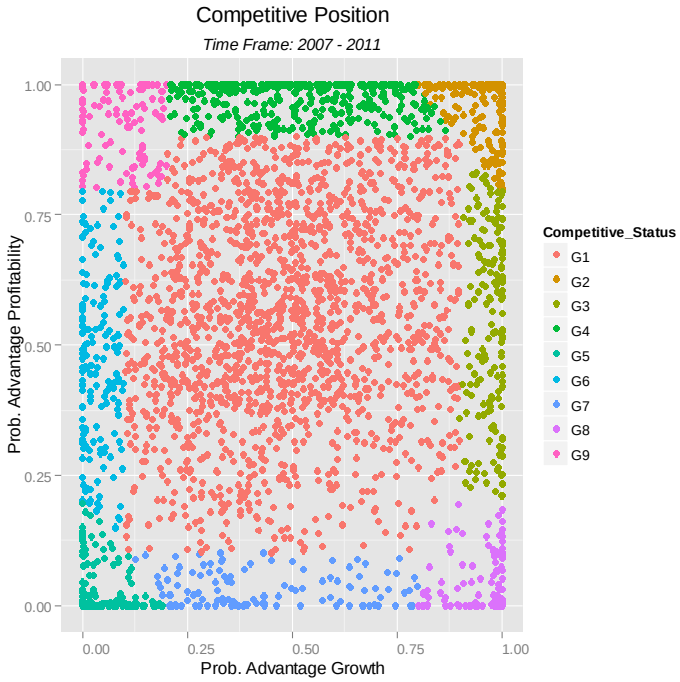


Figure 18. Graphical representation of competitive status mapping for 2007/2011 time frame

Moving to the portion of firms that have outperformed their industries, it is found that the total percentage of firms in competitive advantage varies between 22 and 29% of all firms, averaging 25%. Despite the differences on model methodology and on competitive advantage definition, these empirical results indicate that competitive advantage is not so rare as it was found in previous studies (Brito & Brito, 2012; Powell, 2003; Wiggins & Ruefli, 2002). Rarer, is the percentage of firms ability to outperform simultaneously in profitability and growth rates. Only 5 to 8% of firms have achieved the double competitive advantage status over time.

Exploring the single advantage statuses, it was found that competitive advantage can manifest in different ways across firms, reinforcing the debate against the use of only one metric (financial returns) to measure firms' competitive advantage (Coff, 1999, 2010; Powell, 2001). The percentage of firms that outperforms it's industry in profitability dimension varies from 7 to 13%, averaging 9%. This is similar to the percentage found by Brito & Brito (2012), which is close to 12.1%. From 6 to 13% of firms presented higher levels of growth rate than their industry, which characterize the status of single advantage in growth. In other words, it means that those firms present a higher trade-off effect in their ability in managing suppliers and customers' relationship than those firms able to achieve the double advantage status.

Results found in this work presents slightly differences from those presented by Brito & Brito (2012). According to the results, almost 25% of firms are in competitive status, while they found 16%. The percentage of firms in parity is 44%, in average, while theirs is close to 66%. Closer results were found for disadvantage classification, while results here show 18%, in average, and they found 16.5% of firms. Although both studies define competitive advantage manifestation based on the economic value creation definition, differences on methodological approach have resulted in differences on firms' classification across competitive statuses.

Table 4. Exploring the origin of competitive advantage manifestation by time frame

Competitive Status	Time frame					
	1995 - 1999	1998 - 2002	2001 - 2005	2004 - 2008	2007 - 2011	Average
(1) Parity	43%	37%	47%	41%	54%	44%
(2) Double advantage	6%	5%	8%	6%	6%	6%
(3) Single advantage in growth	9%	13%	8%	7%	6%	9%
(4) Single advantage in profitability	7%	8%	13%	13%	11%	10%
(5) Double disadvantage	7%	7%	6%	7%	5%	7%
(6) Single disadvantage in growth	11%	8%	5%	7%	5%	7%
(7) Single disadvantage in profitability	3%	3%	3%	4%	4%	3%
(8) Undetermined with advantage in growth	5%	7%	6%	6%	5%	6%
(9) Undetermined with advantage in profitability	9%	13%	3%	8%	3%	7%
Firms in advantage status	**21%**	**25%**	**29%**	**27%**	**23%**	**25%**
Firms in disadvantage status	**22%**	**18%**	**15%**	**19%**	**14%**	**18%**
Total number of firms	**1690**	**2132**	**2408**	**2751**	**3023**	-

Also, studies that only focus in profitability dimension do not capture this competitive advantage situation, and ignore the fact that those firms can create more value than industry without necessarily present higher profits (Coff, 1999). According to results, one third of the total competitive advantage percentage observed is dismissed when competitive advantage is classified based only on profitability results.

3.4.2. The dynamics of competitive advantage

Moving forward in the competitive advantage characterization, and taking the advantage of having different time frames covered in this study, the dynamics of competitive statuses migration over time are explored next.

Migration matrices were built taking into account the transition rates of subsequent, but non overlapping time frames.

The Table 5 reports the full average transition rates observed in three migration instances: 1995/1999 to 2001/2005; 1998/2002 to 2004/2008; and 2001/2005 to 2007/2011. Rows statuses represent the current competitive status of a given firm, while column statuses indicate the competitive position in the subsequent time frame. The percentage of cases reported in the first column is the average frequency distribution of firms in the status within the five five-year frames.

To comprehend the dynamic of competitive status migration, an aggregation of competitive statuses is proposed. For instance, taking the advantage statuses as an example, the migration rates were recalculated considering within the same status all firms in single and double advantage. A similar procedure was done to consolidate rates for disadvantage statuses. Results for aggregated statuses are reported in Table 6.

Parity status encompasses 44% of firms and, 68% of them are not going to change this status in a future time frame, indicating that most of the firms in parity tend to remain in parity. Migrations from parity to advantage, or disadvantage statuses are less common, being observed in 15% and 13.2% of firms respectively.

According to the empirical findings, competitive advantage is not a rare event, once it is observed for a quarter of the total firms. The frequency of firms in single advantage in growth and profitability is quite similar, 10% in each dimension. In general a high persistence in advantage is observed, and close to 39% of firms in advantage tend to remain in advantage; while 41.6% of them migrate to parity status, and only 11% achieved a disadvantage position. This high persistence of competitive advantage is another indication of the relative ubiquity and relevance of the sustained competitive advantage concept.

The results point to an opposite direction of Wiggins and Ruefli (2002) findings now with a comparable time length. In the sample, close to 10% (25% x 38.9%) of all firms still remain in some type of competitive advantage status for two consecutive five-year periods. This pattern, however, depends greatly in the dimension of advantage.

Profitability dimension shows higher persistence in advantage than growth dimension. In average, 40.1% of firms originally in single advantage in profitability remain in this status and 31.2% of firms in double advantage migrate to Single advantage in profitability. Growth advantage is more temporary and most likely turns to parity in the following time frame.

A similar pattern can be observed in the Disadvantage status. Disadvantage in general is less persistent than advantage (27.9% of firms remain in disadvantage, against 38.9% observed in advantage). Close to 44.6% of firms in disadvantage migrate to parity in the following time frame, 27.9% remain in disadvantage, and a migration of 15.9% to any advantage statuses is observed. The direct migration from advantage to disadvantage and vice-versa does occur for a relatively small fraction of firms. This migration is again concentrated on the growth dimension due to its volatility.

According to results presented in Table 5, the disadvantage in profitability is also more persistent than the disadvantage in growth. Growth is more erratic and unpredictable than profitability (Brito & Vasconcelos, 2009; Geroski, Machin, & Walters, 1997) probably because it can happen in spurts rather than continuously (Edith Penrose, 1959, p.213). The direct migration from advantage to disadvantage and vice-versa does occur for a relatively small fraction of firms. This migration is again concentrated on the growth dimension due to its volatility.

The undetermined status, where a firm has an advantage in one dimension and a disadvantage in another, shows an interesting migration pattern. The most common destination in the next time frame is the advantage status. Sacrificing performance in the short term to one dimension may be a path to advantage. Results suggest that this happen most often sacrificing growth to achieve superior profitability to later recover from the disadvantage in growth moving into advantage. Close to 45% of firms in undetermined status with advantage in profitability move to advantage in the following time frame.

Table 5. Full migration matrix for competitive statuses

Current time frame		Next time frame								
		Parity	Advantage			Disadvantage			Undetermined	
Competitive status	Cases (%)		Double	Single growth	Single profitability	Double	Single growth	Single profitability	Advantage growth	Advantage profitability
Parity	44%	68.0%	2.6%	5.3%	7.1%	3.7%	7.5%	2.0%	0.8%	3.1%
Double advantage	6%	31.7%	10.5%	4.8%	31.2%	3.8%	4.5%	1.4%	1.2%	10.9%
Single advantage in growth	9%	56.3%	5.4%	8.8%	7.2%	4.2%	11.8%	1.3%	1.3%	3.7%
Single advantage in profitability	10%	29.8%	12.4%	1.8%	40.1%	1.9%	2.6%	0.6%	0.1%	10.6%
Double disadvantage	7%	30.8%	5.4%	6.3%	3.4%	16.2%	5.2%	13.1%	16.0%	3.6%
Single disadvantage in growth	7%	58.3%	3.8%	5.8%	6.4%	6.8%	7.4%	4.3%	3.2%	4.0%
Single disadvantage in profitability	3%	33.2%	3.1%	7.1%	6.4%	23.7%	3.7%	13.3%	5.8%	3.6%
Undetermined with advantage in growth	6%	26.8%	9.1%	10.2%	5.0%	16.1%	7.6%	11.1%	11.7%	2.3%
Undetermined with advantage in profitability	7%	34.1%	7.8%	4.9%	32.1%	2.2%	6.1%	1.4%	0.5%	10.9%

Table 6. Aggregated migration matrix for competitive statuses

Current time frame		Next time frame			
Competitive status	Cases (%)	Parity	Advantage	Disadvantage	Undetermined
Parity	44%	68.0%	15.0%	13.2%	3.8%
Advantage	25%	41.6%	38.9%	11.0%	8.6%
Disadvantage	18%	44.6%	15.9%	27.9%	11.6%
Undetermined	13%	28.9%	36.8%	21.2%	13.1%

3.4.3. Evaluating industry effects over the competitive advantage manifestation

Examination of firms' effect over performance is a fundamental question in strategic management research field (McGahan & Porter, 1997). Different studies try to identify the relative importance of industry effects over performance's variability across firms (Brito & Vasconcelos, 2009; McGahan & Porter, 1997; Rumelt, 1991; Schmalensee, 1985), and whether firms' performance is driven primarily by industry or firms' factors (Hawawini, Subramanian, & Verdin, 2003; Karniouchina et al., 2013; Wiggins & Ruefli, 2002). Such studies have represented an important advancement in the strategic management literature, and extended the understanding of organizational adaptation and firms and industry influences in firm performance over time (Short et al., 2006).

First evidence around industry effect influence were found early by Schmalensee (1985). Later on, Rumelt (1991) found that industry is not the main effect, being the firm responsible for majority of the performance variance. This paper has encouraged several other studies regarding industry influences over firms' performance (McGahan & Porter, 1997; Powell, 1996).

To Hawawini et al (2003) industry-specific factors may have different meaning for different types of firms, and the variance of firms factors seems to be more impacted by the presence of outliers firms (leaders and losers) than by industry that they belong. Authors found that industry factors, on average, matter little to firm performance. The absolute and relative influence of industry, corporate-parent, and business-specific effects differs substantially across broad economic sectors in ways which suggest characteristic differences in their industry structural context. Wiggins & Ruefli (2002) found empirical results about the effect of industry on competitive advantage manifestation taking into account only profitability measures.

To evaluate whether industry effect matters, or not, a comparative analysis of firms' competitive statuses was conducted across industries. The objective is to explore whether industry effect matters in terms of firm's performance differentiation, leaving apart the focus on variance decomposition literature, in determining how much

performance variance is explained by different levels of analysis. Differently from most performance variance decomposition studies, this model allows observing the variance across industries by comparing the differences on firms' distribution across competitive statuses.

A subsample with at least 10 firms per industry (SIC 4-digits) was selected from the most recent time frame (2007/2011), resulting in 99 industries to perform the study. To each one of industries, the percentage was calculated of firms in each competitive statuses. Then all firms are compared taking into account the concentration of firms in each competitive status. As exhibited by Figure 19, the percentage of firms in advantage status (obtained summing up the percentage of firms in the double and single advantage) varies across industries from 0 to 75%. This wide range indicates that competitive advantage can be more difficult to be observed in some industries, than it is in others.

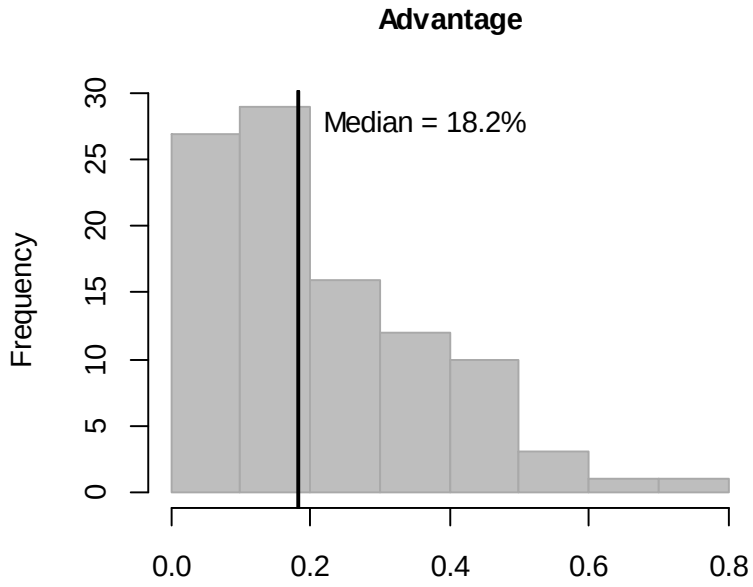


Figure 19. Distribution of the percentage of firms in competitive advantage by industry

Some examples of industries covering the wide range of values are presented in Table 7. There are some firms that competitive advantage statuses are not observed, like Natural Gas Distribution or Electric Services. Those industries are clearly highly regulated, or offer little room for firms to differentiate themselves or have resource heterogeneity. Also, in those industries it is rare the observation of new entrants (Porter, 1991), which lead to a more homogeneous market. Higher or low performance are dependent on supply chain and transaction costs management (McGahan, 2000).

Table 7. Heterogeneity of firms in competitive advantage manifestation

Industry		Total number of firms	Firms in advantage (%)
SIC Code	Description		
1531	Operative Builders	16	0%
4924	Natural Gas Distribution	23	0%
4941	Water Supply	12	0%
5045	Computers and Software-Whsl	15	0%
4911	Electric Services	104	1%
4931	Electric and Other Serv Comb	55	2%
7990	Misc Amusement and Rec Service	27	7%
7389	Business Services, Nec	26	15%
5812	Eating Places	47	17%
3663	Radio, TV Broadcast, Comm Eq	39	18%
7372	Prepackaged Software	116	23%
1311	Crude Petroleum and Natural Gs	136	29%
3674	Semiconductor,Related Device	102	36%
2836	Biological Pds, Ex Diagnstics	90	43%
3845	Electromedical Apparatus	45	44%
2834	Pharmaceutical Preparations	108	52%
3577	Computer Peripheral Eq, Nec	18	56%
1040	Gold and Silver Ores	24	58%
3826	Lab Analytical Instruments	16	69%
2821	Plastics,Resins,Elastomers	12	75%

In the other extreme, firms like Pharmaceutical Preparations or Semiconductors present higher concentration of firms in competitive advantage. In those sectors, stable core activities are observed, however their core assets can be threaten by the discovery of new ones (McGahan, 2000), which add more heterogeneity between firms performance. Firms not prepared for changes can face difficulties in achieving the competitive advantage, and therefore, this group of firms seems to be related to higher resource heterogeneity due to patents and technology.

The full table with frequency distributions to all industries is reported in the Appendix D of this work. Histograms with parity and competitive disadvantage distributions are reported in Appendix E.

Reshaping antecedent studies, which tried to measure how much industry matter, this work presents empirical evidences around firms' heterogeneity in terms of competitive positioning. One direct implication brought by those results is that heterogeneity on firms' performance differs from one industry to another. Results found are in line with literature previous findings and expand the topic with a more comprehensive definition of competitive advantage, a more realistic model providing greater granularity about this industry effect. Explore the causes of these differences is beyond the scope of this work, but offers a fertile ground for future research.

Going further, significant differences in migration pattern were found when comparing the dynamic of competitive statuses migration over time between groups with high and low concentration[13] in advantage statuses. Matrices were generated observing the same criteria described early. Results for the aggregated matrices are reported in Table 8 and Table 9, and reflect the average migration rate observed. Full migration matrices can be assessed in the Appendix F.

Industries with low concentration in competitive advantage statuses are more concentrated in parity status (61% of firms). Low number of firms is concentrated in undetermined statuses, which represents only 6% of cases. For those industries where competitive advantage is more frequently observed (high concentration group), it was found that firms are more homogeneous distributed across competitive statuses. Undetermined status encompasses 20% of firms, while advantage encompasses 32% of cases.

Also, firms allocated in more homogeneous industries present a higher persistence rate to remain in parity status (76.7%), than it is observed in the group of firms highly concentrated in advantage status (50.4%). Persistence in advantage for low concentration group is 21.2%, being lower than the half of the rate observed for high concentration group, which is close to 51.5%.

A different migration pattern is observed in disadvantage status. Firms within industries, where competitive advantage is not commonly observed, tend to present lower persistence rate to disadvantage (17.9%). Close to 65.7% of firms in disadvantage migrate to parity status, which is the most likely path to be followed. Persistence in

[13] An industry is said to have high concentration in competitive advantage status when the observed frequency of firms in advantage status is greater than the median.

disadvantage to the more heterogeneous group of industries is almost double of the rate, achieving 34.6%.

In addition to the differences observed on firms distribution across competitive statuses, these results indicate that these two group of industries, present different migration pattern and therefore. Therefore, it can be concluded that there is any non-null effect interfering in the dynamism of competitive advantage manifestation associated to industry effects.

Table 8. Migration matrix for aggregating competitive statuses – High concentration

Current time period		**Next time period**			
Competitive status	**Cases (%)**	**Parity**	**Advantage**	**Disadvantage**	**Undetermined**
Parity	28%	50.4%	26.2%	16.7%	6.7%
Advantage	32%	27.7%	51.5%	8.5%	12.3%
Disadvantage	21%	30.1%	19.6%	34.6%	15.7%
Undetermined	20%	24.4%	39.8%	21.0%	14.8%

Table 9. Migration matrix for aggregating competitive statuses – Low concentration

Current time period		**Next time period**			
Competitive status	**Cases (%)**	**Parity**	**Advantage**	**Disadvantage**	**Undetermined**
Parity	61%	76.7%	9.8%	10.9%	2.6%
Advantage	18%	57.7%	21.2%	16.7%	4.5%
Disadvantage	15%	65.7%	10.6%	17.9%	5.8%
Undetermined	6%	38.3%	26.3%	25.4%	10.0%

This finding has relevant implications for strategy practice, for research design and for the relevance of theories. When managing companies in industries where competitive advantage is rare, managers should give high priority to issues that can affect industry structure like regulation, broad technology changes, macroeconomic and country trends. In these industries, monitoring competition to sustain parity is probably a more realistic competitive approach. In industries where competitive advantage is

common, managers should focus on achieving and maintaining advantages over rivals. Priority should be given to issues like proprietary technology, patents, external trends that can be exploited in an idiosyncratic way. Strategy is highly context dependent.

Research designs that use performance or competitive advantage as dependent variables should make sure that industry effect is fully accounted for. The simple use of industry dummy variables does not suffice in most multi-industry studies. Studies that explore single or similar industries can be quite valuable.

Finally the results bring new light on the debate about the utility of industry approaches to theory versus the resource-based one (Barney, 2001). Industry approaches like the Porter's five forces (Porter, 1980) are most useful in industries where competitive advantage is rare while the Resource-Based Theory is key where competitive advantage is a frequent occurrence. In general, both approaches are necessary and complementary. New research should strive to jointly explore the interplay between these approaches and others (Makadok, 2011), and results can help to direct and contextualize this effort.

3.5. Conclusions

This work has contributed to the discussion about competitive advantage manifestation supported by the value creation definition (Peteraf & Barney, 2003), presenting empirical evidence on it. Despite the model complexity, this work introduces new modeling perspective, and based on the Bayesian approach, makes richer inferences about competitive statuses of firms. Different from previous studies, the proposed model exploits simultaneously the bi-dimensional vector structure used to measure competitive advantage under economic value approach, and estimates individually firms' effects.

The results provide a consolidated view of the topography of competitive advantage and disadvantage in the U.S. context from 1995 to 2011. Different from previous studies (Brito & Brito, 2012; Powell, 2003; Wiggins & Ruefli, 2002), it was

found that competitive advantage is not rare, once that close to 25% of all firms are classified within a competitive advantage statuses. One third of firms achieve single advantage in growth dimension, meaning that that empirical studies only focused on financial returns did not capture the full effects value creation and competitive advantage. Evaluating the persistence of firms within a competitive status, it is observed that the growth dimension is more volatile than profitability. Double advantage is less persistent than single advantages.

Significant differences on competitive status distribution between industries were found. Industry not only has a direct effect on financial performance through firm effects, but also determines the possibility and relevance of firm effects and competitive advantage. It is not likely to see firms classified in competitive advantage status in industries belonging to highly regulated environments, as for example Water Supply and Natural Gas Distribution. On the other hand, in industries whose environment demands for continuous innovation, as Pharmaceutical Preparations, more firms are able to achieve an advantage status.

Theoretically, the results found emphasize that the relevance of different theories (e.g. industry and resource based approaches) to performance is context dependent. This implication supports Makadok (2011) call for future research that integrates and explores linkages between different theoretical perspectives. For practice, results indicate that managers should focus different aspects in different contexts.

Future works can explore the time trend effect of value creation to foresee firms' competitive status over time. A large field of study appears with the introduction and testing of explanatory variables associated to firms, industry, and country levels as explanatory variables to explain causal relationships on value creation and competitive advantage topography.

As limitations of this work the investigation of country or market conditions can be introduced in the analysis to enhance the environment effect over firms' performance. In addition, the causes of industry effect over competitive advantage manifestation of firms can be further investigated.

Findings of this work resulted in a complete paper that was submitted to the Academy of Management Annual Conference (2014) and it is pending on their review. Final paper can be accessed in the Appendix G section of this document.

4. Paper III – Using firms' competitive momentum and consistency to explore how firms evolve over time

4.1. Introduction

Investigate the dynamic of competitive advantage topography and the time dependency on economic value creation is still an unexplored field in Strategic Management. Existent studies give primary attention to the point in time performance comparison, trying to define the topography of competitive advantage (Brito & Brito, 2012; Wiggins & Ruefli, 2002) rather than make use of longitudinal perspective of firms' trajectories over time (Short et al., 2006).

The main objective of this work is not quantifying how much time effect matters, rather the interest is to know how this factor can help understanding competitive advantage topography discussed in the previous article. Two alternative dimensions are introduced into competitive advantage assessment, seeking for capturing the trend of value creation (competitive momentum), and for evaluating the way consistency in which firms create value over time.

Because both dimensions encompass elements associated to the forward perspective those dimensions are tested as predictors of future competitive statuses. Empirical evidence combining information of performance time-trajectory and their competitive advantage status are reported, showing that although firms are classified within the same competitive status, they present different trends of value creation over time.

In adding to the competitive momentum component into competitive status evaluation, it is expected to overcome the existent limitation inherent to average comparison, enhancing the understanding about firms and industry performance.

This work starts with a literature review focused on the time perspective benefits in competitive advantage characterization. Next, a new dimension is proposed, being able to capture the trajectory of firms' performance over time. Using the same

Bayesian model proposed in the previous work, based on value creation perspective the competitive momentum quantification is discussed in following next section, and final results, reporting evidence about the relationship between competitive momentum and competitive advantage topography, are presented next. Results section ends with a multinomial model proposition using competitive momentum and consistency as predictors of future competitive status. Finally, main conclusions and limitation of this work are discussed, and some additional studies using new proposed dimensions are suggested.

4.2. Adding a time perspective into competitive advantage characterization

Time effect is not recognized by scholars as the main source of firms' heterogeneity. Early studies found that firms or industry related effects are the main sources of performance heterogeneity (Richard et al., 2009; Short et al., 2006, McGahan & Porter, 1997; Rumelt, 1991). However, when the focus changes from the relative importance of model effects to a more general view of firms' internal capacity of using their internal resources to improve economic, financial, and operational results (Selove, 2012; Teece et al., 1997; Wernerfelt, 2011), or its capacity to adapt to changes in the external environment, the perception of time effect on competitive advantage manifestation changes.

To Ployhart & Vandenberg (2010), time itself does not cause firm sustainable advantage, but rather, firms' mix of strategic resources, competitive environment, and ability to leverage those capabilities leading firms to sustain an advantage status over time.

According to Pacheco-de-Almeida & Zemsky (2007), timing of resource development and impacts on firms performance can be determinant in its success on achieving, and sustaining competitive advantage statuses. Thus, the time needed to the firm to achieve competitive advantage is highly dependent on how much time the firm needs to adjust its operations, to develop new resources, and to adapt itself to new

market and competitors conditions until it starts capturing the financial benefits of these changes.

For instance, suppose that a pharmaceutical firm is working on the development of a new drug. During this period, high internal investments are done, impacting directly the firm value creation and appropriation capacity. For some time frame, business differentiation and internal resources improvement will not be converted into economic value. During this period, other rivals can assume an advantage position, until the benefits of this internal investment starts impacting firms financial and economic results. Firms' ability in dealing with internal and external changes without losing their performance will drive firms to the differentiation in terms of their competitive position.

Under this perspective, when the longitudinal effect is used to capture firms' ability in present higher performance researchers will have a more complete view about the dynamics of value creation, and over competitive advantage manifestation as well. This enhances the understanding of the adaptation process that a firm faces over time, and it can help to comprehend how and why firms or industry specific effects affect their performance (Short et al., 2006).

The proposition here is adding the future perspective of firms' performance to the point in time analysis of firms' competitive status. When the current competitive status is combined to the trend of firms' value creation, researchers can infer how likely a firm is to move towards competitive advantage, or disadvantage status in future. Therefore, the current competitive position helps to understand the current competitive status of firms when compare to rivals, while the competitive momentum will explain what is expected next.

4.3. Competitive momentum

Competitive momentum is defined as the momentum experienced by firms in terms of their performance trajectory over time. It is not related to the average performance, but to the trajectory experienced by firm, compared to industry.

Competitive momentum incorporates into competitive advantage analysis the history of value creation and adds a forward view into competitive analysis.

For instance, consider the value creation trend presented by a given firm as exhibited in Figure 20. Although that firm has created value close to industry (in average), it presents an optimistic perspective over time. This means that the velocity in which that firm creates economic value is higher than the industry overall capability on doing it. In creating greater economic value, the firm experience a competitive momentum towards advantage, suggesting that this firm will be likely to achieve an advantage status in future time frames. In cases where firms already are classified in competitive advantage statuses, it will be more likely to sustain its advantage in next time frames.

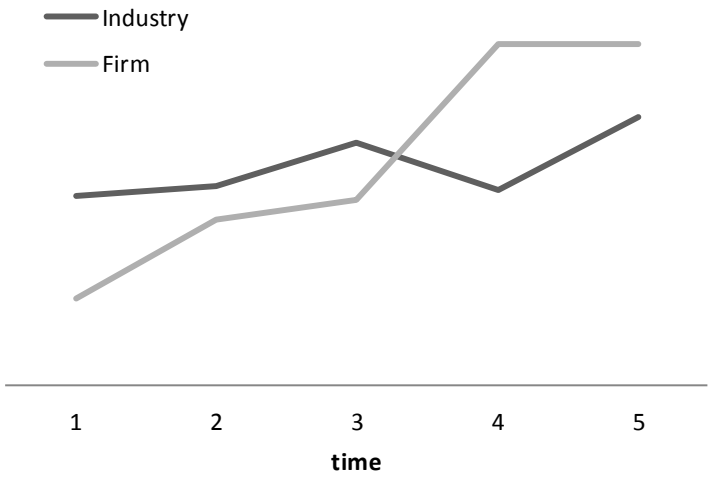


Figure 20. Competitive momentum towards advantage example

Figure 21 exhibits an opposite situation. The value creation rate for the firm is lower than the velocity observed in industry. In cases like that, firms tend to lose their competitive status over time, moving towards a disadvantage. For instance, if firm is classified in advantage status and experience momentum as reported in the figure below, the firm will be less likely to keep the advantage position.

In that situation, the competitive momentum dimension works as warning sign to foresee a possible migration among competitive statuses over time.

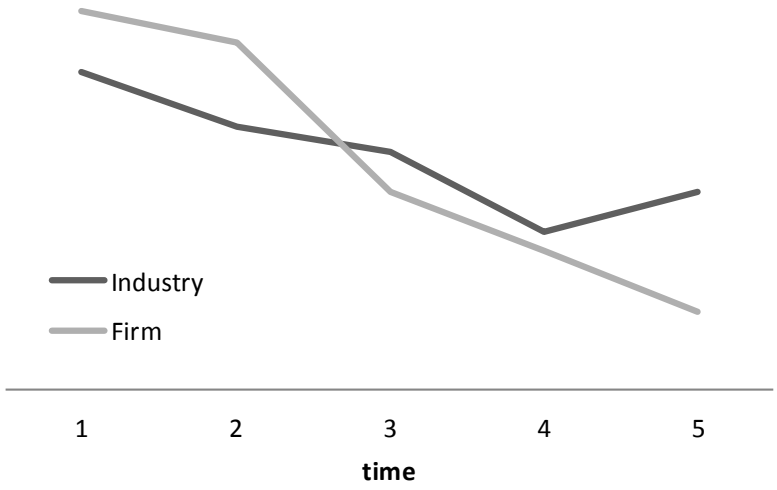


Figure 21. Competitive momentum towards disadvantage

In cases when value creation rate of firms is synchronized to industry, competitive momentum is said to be in pace with industry. For those firms that evolve as they industry, it would be less expected to observe migration to a different competitive status over time, because they present same pattern of evolution as their rivals.

Moreover, evaluating competitive advantage under value creation perspective, time effects can run differently depending on the dimension evaluated. Firms can face different experience in each economic value dimension. In such situation, while some firm are more likely to outperform rivals in one dimension, it can experience poorer trajectory in another one. This inequality in trajectories of firm's value creation dimensions characterizes a competitive momentum called mismatch trend.

4.4. Consistency

The main role of Consistency dimension is to differentiate firms in terms of heterogeneity of value creation within a length of time, even though they are rated in the same competitive status, or they have experienced the same competitive momentum.

While competitive status brings the present location of firms within competitive advantage topography and competitive momentum provides some evidences on where firms will be located in future, the consistency dimension includes the uncertainty into the analysis.

According to Thomas & D'Aveni (2009), volatility in firms performance is more likely to be observed in transition moments, or when special events (inside, or outside firms environment) happen. Other authors presented different causes of heterogeneity of performance. Porter (1991), for instance, raised new entrants, and the increase of competition, as sources of higher heterogeneity. Helfat & Peteraf (2003) recognize firms internal capability in manage internal resources as a source of volatility in their performance.

Thus, the analysis of the volatility of firms' value creation combined to the competitive status identification can explain the most likely trajectory of firms over time, segregating firms experiencing transition moments from those ones whose value creation is more consistent. The observation of the consistency, or the volatility in which firms' value creation evolve, is proposed to be one new dimension of competitive analysis to be evaluated together with the competitive status.

The underlying argument is that the more consistent is the evolution of economic value creation over time, the more sustainable is the firms' performance, and therefore, the lower the uncertainty of future competitive perspective (Brooks & Buckmaster, 1976; Dichev & Tang, 2009; Frankel & Litov, 2009). On the other hand, the more erratic is firms' performance, the more unpredictable are the firms' value creation, and the lower the certainty about firms' sustainability of their current competitive status over time. In this last situation, researchers and practitioners believe about the sustainability of firms competitive statuses over time will decrease.

Next section brings the methodological approach followed to operationalize the new dimensions discussed in this paper.

4.5. Methodological approach

The empirical identification of competitive momentum experienced by firms is done using the outputs provided by the hierarchical Bayesian model proposed in the previous papers, and discusses aspects related to competitive momentum not covered before.

The consistency of trajectory followed by firms is going to be measured by the Root of Mean Squared Error (RMSE). Several metrics available in the statistical literature allow measuring the dispersion of predicted values from the observed ones, and might be used in place of the RMSE, however, one advantage of this one is to capture the deviation from the average predicted values, applying higher weight to the higher differences. Higher RMSE values indicate that the observed performance trajectory is more volatile, or, in other words, indicate that observe values are far from average predicted values.

As well as discussed in the previous papers, competitive momentum is defined in terms of a bi-dimensional statistical model structure, observing simultaneously information from value created by industry and customers. Competitive momentum will be assessed in this work only considering information of profitability dimension due to some model limitation, while consistency can be observed in a bi-dimensional view.

Next sections describe the statistical model and the inference procedure adopted to identify the competitive momentum and consistency of firms.

4.5.1. Statistical model

As discussed in the previous papers, value creation can manifests either by profitability or by growth dimensions, which require an adoption of a bi-dimensional model structure. A bi-dimensional vector is adopted to quantify competitive status of

firms, and to identify the competitive momentum, which is composed by the portion of value created by firm (profitability) and by customers (growth).

Taking into account both metrics simultaneously, the first hierarchical level is described as following a Bivariate Normal (BN) probability distribution with average μ_j and covariance structure represented by Σ, as given by the expression (22). Both metrics are measured in different moments in time, allowing the inclusion of the time effect over those measures within each firm.

$$Y_{jt} = (Y_{1jt}, Y_{2jt}) \sim BN(\mu_j, \Sigma) \quad (22)$$

$\mathbf{Y_{jt}}$ is the dependent vector, containing the observed outcomes at the $\boldsymbol{t}$ time for firm $\boldsymbol{j}$. It is composed by two components: (a) $\boldsymbol{Y_{1t}}$ measuring profitability dimension; and (b) $\mathbf{Y_{2t}}$ measuring the dimension related to the growth of firms.

The average effect of $\boldsymbol{Y_{jt}}$ for a specific firm $\boldsymbol{j}$ within a specific period of time **t**, is given by $\boldsymbol{\mu_j}$, a (2x1) matrix. As the dependent vector, $\boldsymbol{\mu_j}$ also follows a **BN** probability distribution, as reported in expression (23). Average vector components follow an Univariate Normal distribution (**N**), with average $\boldsymbol{\mu_{1j}}$ (profitability) and $\boldsymbol{\mu_{2j}}$(growth) as described by the expressions (24) and (25):

$$\boldsymbol{\mu_j} \sim BN\left(\begin{bmatrix}\mu_{j1}\\ \mu_{j2}\end{bmatrix}, \Sigma_\mu\right) \quad (23)$$

$$\boldsymbol{\mu_{1j}} = \pi_{10j} + \pi_{11j} \times time_t \quad (24)$$

$$\boldsymbol{\mu_{2j}} = \pi_{20j} + \pi_{21j} \times time_t \quad (25)$$

Where, $\boldsymbol{\pi_{10j}}$ and $\boldsymbol{\pi_{11j}}$ represent firms average and time effect over profitability dimension, observed for firm **j**. In particular, $\boldsymbol{\pi_{10j}}$ measures the effect of firms associated to the profitability dimension, and it is used to identify competitive status. The profitability time trend to the firm **j** is captured by $\boldsymbol{\pi_{11j}}$ effect. This parameter is related to the influence of time on profitability of the firm, and it is going to be used to assess the competitive momentum.

To growth dimension the interpretation of parameters changes. As discussed in the second paper, there is no direct interpretation of π_{20j}, unless to measure average firm's size and segregate small from big firms. Moreover, $\boldsymbol{\pi_{21j}}$ cannot be used to measure the time effect over the growth of the firm, once it is a function of the growth

of firm within the time frame. The current structure adopted to capture the growth of the firm does not allow capturing the influence of time on this dimension, and therefore using the proposed model configuration, the evaluation of competitive momentum of firms can only be conducted by observing the profitability dimension of the model. Although it can be seen as a model limitation, it does not invalidate the contribution of competitive momentum to competitive advantage research.

4.5.2. Sample design

Sample was designed in such way that competitive statuses and competitive momentum can be tracked over time. Data extraction followed the same procedures discussed in the previous paper, in the section 3.3.2.

4.5.3. Competitive momentum and consistency operationalization

The posteriori distribution of profitability time effect (π_{11j}) was compared with the correspondent industry time effect to identify the competitive momentum of firms. The rationale is analogous to that one used to define competitive status, comparing firms' average effect to industry effect, as discussed in previous paper.

Based on the comparison of posterior probability distribution and industry average effect, and considering only profitability dimension, three different competitive momentum classes are identified. Table 10 shows the criteria used to identify firms' competitive momentum. This approach is similar to that one used by Hansen et al. (2004) to evaluate the effect of administrative decisions over firms' performance.

Thresholds applied were arbitrary defined, aligned to the cut off defined to competitive statuses. For instance, when a firm presents probability higher than 80% to

experience a greater time trend compared to the average of its industry, it is said that this firm is experiencing a competitive momentum towards advantage.

Consistency estimates are obtained by calculating the Root of Mean Square Errors (RMS) for both, profitability and growth dimension. RMSE is calculated following expression (26):

$$RMSE_i = \sqrt{\frac{\sum_{t=1}^{n}(Observed_{it} - predicted_{it})^2}{(n\ of\ observations)}} \qquad (26)$$

Where

$Observed_{it}$*:* is the observed value created by *i* firm at *t* time.

P$redicted_{it}$*:* is the predicted, or the expected value created by *i* firm at *t* time. Ppredicted values are obtained from the average parameters estimated in MCMC process.

High RMSE values indicate that observed values are far from the average predictive curve, which is associated to high volatility. Low RMSE values indicate that firm trajectory is consistent over time and present good fitting on predictive values.

The criteria adopted to define if RMSE values are low enough to represent a consistent behavior is similar and follows the same rationale adopted to classify firms into competitive statuses. Firms whose individual RMSE is higher than the industry median are classified into low consistency category. Firms whose individual RMSE is lower than median are classified into high consistency category.

Because profitability and growth are assessed simultaneously, to segregate firms between low and high consistency the RMSE should be calculated to both dimensions (growth and profitability) and to all firms individually. Then, those values must compare to the industry RMSE value. In this paper, we propose to compare the individual values with the median RMSE value observed within each industry.

Table 10. Competitive momentum definition

Momentum	Description
Towards Advantage	Higher probability to experience a greater time trend compared to the industry average. $P(\ time_{\ firm} > time_{industry}) \geq 0.80$
Towards Disadvantage	Higher probability to experience a lower time trend compared to the industry average. $P(\ time_{\ firm} < time_{industry}) \geq 0.80$
In pace with industry	Probability to experience a greater time trend compared to the industry average is in between 20 and 80%. $0.20 \leq P(\ time_{\ firm} > time_{industry}) \geq 0.80$

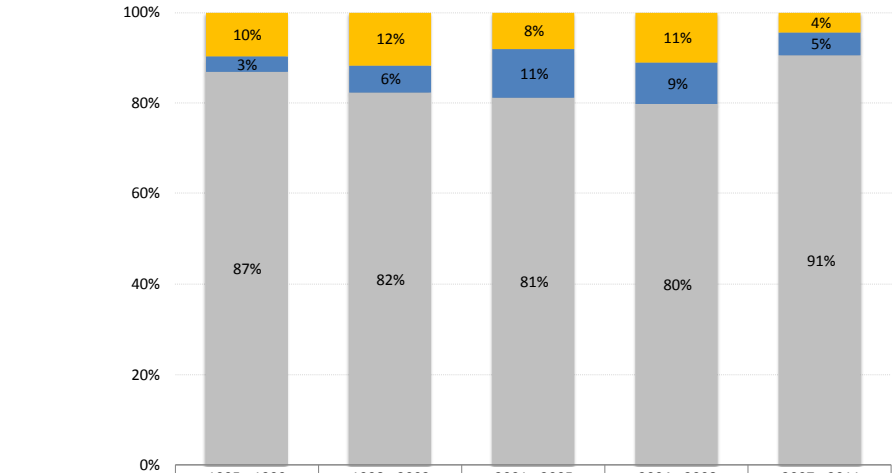
4.6. Results

In this section an exploratory analysis about competitive momentum is presented using the empirical results observed for the five time frames. Competitive momentum frequency distribution is initially presented to each one of the time frames in order to assess the stability of firms' trajectories over time.

Next, competitive momentum is associated to the competitive statuses, as a tentative to better predict the competitive status based on competitive momentum. This analysis is complemented by the consistency of firms' performance evaluation, and its relationship with competitive statuses. Next, the topography of competitive advantage is leverage with consistency and competitive momentum information. In the end of this section a multinomial model to predict competitive statuses using momentum and consistency dimension as predictors is presented.

4.6.1. Exploring competitive momentum

Competitive momentum distribution is evaluated to each one of the five time frames. As exhibited in Figure 22, in regards to the profitability dimension, most of firms (from 80 to 91%) present time evolution in pace with industry. From 10% to 12% of firms present higher probability in experiencing lower time trend compared to the industry average, which indicates that those firms are less likely to sustain their current competitive statuses in further time frames. The only exception is the most recent time frame (2007/2011), in which the percentage drops to 4%.



	1995 - 1999	1998 - 2002	2001 - 2005	2004 - 2008	2007 - 2011
Towards disadvantage	10%	12%	8%	11%	4%
Towards advantage	3%	6%	11%	9%	5%
In pace with industry	87%	82%	81%	80%	91%

Figure 22. Competitive momentum frequency distribution by time frame

Classical competitive advantage analysis is focused on average performance within a certain length of time. This standalone analysis helps understanding the competitive status of a firm; however it does not capture the momentum faced by firm compared to industry.

When competitive momentum across different competitive statuses is explored it is noticed that only few firms in parity status experience competitive momentum significantly different from industry. As reported in Table 11, in average, close to 2% of firms classified in parity status are experiencing competitive momentum towards advantage, and another 2% are experiencing a momentum towards disadvantage.

Also, there are firms experiencing different competitive momentums in each one of the competitive status, reflecting the dynamism of value creation across firms. Results suggest that each competitive status behave in a different way. While competitive momentum seems not vary substantially among firms in parity, the same does not hold for the other statuses. Firms in disadvantage and in undetermined statuses, for instance, tend to present different frequency distribution across competitive momentum categories, which might indicate that they are trying to reverse their status towards advantage, or parity, while others confirm their disadvantage position.

Table 11. Topography of competitive statuses by competitive momentum – Aggregated level

Competitive statuses	**Competitive momentum**		
	In pace with industry	**Towards advantage**	**Towards disadvantage**
Parity	96%	2%	2%
Advantage	86%	5%	8%
Disadvantage	67%	13%	20%
Undetermined	62%	21%	16%
Total	84%	7%	9%

Investigating the origins of differences for disadvantage and underdetermined statuses, a greater concentration of firms experiencing a competitive momentum towards advantage is found. It occurs more frequently among firms classified in single disadvantage in profitability (22%), or in undetermined with advantage in growth (38%) statuses. Detailed results are presented in Table 12. In common, both statuses show that there is a trend of firms leaving the disadvantage in profitability face in a given time frame, characterizing single advantage in profitability as a transient status.

When the double disadvantage status is observed, a greater concentration of firms with competitive momentum towards disadvantage is noticed. This suggests that those firms are more likely to keep this disadvantage status while industry is going in an opposite direction.

Among firms classified in double advantage competitive status is most likely to see firms experiencing the same performance trend as industry (79%). However, close

to 12% of firms in this status present a momentum indicating a migration towards disadvantage. Because of it, double advantage status might not be sustained in future.

Notice that the inclusion of competitive momentum into competitive status analysis refines the competitive advantage topography assessment, and captures some divergent evolution trends not reported before.

Table 12. Topography of competitive statuses by Competitive Momentum – Full description

Competitive status	Cases (%)	Competitive momentum		
		In pace with industry	Towards advantage	Towards disadvantage
Parity	44%	96%	2%	2%
Double advantage	6%	79%	8%	12%
Single advantage in growth	9%	90%	7%	3%
Single advantage in profitability	10%	86%	3%	11%
Double disadvantage	7%	52%	17%	31%
Single disadvantage in growth	7%	85%	3%	12%
Single disadvantage in profitability	3%	59%	22%	19%
Undetermined with advantage in growth	6%	47%	38%	15%
Undetermined with advantage in profitability	7%	76%	4%	20%
Total	-	84%	7%	9%

The next interest is to explore if competitive momentum adds some predictive power into the future competitive status. Table 13 brings the results when the competitive momentum observed in the current time frame is compared to the competitive status reached by firms in the subsequent time frame. Values reported are the average observed for the five time frames.

Although a gap of two years period is considered, it was found that more than half (53%) of the 84% of firms that present competitive momentum in pace with industry stay in a parity status in a future time frame. A quarter of them (25%) migrate to advantage, and the remaining firms are concentrated in disadvantage (13%) or in undetermined competitive status (9%).

Table 13. Competitive momentum as a predictor of competitive status

Competitive momentum (current time frame)	**Cases (%)**	**Competitive status (next time frame)**			
		Parity	**Advantage**	**Disadvantage**	**Undetermined**
In pace with industry	84%	**53%**	25%	13%	9%
Towards advantage	7%	21%	**34%**	24%	21%
Towards disadvantage	9%	21%	19%	**44%**	16%
Total	-	48%	25%	16%	11%

Firms experiencing a competitive momentum towards advantage are not as highly concentrated in only one competitive status as firms in parity are. The highest concentration occurs in the advantage status (34% of firms).

Those results suggest that competitive momentum can be used as a predictor of competitive advantage status, helping explaining is current competitive status sustainability over time.

Since parity represents the status where firms found the equilibrium with industry, evaluates firms migration from this status to other ones contributes on the investigation of the dynamism of competitive advantage or disadvantage manifestation over time.

Performing the same analysis discussed before, now considering only firms set in parity status, a different scenario is found. Although only 2% of those firms present competitive momentum towards advantage, 49% of them achieve the advantage competitive status in a future time frame. Same percentage is observed in firms experiencing competitive momentum towards disadvantage. Thus, although rare, in cases when firms experience different competitive moment than its industry it is more likely to leave parity and to migrate to other competitive statuses over time. Table 14 brings the detailed transition analysis for firms in parity status.

Table 14. Competitive momentum as a predictor of competitive status - Parity status

Competitive momentum (current time frame)	Cases (%)	Competitive status (next time frame)			
		Parity	Advantage	Disadvantage	Undetermined
Same as industry	96%	**70%**	16%	10%	3%
Towards advantage	2%	28%	**49%**	12%	12%
Towards disadvantage	2%	33%	12%	**49%**	6%
Total	-	68%	17%	11%	4%

Moving forward on the exploration of the level of information aggregated by introducing the competitive momentum dimensions into the analysis, it is proposed to observe real cases competitive momentum over time. A snapshot of competitive status and competitive momentum of firms within 2001/2005 time frame is presented in Table 15. Observing some selected firms it is possible to judge their migration from 2001/2005 to 2007/2011 time frame. In some cases, as for example, DELL INC trajectory, the firm leaves the competitive advantage status, after presenting a competitive momentum in pace with industry. At the same time, APPLE INC keeps its advantage status after experiencing a competitive momentum towards advantage.

Again, there are empirical evidences that competitive advantage assessment can be leveraged by competitive momentum analysis, and therefore, it is a potential predictor of firms' future competitive status.

Results presented in this section are not exhaustive. They enhance the competitive advantage analysis by adding the competitive momentum dimension to its analysis, and open the possibility of using them to predict future competitive position of firms over time. Later on, the predictive power using a multinomial logistic regression is explored.

Table 15. Examples of firms

Sic code	Company name	Competitive status (2001/2005)	Competitive momentum (2001/2005)	Competitive status (2007/2011)
2330	GUESS INC	Disadvantage	Towards Advantage	Advantage
2670	3M CO	Advantage	In pace with industry	Advantage
2834	INTEGRATED BIOPHARMA INC	Parity	Towards Disadvantage	Disadvantage
2834	QUESTCOR PHARMACEUTICALS INC	Parity	Towards Advantage	Advantage
2834	UNITED THERAPEUTICS CORP	Advantage	Towards Advantage	Advantage
2836	LIFE TECHNOLOGIES CORP	Advantage	In pace with industry	Advantage
2836	ANIKA THERAPEUTICS INC	Advantage	Towards Advantage	Advantage
2844	AVON PRODUCTS	Advantage	In pace with industry	Parity
3571	DELL INC	Advantage	In pace with industry	Parity
3571	APPLE INC	Advantage	Towards Advantage	Advantage
3572	SEAGATE TECHNOLOGY PLC	Parity	Towards Advantage	Advantage
3674	ADVANCED MICRO DEVICES	Parity	In pace with industry	Parity
3721	BOEING CO	Parity	In pace with industry	Parity
3841	ROCHESTER MEDICAL CORP	Parity	Towards Advantage	Advantage
4512	DELTA AIR LINES INC	Parity	In pace with industry	Advantage
4512	SOUTHWEST AIRLINES	Parity	In pace with industry	Parity
4512	UNITED AIRLINES INC	Disadvantage	In pace with industry	Parity
4911	ENTERGY CORP	Parity	In pace with industry	Parity
4923	SOUTHERN NATURAL GAS CO	Parity	In pace with industry	Parity
5311	PENNEY (JC) CO	Disadvantage	In pace with industry	Parity
5331	WAL-MART STORES INC	Parity	In pace with industry	Parity
5812	STARBUCKS CORP	Advantage	In pace with industry	Parity
5912	WALGREEN CO	Advantage	In pace with industry	Parity
7370	INTL BUSINESS MACHINES CORP	Advantage	Towards Disadvantage	Advantage
7372	CONCUR TECHNOLOGIES INC	Parity	Towards Advantage	Advantage
7372	MICROSTRATEGY INC	Advantage	In pace with industry	Advantage
7373	TELECOMMUNICATION SYS INC	Disadvantage	Towards Advantage	Advantage

4.6.2. Introducing consistency dimension into competitive advantage analysis

Consistency frequency distribution by economic value dimension is reported in Table **16**. In average, 31% of firms present consistency (RMSE) higher than median in profitability and growth dimensions simultaneously, while only 16% present low consistency in only one dimension at once. Considering all five time frames, in average,

close to 37% of cases present low consistency in both dimensions simultaneously, as a result of high volatility in their economic value over time.

Table 16. Consistency analysis by economic value dimension

Profitability	**Growth**		**Total**
	Low	**High**	
Low	37%	16%	53%
High	16%	31%	47%
Total	53%	47%	100%

Results combining consistency categories and competitive status information show that parity and advantage competitive statuses are composed by firms with different consistency patterns. Slightly higher than average, close to one third of firms are classified in each one of consistency categories, suggesting that while some firms are creating values consistently in both dimensions, other ones are experiencing a transition phase.

Moreover, less consistent firms are more concentrated in disadvantage (55.3%), and in undetermined (47.7%) competitive statuses. These results show that value creation evolution over time is less predictable in those competitive status, or, according to Thomas & D'Aveni (2009), those statuses might concentrate firms facing transition in its competitive status.

Table 17. Consistency frequency distribution by competitive status

Consistency	**Competitive status**				**Average**
	Parity	**Advantage**	**Disadvantage**	**Undetermined**	
Low consistency in both dimensions	30.1%	33.1%	55.3%	47.7%	37.2%
High consistency in one dimension	34.6%	31.9%	28.8%	24.8%	31.6%
High consistency in both dimensions	35.3%	34.9%	15.9%	27.5%	31.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

The investigation of whether competitive momentum associated to consistency dimension contributes to the understanding competitive advantage topography is presented next. Results reported on Table 18 are the percentages of average values

calculated covering the five time frames, and values within parenthesis are the percentages within each competitive momentum.

Focusing first on firms classified in Parity status, it is found that they are almost equally distributed across consistency categories, while they experience a competitive momentum in pace with industry (close to 96% of total firms). Although having a competitive momentum different from industry is a rare event, firms that not follow this pattern present a different profile in terms of their value creation consistency. Firms experiencing a momentum towards advantage tend to present low consistency (48.4%), or consistency in only one dimension (33.6%). Firms experiencing a competitive momentum towards disadvantage are concentrated in low consistency category (50.6%) reinforcing the argument that migration towards advantage or disadvantage are associated to higher volatility in value creation.

Another group of interest is composed by firms that have achieved the double advantage are competitive status. They are able to outperform industry in growth and profitability simultaneously, which is such a rare event. A quite different scenario from parity firms is found when consistency and competitive momentum are evaluated to this set of firms. Although most of firms still present momentum in pace with industry (80% of total firms), a higher concentration of firms whose competitive momentum indicates that firms are moving towards competitive disadvantage (12%) is found. As observed in Parity scenario, one third of firms present high consistency in both dimensions of economic value, while another third present consistency in only one dimension. Greater uncertainty or low consistency is observed in those firms whose competitive momentum diverge from industry.

Full results are reported in Table 19. Percentages represent the average values considering the five time frames, and values within parenthesis are the percentages within each competitive momentum.

Table 18. Consistency frequency distribution by competitive momentum – Parity status

Consistency	Competitive momentum			Average
	In pace with industry	Towards advantage	Towards disadvantage	
Low consistency in both dimensions	27.9% (29.2%)	0.7% (48.4%)	1.4% (50.6%)	29.9% (15.7%)
High consistency in one dimension	33.4% (34.8%)	0.6% (33.6%)	0.9% (28.1%)	34.8% (42.3%)
High consistency in both dimensions	34.5% (36.1%)	0.3% (17.9%)	0.4% (21.2%)	35.2% (42.1%)
Total	95.8% (100%)	1.5% (100%)	2.7% (100%)	100% (100%)

Table 19. Consistency frequency distribution by competitive momentum – Double advantage status

Consistency	Competitive momentum			Average
	In pace with industry	Towards advantage	Towards disadvantage	
Low consistency in both dimensions	26.8% (33.8%)	3.6% 38.0%)	5.6% (46.1%)	36.0% (35.8%)
High consistency in one dimension	27.7% (33.9%)	3.5% (47.3%)	3.7% (30.0%)	34.9% (33.9%)
High consistency in both dimensions	25.3% (32.3%)	1.4% (14.7%)	2.5% (23.9%)	29.2% (30.0%)
Total	80% (100%)	9% (100%)	12% (100%)	100% (100%)

4.6.3. Multinomial model to predict competitive statuses

Since previous results showed that competitive momentum and consistency has good attributes to predict future competitive status, a multinomial model using those factors were run. Using competitive momentum and consistency dimensions as

predictors, a multinomial model is estimated, having as dependent variable the competitive status.

The sample used considers only active companies within 2001/2005 time frame, which remained active in following frame, 2007/2011. Competitive momentum and consistency were measured in the first time frame while competitive status was observed in the subsequent period.

A multinomial legit model is chosen to estimate the probability of a firm to achieve one particular competitive status based on consistency and momentum characteristics because there are four possible outcomes to the model. This is a natural extension of binomial logistic models, for cases where more than two outcomes are available (Agresti, 2007; Ntzoufras, 2009).

The model assumes that $\boldsymbol{Y}_i$ the *i-th* competitive status of a firm. Assuming that aggregated competitive status are the distinct levels of the dependent variable, $\boldsymbol{Y_i}$ can be a vector written as $Y_i = (Y_{i1}, Y_{i2}, Y_{i3}, Y_{14})$. Where Y_{ik} denotes the frequency distribution of the *k-th* level.

To model the probability of a given firm to achieve one of the four competitive status, Y_i is defined as following a multinomial distribution with four different categories: parity, advantage, disadvantage and undetermined. Parity was set as reference category of the model.

The proposed model can be written as:

$$Y_{ij} \sim Multinomial\ (\pi_{ij.}, n_{ij})$$

$$\pi_{ijk} = \frac{n_{ijk}}{\sum_{k=1}^{4} n_{ijk}}, \text{ and } n_{ik} = e^{\alpha_k + \beta_{ik} + \gamma_{jk}}.$$

Where $n_{ij} = \sum_{k=1}^{4} X_{ijk}$. The parameters $\alpha_1, \beta_{j1}, \beta_{1k}, \gamma_{j1}, and\ \gamma_{1k}$ are set as zero for identifiability. This model is discussed in more details in Ntzoufras (2009, pg. 298). All initial parameters are initially given idependent non-informative prioris. Estimates were done by MCMC simulation, considering 10.000 runs with thining rate equal to 10. More details are available in the Appendix H section of this document. Table 27 brings model parameter estimates.

According to model probability estimates, firms experiencing a competitive momentum in pace with industry, with homogeneous performance over time, have 65%

of probability in achieving parity, and 21% of being in advantage in the next time frame. Migration to undetermined status, is less probable especially if firms are experiencing a competitive momentum in pace with industry, only 3%.

Firms experiencing a competitive momentum towards advantage have 39% of probability in achieving an advantage status, if they also present high consistency in value economic creation over time.

Applying this model in the development sample, found that in 60% of cases model predicted the competitive status correctly. This is not a bad rate however, other explanatory variables as the competitive status in the time of observation, or the size or industry of firms could also be incorporated into the model in order to improve model performance.

Table 20. Model probability estimates.

Competitive momentum	**Consistency**	**Competitive status (dependent variable)**			
		Parity	**Advantage**	**Disadvantage**	**Undetermined**
In pace with industry	**Low consistency**	**60%**	16%	16%	7%
	High consistency in one dimension	**68%**	17%	11%	4%
	High consistency in both dimensions	**65%**	21%	10%	3%
Towards Advantage	**Low consistency**	28%	28%	**32%**	13%
	High consistency in one dimension	**35%**	33%	24%	8%
	High consistency in both dimensions	32%	**39%**	22%	7%
Towards Disadvantage	**Low consistency**	**36%**	22%	24%	18%
	High consistency in one dimension	**45%**	25%	18%	11%
	High consistency in both dimensions	**42%**	31%	17%	10%

Reproducing the same model only considering firms in parity status within 2001/2005 time frame, there is high persistency in parity. Due to model convergence requirements, longer MCMC runs were necessary[14]. Those results are available in the Appendix I of this document. Based on the probability estimates reported in the Table 21, the migration to parity persists in all scenarios. However, it is higher when firms face competitive momentum in pace with industry (over 75%).

[14] MCMC chain was generated using 40.000 runs with thinning rate equal to 40.

To firms experiencing competitive momentum towards advantage, the second most likely path is to migrate to advantage stages in next time frame. It is seen that the higher the consistency, the higher the probability of the migration occurs (25% for low consistency and 30% to high consistency firms). To firms in experiencing competitive momentum towards advantage, also the parity persistency predominates. To those firms the second most likely status is migrating to disadvantage competitive status.

When results presented at the Table 21 are compared to the initial estimates of migration rates found in the second paper (see Table 6), it is noticed that the inclusion of competitive momentum and consistency dimensions improve the capacity of discrimination between firms future perspective of their competitive statuses. For instance, the persistence in parity reported in Table 6 is close to 68%. When the competitive dimension and consistency are introduced into the analysis, probabilities of firms vary from 40% to 79%. The lower probability in persisting in parity is found in those cases where competitive momentum indicates that firms is experiencing a momentum towards disadvantage, with low consistency (higher volatility) in value creation. Higher probability is found in those firms following the same competitive momentum as industry, with value creation very consistent in at least one of the value dimensions.

Observing the parity to advantage migration rate originally found, it is seen that there are close to 15% of migration between those statuses. After introducing competitive momentum and consistency, higher probabilities of migration are concentrated in competitive momentum towards advantage are found. The probability of migration to advantage statuses is twice the value (c. 30%) in those firms with homogeneous performance.

Table 21. Model probability estimates – Parity population.

Competitive momentum	Consistency	Competitive status (dependent variable)			
		Parity	Advantage	Disadvantage	Undetermined
In pace with industry	Low consistency	75%	9%	13%	3%
	High consistency in one dimension	79%	10%	9%	2%
	High consistency in both dimensions	79%	10%	9%	2%
Towards Advantage	Low consistency	44%	25%	22%	9%
	High consistency in one dimension	48%	29%	17%	5%
	High consistency in both dimensions	48%	30%	16%	6%
Towards Disadvantage	Low consistency	40%	17%	33%	10%
	High consistency in one dimension	46%	20%	27%	7%
	High consistency in both dimensions	46%	21%	25%	8%
Migration rates (reported at Table 6)		68.0%	15.0%	13.2%	3.8%

Based on results discussed in this section, competitive momentum and consistency emerges as important dimensions to be incorporated in competitive advantage analysis. Together with the current competitive status, the two new proposed dimensions enhance the predictive power of future competitive position of firms, introducing a new perspective on competitive advantage analysis.

4.7. Conclusions

In this work new dimensions were proposed seeking for enhancing the competitive advantage analysis and enabling to capture how value created evolves, and how consistent it is over time. By capturing the longitudinal effect, strategic management researchers can leverage their knowledge about the dynamics of value creation, make comparison within and across industries, and expands the understanding of the adaptation process that a firm faces over the time (Short et al., 2006).

The evaluation of the average performance (captured by competitive statuses) combined to the assessment of the time evolution perspective (introduced by competitive momentum), add a new perspective to the competitive advantage analysis. The introduction of this new dimension gives the opportunity to differentiate firms within the same competitive statuses based on their longitudinal performance. Results indicate that most of firms experience same competitive momentum than their industries; however there is a group of firms experiencing a divergent momentum than their industry when competitive status is aggregated into analysis. And for that reason, the introduction of competitive momentum dimension to refine competitive advantage definition is justifiable.

Firms classified in parity status, whose competitive momentum is same experienced by their industry, tend to keep in parity (over 70% of cases). When the competitive momentum indicates that firms are experience a competitive momentum towards advantage, there are a higher chance of a migration to advantage in a future time frame (49% of cases). The same happens when competitive momentum suggests firms are moving towards disadvantage. Divergent performance evolution is more frequently found in competitive statuses associated to disadvantage situations.

Findings in this paper are aligned to Thomas & D'Aveni (Thomas & D'Aveni, 2009) argument, which states that during transient moments firms can be more susceptible to present higher volatility in their performance.

There is evidence that competitive momentum and consistency are good predictors of competitive status. When those dimensions are included into the analysis, firms' future perspective and increase the predictive power of their future competitive status can be differentiated. They contribute to the characterization of the dynamism of competitive statuses and its sustainability over time.

This work is not exhaustive. One of its limitations is the fact the competitive momentum is only evaluated considering the profitability dimensions. Further research can be done in order to test different growth drivers, or growth expressions, that allow capturing how growth of firms evolves over time. As future studies it is recommend exploring other drivers together with competitive momentum and consistency as predictors of competitive statuses.

5. Conclusions – integrating the three papers

This work revisits the definition of competitive advantage, proposing new dimensions, quantifying its existence and dynamism, and its relationship with the financial performance overtime. It contributes theoretically, empirically and methodologically to the debate about competitive advantage.

Theoretically, this work refines and operationalizes the definitions of competitive advantage and disadvantage, evaluating competitive advantage topography using two dimensions simultaneously. A new methodological perspective is added to the analysis by Bayesian inference in which firms' performance is individually compared to their rivals within industry. Results corroborate the multi-dimensional perspective of competitive advantage discussed earlier by Boyed et al (2005) and Richard et al (2009). Results also support Powell (2001) and Coff (1999, 2010) arguments related to the weakness on the competitive advantage characterization based only on profitability returns.

The introduction of new dimensions to characterize competitive advantage is another theoretical contribution. Those dimensions encompass time effect and consistency of firms' performance, allowing to capture the way value creation evolves over time, and contribute to the debate on how time can help to explain competitive advantage manifestation (Short et al., 2006). Using competitive momentum and consistency as predictors, firms' migration pattern between competitive statuses increases predictive power, and adding extra elements to the dynamism competitive advantage.

While previous studies find different results on the effect of industry over firms performance, and debated if industry really matters to performance heterogeneity (McGahan & Porter, 1997; Rumelt, 1991; Vasconcelos & Brito, 2004), my results show that industry affects performance in different ways. Industry context determines whether competitive advantage can exist or not. Following these findings, different theoretical perspectives are valid and necessary to understand performance heterogeneity. In industries where competitive advantage is less frequently observed, Porter's five forces (Porter, 1980) analysis makes more sense and is relevant. On the other extreme there are

industries where firms are more likely to achieve competitive advantage over rivals. In those industries the Resource Based Theory lens (Barney, 1991) will be more useful to the analysis. The conclusion is that, both approaches are necessary and complementary. New research should strive to jointly explore the interplay between these approaches and others (Makadok, 2011), and results can help to contextualize this effort.

One additional contribution of my work is the estimation of individual effects to each one of the firms, and the comparison of them to their respective industry. Differently from what was proposed by Brito & Brito (2012), the model presented here estimates the relative position of firms within their industry, without comparing all firms using a single parameter. Also the detailed firms' frequency distribution across competitive status by different industries can be derived from the proposed model.

Managerially, this work helps on the definition of practitioners' priority in strategy definition. Depending on the industry where the firm is located, internal or external firms' environments should be evaluated at the moment of strategy definition. As discussed early in this chapter, strategists must focus on internal firms' capabilities (Teece et al., 1997; Winter, 2003) and internal resources (Barney, 1991; Wernerfelt, 2011) to define and sustain their strategies when they are dealing with industries where competitive advantage is more frequently observed. Priority should be given to issues like proprietary technology, patents, external trends that can be exploited in an idiosyncratic way.

Strategist should support their decisions on scenarios analysis as proposed by Porter, giving higher priority to issues that can affect industry structure like regulation, broad technology changes, macroeconomic and country trends always when they are dealing with industries where competitive advantage is not commonly observed, and most of firms are concentrated in parity status. In these industries, monitoring competition to maintain parity is probably a more realistic competitive approach.

The third aspect that this work has contributed is the methodological one. The proposed model covered the gaps from previous studies, in regards to the conjoint estimation of firms and industry effects, not being limited to the use of only one metric to assess competitive advantage of firms (Brian K. Boyd et al., 2005; Brito & Brito, 2012; Richard et al., 2009). This works innovates methodologically, proposing a bivariate Bayesian hierarchical model to infer competitive status of firms. Based on the comparison of posteriori probability distributions for firms and industries, the

probabilities of firms outperforming their industry are quantified. This approach challenges and contrasts McGahan & Porter (1997) and Brito & Brito (2012) works, that considered only one fixed variance component to all firms, strongly associated to the variance components decomposition approach.

It is important to mention that this work is not exhaustive in discussing competitive advantage analysis. The existent limitations open a new horizon on strategic management research in regards to the assessment of competitive advantage of firms. In special, future studies can focus on the determinants of competitive advantage, trying to explore firms or industry specificities that might enhance competitive advantage analysis. Also, further research can deal with different drivers to measure profitability and growth dimensions, and allowing capturing how growth of firms evolves over time. Other opportunities are seen in the exploration of other drivers to predict future competitive status together with competitive momentum and consistency.

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Appendices

Appendix A – Hyperprioris configuration and industry model

Table 22 Hyperprioris configuration

Parameters	Hyper priory
Average parameters (industry)	Normal (0, 10000)
Precision (inverse of variance)	Uniform [0,100]
Covariance	Wishart (I) , I = diagonal matrix

Model codes are presented below.

```
model {
        for (j in 1:J){
        Sbeta0[j] <- SCOVL2[j,1]     Sbeta1[j] <- SCOVL2[j,2]
        SCOVL2[j, 1:2]~dmnorm(Smu.hat3[j,], Stau.COVL2[,])
                Smu.hat3[j,1] <- mu0          Smu.hat3[j,2] <- mu1
        Sbetaw0[j] <- SCOVLW2[j,1]        Sbetaw1[j] <- SCOVLW2[j,2]
        SCOVLW2[j, 1:2]~dmnorm(SmuW.hat3[j,], Stau.COVL2W[,])
                SmuW.hat3[j,1] <- mu0       SmuW.hat3[j,2] <- mu1       }
for (i in 1 : N) { VCT[i,1:2]~dmnorm(Smu.dim[i,1:2],Stau.dim[1:2,1:2])
                Smu.dim[i,1] <- Sbeta0[ind[i]] + Sbeta1[ind[i]]*time[i]
                Smu.dim[i,2] <- Sbetaw0[ind[i]] + Sbetaw1[ind[i]]*time[i]  }
# Prioris defintion#
mu0 ~dnorm (0, .0001)        muw0 ~dnorm (0, .0001)
mu1 ~dnorm (0, .0001)        muw1 ~dnorm (0, .0001)
Stau.dim[1:2,1:2] <- inverse(Sigma.dim[,])
Sigma.dim[1,1] <- pow(sigma0.a, 2)          sigma0.a ~ dunif (0, 100)
Sigma.dim[2,2] <- pow(sigma0.b, 2)          sigma0.b ~ dunif (0, 100)
```

```
Sigma.dim[1,2] <- rho0*sigma0.a*sigma0.b          Sigma.dim[2,1] <- Sigma.dim[1,2]
rho0 ~ dunif (-1, 1)
Stau.COVL2[1:2,1:2] <- inverse(Sigma.COVL2[,])
Sigma.COVL2[1,1] <- pow(sigma.a, 2)       sigma.a ~ dunif (0, 100)
Sigma.COVL2[2,2] <- pow(sigma.b, 2)       sigma.b ~ dunif (0, 100)
Sigma.COVL2[1,2] <- rho*sigma.a*sigma.b
Sigma.COVL2[2,1] <- Sigma.COVL2[1,2]          rho ~ dunif (-1, 1)
Stau.COVL2W[1:2,1:2] <- inverse(Sigma.COVL2w[,])
Sigma.COVL2w[1,1] <- pow(sigmaw.a, 2)          sigmaw.a ~ dunif (0, 100)
Sigma.COVL2w[2,2] <- pow(sigmaw.b, 2)          sigmaw.b ~ dunif (0, 100)
Sigma.COVL2w[1,2] <- rhow*sigmaw.a*sigmaw.b
Sigma.COVL2w[2,1] <- Sigma.COVL2w[1,2]       rhow ~ dunif (-1, 1)
} # closed the model
```

Appendix B – Level plots for joint probability advantage distribution

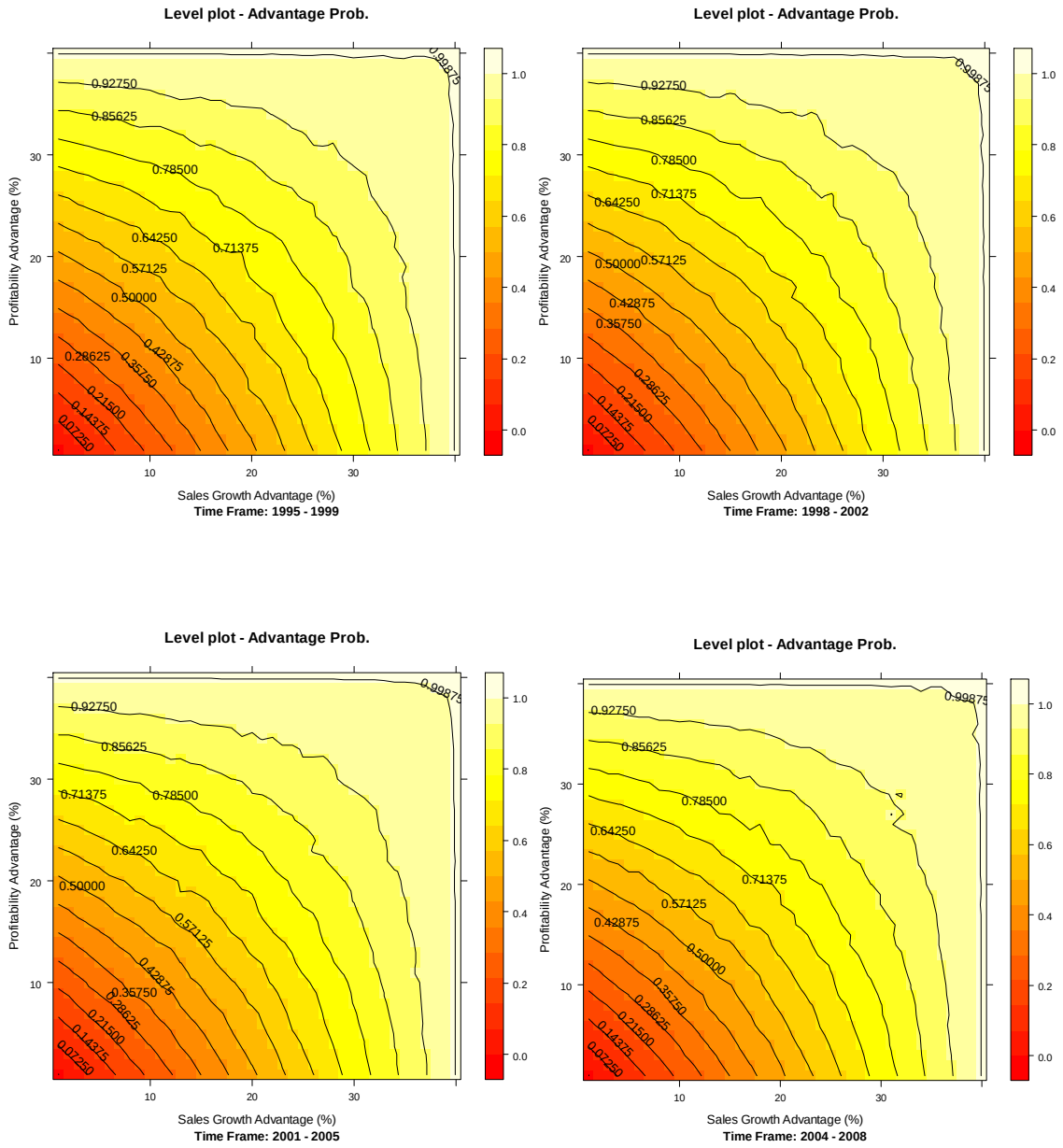

Figure 23. Level plots for the remaining time frames.

Appendix C –Scatter plots for competitive statuses by time frame

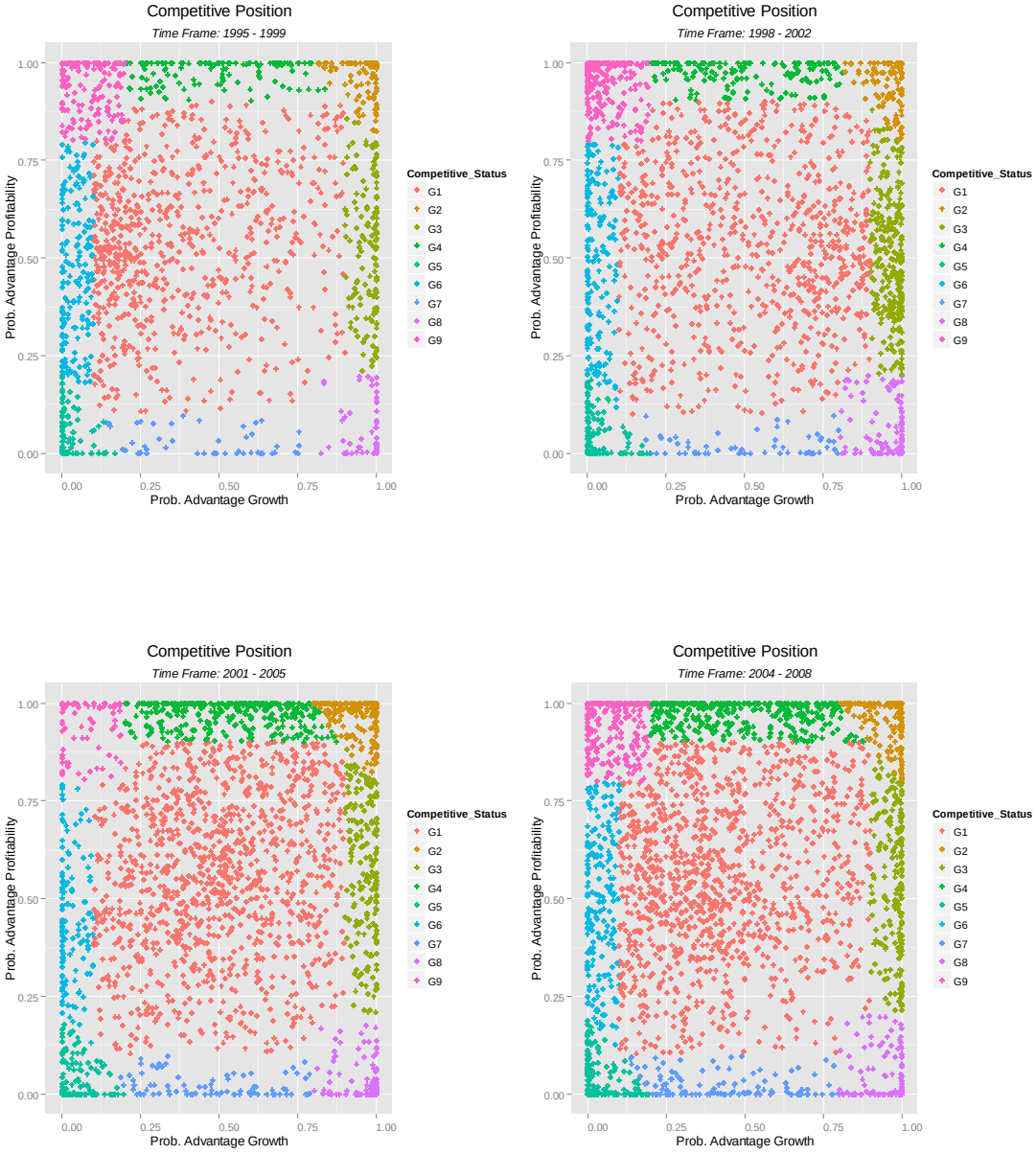

Figure 24. Scatter plot for competitive statuses by time frames.

Appendix D – Competitive status distribution by industry

Table 23. Competitive status distribution by industry code.

Industry		Total number of firms	Parity	Total Advantage	Total Disadvantage	Undetermined	
SIC code	Description					Advantage in Growth	Advantage in Profitability
0100	Agriculture Production-Crops	11	27%	45%	0%	9%	18%
1000	Metal Mining	18	22%	44%	0%	28%	6%
1040	Gold and Silver Ores	24	17%	58%	13%	13%	0%
1220	Bituminous Coal, Lignite Mng	11	45%	36%	9%	9%	0%
1311	Crude Petroleum and Natural Gs	136	37%	29%	24%	5%	5%
1381	Drilling Oil and Gas Wells	17	76%	12%	12%	0%	0%
1389	Oil and Gas Field Services,Nec	12	67%	17%	17%	0%	0%
1531	Operative Builders	16	6%	0%	81%	0%	13%
2086	Btld and Can Soft Drinks, Water	11	36%	27%	36%	0%	0%
2300	Apparel and Other Finished Pds	20	65%	25%	10%	0%	0%
2621	Paper Mills	13	85%	15%	0%	0%	0%
2670	Convrt Papr,Paprbrd,Ex Boxes	11	82%	9%	9%	0%	0%
2810	Indl Inorganic Chemicals	18	78%	11%	6%	6%	0%
2821	Plastics,Resins,Elastomers	12	0%	75%	0%	25%	0%
2834	Pharmaceutical Preparations	108	5%	52%	18%	16%	10%
2835	In Vitro,In Vivo Diagnostics	20	5%	45%	25%	15%	10%
2836	Biological Pds, Ex Diagnstics	90	9%	43%	21%	14%	12%
2860	Industrial Organic Chemicals	19	47%	32%	21%	0%	0%
2870	Agricultural Chemicals	12	33%	33%	17%	8%	8%
2911	Petroleum Refining	17	82%	18%	0%	0%	0%
3089	Plastics Products, Nec	13	92%	0%	8%	0%	0%
3312	Steel Works and Blast Furnaces	14	71%	14%	7%	7%	0%
3420	Cutlery, Handtools,Gen Hrdwr	10	90%	10%	0%	0%	0%
3490	Misc Fabricated Metal Prods	11	64%	27%	0%	0%	9%
3533	Oil and Gas Field Machy, Equip	11	91%	0%	9%	0%	0%
3559	Special Industry Machy, Nec	22	64%	18%	18%	0%	0%
3572	Computer Storage Devices	13	38%	23%	23%	15%	0%
3576	Computer Communications Equip	25	36%	40%	16%	8%	0%
3577	Computer Peripheral Eq, Nec	18	11%	56%	22%	6%	6%
3620	Electrical Indl Apparatus	12	8%	50%	17%	17%	8%
3640	Electric Lighting, Wiring Eq	11	27%	27%	27%	0%	18%
3661	Tele and Telegraph Apparatus	22	45%	18%	32%	0%	5%
3663	Radio, TV Broadcast, Comm Eq	39	56%	18%	23%	3%	0%
3669	Communications Equip, Nec	13	15%	31%	23%	0%	31%
3672	Printed Circuit Boards	14	79%	14%	7%	0%	0%
3674	Semiconductor,Related Device	102	39%	36%	19%	6%	0%
3679	Electronic Components, Nec	21	24%	33%	24%	0%	19%

Industry		Total number of firms	Parity	Total Advantage	Total Disadvantage	Undetermined	
SIC code	Description					Advantage in Growth	Advantage in Profitability
3690	Misc Elec Machy,Eq,Supplies	25	12%	48%	12%	16%	12%
3711	Motor Vehicles and Car Bodies	14	57%	21%	0%	7%	14%
3714	Motor Vehicle Part,Accessory	32	56%	28%	13%	3%	0%
3728	Aircraft Parts, Aux Eq, Nec	11	82%	18%	0%	0%	0%
3812	Srch,Det,Nav,Guid,Aero Sys	12	42%	17%	8%	17%	17%
3823	Industrial Measurement Instr	14	71%	14%	14%	0%	0%
3825	Elec Meas and Test Instruments	19	63%	11%	26%	0%	0%
3826	Lab Analytical Instruments	16	6%	69%	6%	13%	6%
3827	Optical Instruments and Lenses	10	50%	20%	20%	0%	10%
3829	Meas and Controlling Dev, Nec	16	69%	6%	19%	0%	6%
3841	Surgical,Med Instr,Apparatus	34	18%	41%	9%	21%	12%
3842	Ortho,Prosth,Surg Appl,Suply	21	71%	14%	5%	10%	0%
3845	Electromedical Apparatus	45	11%	44%	20%	13%	11%
3990	Misc Manufacturng Industries	16	56%	25%	13%	6%	0%
4011	Railroads,Line-Haul Operatng	10	100%	0%	0%	0%	0%
4213	Trucking, Except Local	18	78%	11%	11%	0%	0%
4400	Water Transportation	17	76%	6%	6%	6%	6%
4412	Deep Sea Frn Trans-Freight	29	66%	21%	14%	0%	0%
4512	Air Transport, Scheduled	14	79%	21%	0%	0%	0%
4812	Radiotelephone Communication	18	50%	39%	0%	6%	6%
4813	Phone Comm Ex Radiotelephone	24	67%	25%	8%	0%	0%
4832	Radio Broadcasting Stations	10	80%	0%	10%	10%	0%
4833	Television Broadcast Station	20	55%	15%	25%	0%	5%
4841	Cable and Other Pay TV Svcs	18	67%	17%	11%	6%	0%
4899	Communications Services, Nec	28	39%	29%	14%	11%	7%
4911	Electric Services	104	94%	1%	5%	0%	0%
4922	Natural Gas Transmission	20	80%	20%	0%	0%	0%
4923	Natural Gas Transmis and Distr	19	74%	11%	16%	0%	0%
4924	Natural Gas Distribution	23	96%	0%	4%	0%	0%
4931	Electric and Other Serv Comb	55	96%	2%	2%	0%	0%
4941	Water Supply	12	92%	0%	0%	8%	0%
4955	Hazardous Waste Management	11	55%	27%	9%	0%	9%
4991	Cogeneratn-SM Power Producer	10	60%	0%	30%	10%	0%
5045	Computers and Software-Whsl	15	80%	0%	20%	0%	0%
5051	Metals Service Centers-Whsl	11	91%	0%	9%	0%	0%
5065	Electronic Parts,Eq-Whsl,Nec	10	50%	0%	40%	0%	10%
5331	Variety Stores	11	82%	18%	0%	0%	0%
5411	Grocery Stores	13	85%	15%	0%	0%	0%
5500	Auto Dealers, Gas Stations	17	82%	6%	6%	6%	0%
5621	Women's Clothing Stores	13	46%	15%	38%	0%	0%
5651	Family Clothing Stores	15	67%	20%	13%	0%	0%
5812	Eating Places	47	66%	17%	17%	0%	0%

Industry		Total number of firms	Parity	Total Advantage	Total Disadvantage	Undetermined	
SIC code	Description					Advantage in Growth	Advantage in Profitability
5940	Misc Shopping Goods Stores	10	80%	10%	10%	0%	0%
5961	Catalog, Mail-Order Houses	18	50%	17%	22%	6%	6%
5990	Retail Stores, Nec	11	91%	9%	0%	0%	0%
7011	Hotels and Motels	10	80%	0%	20%	0%	0%
7200	Personal Services	10	90%	10%	0%	0%	0%
7310	Advertising	11	45%	36%	18%	0%	0%
7359	Equip Rental and Leasing, Nec	14	93%	7%	0%	0%	0%
7363	Help Supply Services	12	83%	0%	8%	0%	8%
7370	Cmp Programming, Data Process	76	42%	28%	16%	9%	5%
7372	Prepackaged Software	116	52%	23%	21%	3%	1%
7373	Cmp Integrated Sys Design	50	34%	38%	16%	8%	4%
7374	Cmp Processing, Data Prep Svc	19	74%	16%	5%	5%	0%
7389	Business Services, Nec	26	62%	15%	19%	0%	4%
7990	Misc Amusement and Rec Service	27	78%	7%	7%	4%	4%
8062	Gen Med and Surgical Hospitals	11	100%	0%	0%	0%	0%
8071	Medical Laboratories	10	20%	50%	10%	20%	0%
8200	Educational Services	21	24%	43%	19%	14%	0%
8711	Engineering Services	16	81%	6%	6%	6%	0%
8731	Coml Physical, Biologcl Resh	15	7%	33%	27%	7%	27%
8742	Management Consulting Svcs	14	36%	36%	29%	0%	0%

Appendix E – Histograms of firms frequency distributions for parity and disadvantage statuses

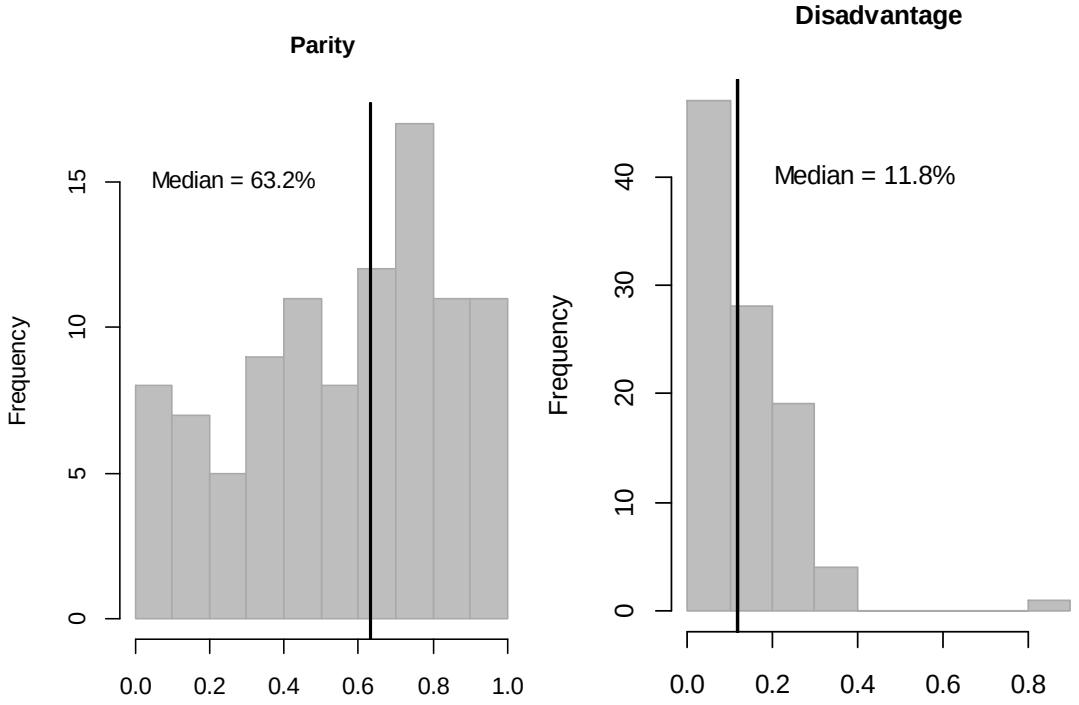

Figure 25. Histograms for industries frequencies distribution for Parity and Disadvantage statuses

Appendix F – Migration matrices for high and low concentration in advantage statuses industries

Table 24. Migration matrix for high concentration in advantage industries

Current time frame		Next time frame								
			Advantage			Disadvantage			Undetermined	
Competitive status	Cases (%)	Parity	Double	Single growth	Single profitability	Double	Single growth	Single profitability	Advantage growth	Advantage profitability
Parity	28%	50.4%	5.6%	7.0%	13.5%	6.3%	7.1%	3.3%	1.6%	5.1%
Double advantage	9%	26.0%	12.6%	3.7%	33.6%	2.7%	4.9%	0.7%	0.8%	15.1%
Single advantage in growth	7%	40.6%	12.1%	6.4%	14.1%	6.8%	8.9%	2.4%	2.9%	5.8%
Single advantage in profitability	15%	21.5%	15.7%	1.7%	45.5%	1.6%	2.2%	0.0%	0.2%	11.6%
Double disadvantage	9%	19.2%	8.7%	4.6%	3.2%	19.7%	4.3%	16.6%	19.5%	4.2%
Single disadvantage in growth	6%	43.0%	6.2%	7.7%	10.5%	10.2%	6.7%	5.6%	5.1%	5.2%
Single disadvantage in profitability	5%	27.1%	4.5%	7.2%	8.3%	23.4%	4.3%	14.3%	5.8%	5.1%
Undetermined with advantage in growth	9%	22.7%	10.6%	7.8%	6.5%	19.2%	7.5%	10.9%	11.5%	3.5%
Undetermined with advantage in profitability	11%	27.9%	10.1%	5.6%	33.7%	2.0%	5.6%	1.6%	0.7%	12.9%

Table 25. Migration matrix for low concentration in Advantage industries

Current time frame		Next time frame								
		Parity	Advantage			Disadvantage			Undetermined	
Competitive Status	Cases (%)		Double	Single growth	Single profitability	Double	Single growth	Single profitability	Advantage growth	Advantage profitability
Parity	61%	76.7%	1.4%	4.8%	3.6%	2.3%	7.2%	1.4%	0.6%	2.0%
Double advantage	10%	45.2%	5.8%	5.8%	19.5%	8.7%	3.3%	3.3%	2.5%	5.8%
Single advantage in growth	5%	61.1%	1.2%	11.5%	3.6%	2.6%	16.0%	1.0%	0.5%	2.4%
Single advantage in profitability	3%	54.8%	5.0%	2.5%	19.7%	3.3%	5.1%	3.0%	0.0%	6.7%
Double disadvantage	4%	57.3%	0.0%	8.0%	4.6%	8.3%	5.9%	7.1%	6.2%	2.6%
Single disadvantage in growth	8%	71.8%	1.7%	4.2%	3.7%	3.5%	7.5%	3.1%	2.1%	2.5%
Single disadvantage in profitability	2%	43.1%	0.0%	9.3%	0.0%	34.3%	0.0%	7.9%	5.6%	0.0%
Undetermined with advantage in growth	3%	31.5%	8.5%	15.1%	1.7%	9.4%	8.4%	10.7%	14.8%	0.0%
Undetermined with advantage in profitability	3%	56.0%	1.9%	2.3%	19.0%	3.7%	11.1%	0.9%	0.0%	5.1%

Appendix G – Paper submitted to Academy of Management Annual Meeting

This following paper was submitted to the Academy of Management Annual Meeting in 2014, and it is under review.

COMPETITIVE ADVANTAGE AND FINANCIAL PERFORMANCE: A BAYESIAN MODEL

LUIZ L A BRITO
KARINA PRETTO
Fundação Getúlio Vargas

COMPETITIVE ADVANTAGE AND FINANCIAL PERFORMANCE: A BAYESIAN MODEL

INTRODUCTION

Although the ultimate objective of strategic management research is to explain superior performance, considerable debate still exists about how to define and measure performance and how to differentiate superior performance from competitive advantage.

The first main issue is the dimensionality and measurement of performance. Miller, Washburn, and Glick (2013) identify an inconsistency in management research about how scholars treat their most common dependent variable—performance. Although most studies conceptualize performance as a latent, higher-level, unique construct, their methods treat performance as a domain of separate, possibly unrelated, constructs. Another complicating factor is the large diversity and lack of consensus in the choice of indicators. Richard et al. (2009) find 207 different measures of performance used in 213 studies. Other authors identify similar and related problems (Combs, Crook, & Shook, 2005; March & Sutton, 1997; Steigenberger, 2013).

The second main issue is the definition of competitive advantage and its connection to performance. The term has been used loosely without a precise definition (Sigalas & Economou, 2013). Some scholars refer to it in the plural form, assuming the existence of several competitive advantages that may co-exist with competitive disadvantages (Powell, 2001). Many empirical studies refer conceptually to competitive advantage but treat it as simply equivalent to superior financial performance (Newbert, 2008). If competitive advantage only means superior performance, why do we need two concepts? The lack of a more precise competitive advantage definition has led to a debate about its existence, rareness, and logical falsifiability (Arend, 2003; Durand, 2002; Foss & Knudsen, 2003; Powell, 2001).

However, there seems to be an emerging consensus in the field toward defining competitive advantage in terms of superior economic value creation (Peteraf & Barney, 2003). Economic value is defined as the wedge between customers' willingness to pay and suppliers' opportunity cost (Brandenburger & Stuart, Jr., 1996). This approach separates value creation from value appropriation, and it becomes possible to conceive a situation in which a firm has competitive advantage and does not enjoy superior performance (Coff, 1999, 2010).

In this paper, we elaborate on this conceptualization of competitive advantage and its effect on financial performance and test the presence of competitive advantage. Our model proposes that profitability and growth measures are both necessary to ascertain the presence of competitive advantage. Our results also provide the topography of competitive advantage, quantifying its rareness and sustainability. Furthermore, our results add to the industry-firm debate, indicating that the presence of competitive advantage is dependent on industry type and conditions. Nelson's (1991) idea that "firms differ" is highly context dependent. In certain industries, there are virtually no firms in a competitive advantage (or disadvantage) condition because firms do not differ much, and industry effects determine performance. The most relevant theoretical lenses are models such as Porter's five forces (Porter, 1980). In other industries, competitive advantage (and disadvantage) is highly ubiquitous, with many firms exhibiting competitive advantage or competitive disadvantage. In these industries, firms differ substantially, and the resource-based theory is most relevant.

The next section discusses the concept of competitive advantage and its evolution through time and proposes our refinements to the concept in an attempt to reach precision. We then develop a conceptual model that links the existence of competitive advantage and disadvantage to financial performance. The following two sections describe our Bayesian model and discuss its results, providing insights about the topography of competitive advantage and its sustainability. A concluding section summarizes the paper's contributions and avenues for future research.

WHAT IS COMPETITIVE ADVANTAGE?

The term "competitive advantage" gained popularity in the 1980s, fueled by Porter's influential book (Porter, 1985). Despite its popularity and ubiquity, competitive advantage is not precisely defined (Rumelt, 2003). Many researchers treat competitive advantage simply as superior performance, using the terms interchangeably and failing to differentiate the two concepts (Newbert, 2008; Rumelt, 2003). The growing influence of the resource-based theory in the 1990s led to a focus on the causes of competitive advantage and its sustainability (Kraaijenbrink, Spender, & Groen, 2010). Barney's (1991, p. 102) definition describes a situation in which a firm has competitive advantage: "a firm is said to have a *competitive advantage* when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors". The resource-based argument and the concept of competitive advantage created a lively debate about the validity and logical soundness of the concept (Arend, 2003; Barney, 2001a; Durand, 2002; Foss & Knudsen, 2003; Powell, 2001; Priem & Butler, 2001).

In a response to Foss and Knudsen (2003), Peteraf and Barney (2003) agree about the need for more definitional clarity and offer a new definition of competitive advantage: "an enterprise has a *Competitive Advantage* if it is able to create more economic value than the marginal (break-even) competitor in its product market". They more precisely define the notion of the economic value created as "the difference between the perceived benefits gained by purchasers and the economic cost for the enterprise" (Peteraf & Barney, 2003, p. 314). This new definition has several advantages. First, it clearly differentiates competitive advantage from superior performance. Competitive advantage refers to the creation of more value, whereas performance is affected by value capture and industry effects. Second, this definition is integrative because the value created results from the combination of all firm resources. Either a firm has a competitive advantage or it does not. The previous definition allows for the understanding of several competitive advantages, as discussed by Powell (2001), and the co-existence of competitive advantages and competitive disadvantages. In this new definition, competitive advantage is a

status resulting from a comparison of created value against the marginal, break-even competitor. Third, this definition partially integrates the concept of economic value from economics (Brandenburger & Stuart, Jr., 1996) that was gaining acceptance in the strategic management literature at the time, sometimes referred to as the value-price-cost (VPC) framework (Besanko, Dranove, Shanley, & Schaefer, 2004; Bowman & Ambrosini, 2000; Hoopes, Madsen, & Walker, 2003).

Despite these advancements, the new definition proposed by Peteraf and Barney (2003) has aspects that warrant further improvement. The first aspect is the inclusion of suppliers in the value creation model. When a firm operates, it creates value for itself and for stakeholders beyond its boundaries (Lepak, Smith, & Taylor, 2007). Suppliers sell their products and services to the focal firm because they judge this option to be advantageous to them compared to other alternatives. The difference between the cost to the focal firm and the suppliers' second-best option (suppliers' opportunity cost) is a value portion created by the focal firm and captured by the suppliers. This value portion, symmetrical to the customers' end, is included in the original idea of economic value proposed by Brandenburger and Stuart (1996) and omitted in the formulation of Peteraf and Barney (2003). However, this value portion can be quite relevant. Castellucci and Ertug (2010) discuss the relationship between engine suppliers and Formula 1 teams, noting that these suppliers benefit from teams' reputations to such a degree that they supply engines below cost. Including the suppliers' end also covers the idea proposed by Coff (1999, 2010) that a firm with competitive advantage may not have superior performance due to value appropriation by employees. The second aspect is the basis of comparison of the value created to claim that the firm has an advantage. Peteraf and Barney (2003) propose the marginal break-even competitor as the reference point. This reference does not do justice to the term "competitive" and confounds industry and firm effects. In an attractive industry, most competitors can be above the break-even point, and many firms will have a competitive advantage due to the nature of the industry rather than differences in value creation against their rivals. The opposite situation can occur in less attractive industries. We propose using the mean of the value created by rivals as the reference point, which captures the essence of the

term “competitive” as proposed by Arend (2003). A firm is in a competitive advantage situation if it creates more value than its rivals do, in competitive parity if it creates a similar amount of value, and in competitive disadvantage if it creates less value. The industry mean can be a proxy of this reference point, even with the limitations in the industry definition. The third point is the time frame and the qualification of the term “sustained”. If competitive advantage is a status, then it is intrinsically linked to a time reference that must be expressed simultaneously, as we refer to the concept. We propose that there is no need for the different concept of sustained competitive advantage; the competitive advantage status is always sustained for some time. There can be long-term and short-term competitive advantages statuses, and we simply need to express the time length when we refer to the concept. The choice of time span may be arbitrary, but choosing a length of time equivalent to the tenure of executives may be most meaningful in practice. Powell (2003) suggests periods of three to five years.

We propose that a firm has a competitive advantage when it creates more economic value than its rivals for a defined length of time. Economic value is defined by the difference between customers’ willingness to pay and the opportunity cost of suppliers. The value created by a firm can be divided into three main portions. The difference between customers’ average willingness to pay and the average price is a value portion left to the customers as an incentive for them to transact with the firm. This value portion is similar to the use value of Bowman and Ambrosini (2000). The difference between price and cost is a value portion directly appropriated by the firm, similar to the exchange value of Bowman and Ambrosini (2000). Finally, the portion between the price and the supplier’s opportunity cost is a value portion created by the focal firm but left to its suppliers. These three value portions can affect different aspects of firm’s financial performance through different mechanisms.

FINANCIAL PERFORMANCE AND COMPETITIVE ADVANTAGE

The partitioning of financial performance variability into industry and firm effects, proposed by Schmalensee (1985) and Rumelt (1991), initiated an influential stream of research. A series of studies

followed, discussing the relative magnitude of industry and firm effects (Hawawini, Subramanian, & Verdin, 2003; Hough, 2006; Karniouchina, Carson, Short, & Ketchen, 2013; McGahan & Porter, 1997; Roquebert, Phillips, & Westfall, 1996) and including other classes of effects, such as corporate (E. H. Bowman & Helfat, 2001; Brush & Bromiley, 1997) and country (Brito & Vasconcelos, 2006; Makino, Isobe, & Chan, 2004; McGahan & Victer, 2010). Within this line of research, performance is conceived as a sum of different classes of effects (e.g., firm, industry, corporate, country). Each of these effects is a random variable, and total performance variance is the sum of the variances of these random variables. It has been established that firm effects account for the largest portion of performance variance and that the variability of industry effects is smaller. However, McGahan and Porter (1997) show that industry effects vary substantially by economic sector. In economic sectors such as wholesale and trade or transportation, industry effects are more relevant than firm effects.

Competitive advantage, as defined previously, relates to superior value creation relative to that of rivals, so it is the main explanation for the variability associated with firm effects. However, if competitive advantage is value creation, not value appropriation, how does it logically connect to financial performance?

In the previous section, we note that the value created by a firm can be divided into three distinct portions. The difference between customers' average willingness to pay and the average price is the customers' share; the difference between the average price and economic cost is the firm's share; and the difference between the cost and the suppliers' average opportunity cost is the suppliers' share. It is clear that the firm's share maps directly into measures of profitability. If a firm has a larger firm share than its rivals, it should also have superior firm effects in profitability. We argue, however, that the other value portions (customers' and suppliers' shares) can also affect financial performance through different mechanisms and manifest in other dimensions of financial performance. If a firm creates a larger customer share than its rivals, it will be a preferred option and tend to grow at faster rates than its rivals. As a result, the firm may have superior firm effects in growth. The effect can be moderated by the firm's

capability to economically increase capacity, but the effect does exist, especially if the time frame used to define competitive advantage is long enough. The effect of the suppliers' share in financial performance is likely less direct and clear, but there is evidence in other disciplines that it also exists. The Relational View of strategy has established that relationships with suppliers can be a source of benefits for a company (Dyer & Singh, 1998; Lavie, 2006). The Operations Management literature has extensively established that firms can benefit from closer relationships with suppliers (Frohlich & Westbrook, 2001; Schoenherr & Swink, 2012). Closer relationships require benefits for both parties so that collaboration and joint activities continue in a type of virtuous cycle (Autry & Golicic, 2010). The benefits of this closer interaction with suppliers can appear in different outcomes, contributing to improving a firm's offerings in the market (increasing the willingness to pay of its customers) or achieving cost reductions. Dyer (1996, 1997) has extensively documented how Japanese car manufacturers benefit from the relationship with their suppliers, achieving superior quality and reliability at lower cost. The suppliers' share of value may be necessary to achieve and sustain the total amount of value created by the firm.

If a firm has superior profitability, a superior growth rate relative to its rivals, or both, we have an indication that it creates more value than its rivals and has a competitive advantage status. If a firm has inferior profitability, an inferior growth rate relative to its rivals, or both, we have an indication that it creates less value than its rivals and has a competitive disadvantage status. If a firm has equivalent profitability and growth rate relative to its rivals, it most likely creates an equivalent amount of value and is in competitive parity. Finally, if a firm has superior performance in one dimension and inferior performance in another one relative to its rivals, we cannot make a judgment about the value created, so the status must be classified as undetermined.

METHOD

The model applied to estimate the competitive status is a bi-dimensional hierarchical model with random coefficients. As dependent variables, the model considers simultaneously the manifestation of economic

value created by firms in two dimensions: growth rate and profitability, whose effects are individually estimated for all firms.

Beyond the structural model definition, the method adopted to estimate model parameters and characterize competitive advantage must be robust and flexible enough to make inferences using its outcomes. Bayesian inference emerges as the best alternative because one of its direct advantages is allowing researchers to introduce their previous beliefs in model estimation (Kruschke, Aguinis, & Joo, 2012; Zyphur & Oswald, 2013). Within the Bayesian approach, an inference is richer than within a classical approach, allowing one to make probability statements about outcomes rather than simply a point or interval inference (Hahn & Doh, 2006; Perry, Hansen, Reese, & Pesci, 2005).

We adopted the Monte Carlo Markov Chain (MCMC) method to generate the posteriori distribution of the model's parameters based on stochastic simulation.

The Proposed Bayesian Model

The lowest level of the proposed model is described by the joint distribution of the two dependent variables. The prior probability distribution follows a bivariate normal (BN) distribution with average μ_j and covariance structure represented by Σ, as given by expression (1):

$$\boldsymbol{Y_{jt}} = \left(Y_{1jt}, Y_{2jt}\right) \sim BN\left(\boldsymbol{\mu_j}, \Sigma\right), \qquad (1)$$

where $\mathbf{Y_{jt}}$ is the dependent vector containing the observed outcomes at time $\boldsymbol{t}$ for firm $\boldsymbol{j}$. It is composed of (a) $\boldsymbol{Y_{1t}}$, representing the profitability dimension, and (b) $\mathbf{Y_{2t}}$, representing the dimension related to the growth of firms. Profitability is quantified based on operational return on assets (OPROA), calculated by dividing firm net profits by total assets. Other metrics can be used, but one direct benefit of using OPROA is that its numerator is directly impacted by operational costs; thus, it captures any weaknesses in the supply chain. The growth of the firm, introduced in the second dimension of the proposed model, is

calculated based on the average growth rate of net sales within each time frame. The firm's average growth rate ($\boldsymbol{g_j}$) is derived from an exponential model as a function of the firm's total net sales (see expression (2)):

$$NetSales_{jt} = NetSales_{j0}(1 + \boldsymbol{g_j})^t. \quad (2)$$

When a logarithm transformation is applied to expression (2), the growth rate is expressed as a time-dependent linear function in terms of the logarithm value of the net sales. Therefore, as described in equation (3), the dependent variable adopted for the second dimension of the proposed model is the natural logarithm of net sales.

$$LogNetSales_{jt} = LogNetSales_{jt-1} + t \times \left(1 + \boldsymbol{g_j}\right). \quad (3)$$

The metrics chosen in this model reflect our prior conception about measuring the value created by a firm; however, other metrics for profitability or growth might be used. The average effect of $\boldsymbol{Y_{jt}}$ for a specific firm $\boldsymbol{j}$ within a specific period of time **t**, is given by $\boldsymbol{\mu_j}$, a (2x1) matrix. As the dependent vector, $\boldsymbol{\mu_j}$ also follows a **BN** probability distribution (see equation (4)), whose components follow a univariate normal distribution with average $\boldsymbol{\mu_{1j}}$ (profitability) and $\boldsymbol{\mu_{2j}}$(growth), as described by expressions (5) and (6):

$$\boldsymbol{\mu_j} \sim BN\left(\begin{bmatrix}\mu_{j1}\\ \mu_{j2}\end{bmatrix}, \Sigma_\mu\right) \quad (4)$$

$$\boldsymbol{\mu_{1j}} = \pi_{10j} + \pi_{11j} \times time_t \quad (5)$$

$$\boldsymbol{\mu_{2j}} = \pi_{20j} + \pi_{21j} \times time_t, \quad (6)$$

where $\boldsymbol{\pi_{10j}}$ and $\boldsymbol{\pi_{11j}}$ represent, respectively, a firm's average and time effect over the profitability dimension, observed for firm $\boldsymbol{j}$. In particular, $\boldsymbol{\pi_{10j}}$ measures the firm's average effect over the profitability dimension. The firm's profitability time trend is captured by the $\boldsymbol{\pi_{11j}}$ effect. The effect responsible for

capturing the average growth rate of the firm ($\boldsymbol{g_j}$)**,** described in expression (3), is rewritten from the $\boldsymbol{\pi_{21j}}$ parameter, as shown in expression (6):

$$\boldsymbol{\pi_{21j}} = log(1 + \boldsymbol{g_j}). \quad (6)$$

Therefore, comparing the average performance across firms requires the simultaneous comparison of average effects for profitability ($\boldsymbol{\pi_{10j}}$) and the average growth rate ($\boldsymbol{g_j}$) parameters for each firm individually. All model components ($\pi_{10j,}\pi_{20j}, \pi_{11j}\ and\ \pi_{21j}$) are defined as random components, adding more flexibility to capture firms' individual performance.

The role of the covariance matrix, Σ_μ, is to measure the covariation, or the correlation, between model random coefficients. It also accommodates the intrinsic trade-off between value creation components and excludes any bias in model estimation (Snijders & Bosker, 1999, p. 67). For instance, observing Dimension 1, as described in expression (5), the relationship between random components (intercept and slope) is modeled as follows:

$$\begin{pmatrix}\pi_{10j}\\ \pi_{11j}\end{pmatrix} \sim BN\left(\begin{bmatrix}\mu_{\pi_{10j}}\\ \mu_{\pi_{10j}}\end{bmatrix}, \begin{bmatrix}\sigma^2_{\pi_{10j}} & \rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}}\\ \rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}} & \sigma^2_{\pi_{11j}}\end{bmatrix}\right), \text{ for } \boldsymbol{j}\text{=1..., J,} \quad (7)$$

where $\sigma^2_{\pi_{10j}}$, $\sigma^2_{\pi_{11j}}$ represent, respectively, the variance components for intercept and slope, and $\rho\sigma_{\pi_{10j}}\sigma_{\pi_{11j}}$ represents the covariance between them. An analogous structure is used for Dimension 2. Following the hierarchical or multilevel model structure, in which each firm is subjected to its industry environment, each outcome can be expressed as realizations of hyper-distributions that encompass the entire industry effect. Thus, an extra hierarchical level is created for each model component, assuming that there is global dependence among all industries. Non-informative hyperprioris are adopted to minimize the influence on the posteriori distribution (Kruschke et al., 2012).

Computation of the posteriori distribution is generated by applying MCMC methods with a Gibbs sampler using Winbugs V1.4 software. Inferences are made based on one stochastic chain with 51,000

runs and a burn-in period of 1,000 cases. A thinning rate of 50 is used to avoid an auto-correlation effect (Paulino, Turkman, & Murteira, 2003). Convergence is evaluated by applying the Geweke Convergence Method (Geweke, 1992), supported by the graphical evaluation of auto-correlation and time series plot.

Data

Data were extracted from the COMPUSTAT database (North America database, excluding firms from financial and governmental industries) and covered the historical period from 1995 to 2011, split into five time frames of five years each. The sample selection criteria considered only firms active during at least four of the five years and whose average turnover (Net Sales) was greater than USD 10 million. Although Bayesian inference performs well in cases with few observations or in cases of extreme observations, in the final sample, we decided to retain only firms whose industries (industry identification based on the 4-digit SIC-code) contained at least 20 observations within each time frame. Additionally, individual analysis was performed to evaluate extreme cases. We were conservative in excluding cases, eliminating only extreme cases that did not represent the phenomenon of interest, such as operating returns higher than 1000% or lower than -200%. The composition of the final sample is displayed in Table 1.

Insert Table 1 about here

Competitive Status Identification in a Bayesian Approach

Taking advantage of posteriori distributions for firms and industry effects, we calculated the probability of a firm outpacing the average performance observed within its industry, as represented for both dimensions in Figure 1.

Insert Figure 1 about here

Due to the bi-dimensionality of the proposed model, the competitive advantage (or disadvantage) of a given firm can be expressed in different ways. Based on the joint probability of competitive advantage manifestation, nine different statuses are identified according to the schema presented in Figure 2.

Insert Figure 2 about here

As described in Table 2, firms with probability higher than 80% of outperforming their industry in both dimensions simultaneously (growth and profitability) are said to be achieving a double advantage status at a given moment in time ($P(OPROA_{firm} > \mu_{OPROA_{indus}}$ and $Growth_{firm} > \mu_{growth_{indus}}) \geq 0.80$). Cases in which firms outperform the industry in one dimension with probability higher than 90% without underperforming in another dimension are classified as single advantage statuses. Single advantage in growth, for instance, is observed when a firm presents higher probability of outperforming its industry in the growth rate dimension ($P(Growth_{firm} > \mu_{growth_{indus}}) \geq 0.90$) without outperforming or underperforming in profitability ($0.2 \leq P(OPROA_{firm} > \mu_{OPROA_{indus}}) < 0.9$). The same rationale is applied to a single advantage in profitability ($P(OPROA_{firm} > \mu_{OPROA_{indus}}) \geq 0.90$ and $0.2 \leq P(Growth_{firm} > \mu_{growth_{indus}}) < 0.9$). Disadvantage status focuses on the opposite direction of performance and is characterized as a higher probability of firms to underperform the industry (the same

probabilities thresholds are used). Indetermination statuses are used when a firm outperforms in one dimension at the same time that it underperforms in another. For instance, the "indetermination with advantage profitability" status occurs when a firm has a higher probability of holding an advantage status in profitability ($P\left(OPROA_{firm} > \mu_{OPROA_{indus}}\right) \geq 0.80$) and, at the same time, has a higher probability of presenting disadvantage in the growth dimension ($P\left(Growth < \mu_{Growth_{indus}}\right) \geq 0.80$).

Insert Table 2 about here

RESULTS AND DISCUSSION

The Topography of Competitive Advantage and Disadvantage

As Wiggins and Ruefli (2002, p. 83) note, conducting research in strategic management without knowing the topography of competitive advantage is akin to an epidemiologist studying the various factors that affect a medical condition without knowing its incidence and prevalence in the population. Is competitive advantage such a rare, local, and extreme event that it hardly deserves the attention it receives (Powell, 2003; Wiggins & Ruefli, 2002)? Or is it a more common occurrence that is useful in explaining differences between rivals?

Using our definition of competitive advantage, our model provides the occurrence of each competitive status covering 1995 to 2011 in five overlapping five-year time frames, as shown in Table 3. We can see that the total percentage of firms in competitive advantage varies between 22% and 29% of all

firms, averaging 25%. This level of occurrence is certainly not rare, local, and extreme: one in every four firms creates more value than the industry average. The double advantage (higher profitability and higher growth rate) accounts for 5% to 8%. The percentages of advantage in profitability (7% to 13%) and growth (6% to 13%) are similar. Studies that consider only the profitability dimension do not capture at least one-third of the situations of a company in an advantage position.

Competitive disadvantage presents a similar pattern, including 14% to 22% of all firms. Firms in competitive parity total 37% to 54%, which is the largest portion—as one would expect, given the nature of competition in which over-performing firms tend to be imitated and lower-performing firms correct their deficiencies. Our model could not assess the competitive status in 8% to 20% of firms that had advantage in one dimension and disadvantage in another. Most of these firms are likely to be conceptually in parity status.

Insert Table 3 about here

Our analysis has substantial methodological differences from Wiggins and Ruefli (2002). They investigated 40 industries, whereas our analysis includes 162 to 216 industries in the most recent time frame. We also simultaneously consider profitability and growth dimensions. Similar to Wiggins and Ruefli (2002), we used five-year frames to define the competitive advantage status, but Wiggins and Ruefli's conclusion of rarity refers to competitive advantage sustained for ten years. We judge the shorter time span to be managerially more meaningful because it is closer to the typical management tenure (Powell, 2003). These differences account for the contradictory conclusion that competitive advantage is not so rare and is a relevant concept for strategic management.

The Dynamics of Competitive Advantage

We examine next the dynamics of competitive statuses. Tables 4 and 5 present the migration matrices from one time frame to the adjacent one. The figures represent the averages from three migration instances (1995/1999 to 2001/2005; 2001/2005 to 2007/2011; and 1998/2002 to 2004/2008). They signify the percentage of firms in the row status that migrates to the column status in the adjacent period. The first column represents the average percentage of firms in each status in the five five-year frames analyzed. Table 4 shows figures aggregated by status, and Table 5 provides a more detailed view.

Insert Table 4 about here

Insert Table 5 about here

Firms in parity tend to remain in parity. On average, 68% of the firms in parity in one time frame stay in this status in the next. Firms in advantage tend to remain in advantage (38.9%) or move to parity (41.6%). This high persistence of competitive advantage is another indication of the relative ubiquity and importance of the sustained competitive advantage concept. The results point in an opposite direction from Wiggins and Ruefli's (2002) findings with a comparable time length. In our sample, close to 10% (25% x 38.9%) of all firms remain in some type of competitive advantage status for two consecutive five-year periods. However, this pattern depends substantially on the dimension of advantage. The advantage in profitability seems to be more persistent than the advantage in growth. On average, 40.1% of firms

originally in single advantage in profitability remain in this status, and 31.2% of firms in double advantage migrate to single advantage in profitability. Growth advantage is more temporary and most likely turns to parity in the following time frame. A similar pattern can be observed in the disadvantage status. In general, disadvantage is less persistent than advantage. Most of the firms in disadvantage (44.6%) migrate to parity in the following time frame, and only 27.9% remain in disadvantage. The disadvantage in profitability is also more persistent than the disadvantage in growth. Growth is more erratic and unpredictable than profitability (Brito & Vasconcelos, 2009; Geroski, Machin, & Walters, 1997), likely because it can occur in spurts rather than continuously (Penrose, 1959, p. 213). The direct migration from advantage to disadvantage and vice versa occurs for a relatively small fraction of firms and is concentrated on the growth dimension due to its volatility.

The undetermined status, in which a firm has an advantage in one dimension and a disadvantage in another, shows an interesting migration pattern. The most common destination in the next time frame is advantage. Temporarily sacrificing performance in one dimension may be a path to advantage. The results suggest that this happens most often by sacrificing growth to achieve superior profitability, subsequently recovering from the disadvantage in growth and moving into advantage. Close to 45% of firms in the undetermined status and an advantage in profitability move to the advantage status in the following time frame (summing all advantage destination columns in Table 5).

Industry and Resources Matter

In contrast to most performance variance decomposition studies, our model generates variable intra-industry variance based on the available observations. Our results show that although, on average, 25% of all firms have competitive advantage status, the incidence varies substantially by industry. In some industries, competitive advantage does not exist or is confined to rare cases, whereas in other industries, it is ubiquitous, a common and relevant occurrence. To explore this aspect, we examined a subsample of the most recent time frame in which we had at least 10 firms per industry. The distribution of the percentage

of firms in competitive advantage is shown in Figure 3, and typical industries that cover the range are shown in Table 6. Industries in the lower range, such as natural gas distribution or electric services, are clearly highly regulated, offer little room for firms to differentiate themselves, or have resource heterogeneity. Industries in the top range, such as pharmaceutical preparations or semiconductors, seem to be related to higher-resource heterogeneity due to patents and technology. Exploring the causes of these differences is beyond the scope of this paper but offers fertile ground for future research.

Insert Figure 3 about here

Insert Table 6 about here

The industry influence on the frequency of competitive advantage also has support in previous research. McGahan and Porter (1997), in the debate with Rumelt (1991) about how much industry matters, find that the share of variance attributable to industry effects varies substantially among different economic sectors. These different economic sectors (e.g., agriculture, manufacturing, transportation) are aggregates of essentially different industries. Wiggins and Ruefli (2002) also find several industries with no firms exhibiting sustained superior performance. Karniouchina et al. (2013) explore one of the possible sources of this industry variability: life cycle. They find that industry accounts for a larger portion of variance in mature industries. Our results are in line with these previous findings and expand the topic

with a more comprehensive definition of competitive advantage and a more realistic model providing greater granularity regarding this industry effect.

This finding has relevant implications for strategy practice, research design, and for the relevance of theories. When managing companies in industries where competitive advantage is rare, managers should give high priority to issues that can affect industry structure, such as regulation, broad technology changes, and macroeconomic and country trends. In these industries, monitoring competition to maintain parity is likely a realistic competitive approach. In industries where competitive advantage is common, managers should focus on achieving and maintaining advantages over rivals. Priority should be given to issues such as proprietary technology, patents, and external trends that can be exploited in an idiosyncratic way. Strategy is highly context dependent. Research designs that use performance or competitive advantage as dependent variables should make sure to fully account for industry effect. The simple use of industry dummy variables does not suffice in most multi-industry studies. Studies that explore single or similar industries can be quite valuable. Finally, the results bring new light to the debate about the utility of industry approaches to theory versus resource-based approaches (Barney, 2001b). Industry approaches such as Porter's five forces (Porter, 1980) are most useful in industries where competitive advantage is rare, whereas the Resource-Based Theory is key in industries where competitive advantage is a frequent occurrence. In general, both approaches are necessary and complementary. New research should strive to jointly explore the interplay among these approaches and others (Makadok, 2011). Our results can help to direct and contextualize this effort.

CONCLUSION

Our study makes two main contributions to the field. From a conceptual perspective, we contribute to further refining and operationalizing the definitions of competitive advantage and disadvantage. We extend the definition proposed by Peteraf and Barney (2003) of superior economic value creation by including the suppliers' share and proposing a reference point that avoids confusion with industry effects.

We also argue that a firm can be classified with the competitive advantage status at a certain moment or for a certain length of time. The time frame is an integral part of the definition. Because it is intrinsically linked to time, there is no need to treat the concept of sustained competitive advantage separately; all competitive advantage statuses are sustained for some length of time. It would be more precise to refer to short- and long-term competitive advantage. As a status, there cannot be multiple competitive advantages; either a firm is or is not in the competitive advantage status. However, there can be multiple sources of economic value, and the result of all sources of economic value created by a firm is what determines whether it is in competitive advantage. Nevertheless, from a conceptual perspective, we elaborate on the relationship between competitive advantage and financial performance. Financial performance is the result of value appropriation, whereas competitive advantage refers to value creation. The value created by a firm can be divided into three main portions: the customers', the firm's, and the suppliers' shares. Each of these portions can affect different dimensions of financial performance through different mechanisms. Whereas the effect of the firm's share in profitability measures is clear, the effect of the other two shares is more complex. Superior growth rates relative to rivals may be the result of larger customers' shares offered to the market. Growth is another dimension of financial performance (Combs et al., 2005) that should not be omitted. The effect of the suppliers' share is likely indirect and mediated by the other two value portions.

From empirical and methodological perspectives, our study offers a Bayesian model grounded in the reality of how to determine the competitive statuses of firms. The results provide a view of the topography of competitive advantage and disadvantage in the U.S. context from 1995 to 2011. Other contexts, such as emerging markets, are a natural extension to be explored in future research. We show that competitive advantage is not rare; 25% of all firms are in competitive advantage for a five-year period. This finding is at odds with conclusions from other studies using different methods and samples (Powell, 2003; Wiggins & Ruefli, 2002). We also analyze the migration patterns among competitive statuses across time, identifying greater persistence of advantage than disadvantage and a stronger

persistence of the profitability dimension compared to the growth dimension. The existence and frequency of competitive advantage and disadvantage are also strongly context dependent. In some industries, it is rare or nonexistent, whereas in others, it is quite common. Industry not only has a direct impact on financial performance through firm effects but also determines the possibility and relevance of firm strengths and competitive advantage.

These contributions have implications for research, theory, and managerial practice. For research, our results highlight the importance of growth as a financial performance dimension. Because most empirical studies in strategic management focus solely on profitability outcomes, they may not capture the full effects of value creation and competitive advantage. For theory, the results emphasize that the relevance of different theories (e.g., industry- and resource-based approaches) to performance is context dependent. This implication supports Makadok's (2011) call for future research that integrates and explores linkages among different theoretical perspectives. For practice, our results indicate that managers should focus on different aspects in different contexts.

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TABLES

Table 1

Descriptive statistics of final sample

Main drivers	Time frame				
	1995/1999	1998/2002	2001/2005	2004/2008	2007/2011
Total assets (USD m)	2,543	3,030	3,712	4,034	4,454
Net sales (USD m)	2,115	2,397	2,863	3,302	3,491
Return on assets[a]	5%	0%	1%	2%	1%
Total number of industries	162	180	194	210	216
Total number of firms	1,690	2,132	2,408	2,751	3,023
Total observations	8,423	10,608	12,001	13,703	15,042

a. Operational Return on Assets (OPROA)

Table 2

Descriptions of competitive statuses

Competitive status	Description
Parity	Firms with performance in growth and profitability similar to the average of the industry.
Double advantage	Higher probability to outperform the industry in growth and profitability simultaneously.
Single advantage in growth	Higher probability to outperform the industry in growth without outperforming in profitability.
Single advantage in profitability	Higher probability to outperform the industry in profitability without outperforming in growth.
Double disadvantage	Higher probability to underperform the industry in growth and profitability simultaneously.
Single disadvantage in growth	Higher probability to underperform the industry in growth without underperforming in profitability.
Single disadvantage in profitability	Higher probability to underperform the industry in profitability without underperforming in growth.
Undetermined with advantage in growth	Higher probability to have advantage in growth and disadvantage in profitability.
Undetermined with advantage in profitability	Higher probability to have advantage in profitability and disadvantage in growth.

Table 3

Competitive status distribution by time frame

Competitive status	Time frame					Average
	1995-1999	1998-2002	2001-2005	2004-2008	2007-2011	
Parity	43%	37%	47%	41%	54%	44%
Double advantage	6%	5%	8%	6%	6%	6%
Single advantage in growth	9%	13%	8%	7%	6%	9%
Single advantage in profitability	7%	8%	13%	13%	11%	10%
Double disadvantage	7%	7%	6%	7%	5%	7%
Single disadvantage in growth	11%	8%	5%	7%	5%	7%
Single disadvantage in profitability	3%	3%	3%	4%	4%	3%
Undetermined with advantage in growth	5%	7%	6%	6%	5%	6%
Undetermined with advantage in profitability	9%	13%	3%	8%	3%	7%
Firms in advantage status	21%	25%	29%	27%	23%	25%
Firms in disadvantage status	22%	18%	15%	19%	14%	18%

Table 4

Migration matrix for aggregating competitive statuses

Current time frame		Next time frame			
Competitive Status	Cases (%)	Parity	Advantage	Disadvantage	Undetermined
Parity	44%	68.0%	15.0%	13.2%	3.8%
Advantage	25%	41.6%	38.9%	11.0%	8.6%
Disadvantage	18%	44.6%	15.9%	27.9%	11.6%
Undetermined	13%	28.9%	36.8%	21.2%	13.1%

Table 5

Detailed migration matrix for competitive statuses

Current time frame		Next time frame								
			Advantage			Disadvantage			Undetermined	
Competitive status	Cases (%)	Parity	Double	Single growth	Single profitability	Double	Single growth	Single profitability	Advantage growth	Advantage profitability
Parity	44%	68.0%	2.6%	5.3%	7.1%	3.7%	7.5%	2.0%	0.8%	3.1%
Double advantage	6%	31.7%	10.5%	4.8%	31.2%	3.8%	4.5%	1.4%	1.2%	10.9%
Single advantage in growth	9%	56.3%	5.4%	8.8%	7.2%	4.2%	11.8%	1.3%	1.3%	3.7%
Single advantage in profitability	10%	29.8%	12.4%	1.8%	40.1%	1.9%	2.6%	0.6%	0.1%	10.6%
Double disadvantage	7%	30.8%	5.4%	6.3%	3.4%	16.2%	5.2%	13.1%	16.0%	3.6%
Single disadvantage in growth	7%	58.3%	3.8%	5.8%	6.4%	6.8%	7.4%	4.3%	3.2%	4.0%
Single disadvantage in profitability	3%	33.2%	3.1%	7.1%	6.4%	23.7%	3.7%	13.3%	5.8%	3.6%
Undetermined with advantage in growth	6%	26.8%	9.1%	10.2%	5.0%	16.1%	7.6%	11.1%	11.7%	2.3%
Undetermined with advantage in profitability	7%	34.1%	7.8%	4.9%	32.1%	2.2%	6.1%	1.4%	0.5%	10.9%

Table 6

Firms' heterogeneity in competitive advantage manifestation

Industry (SIC code)	Description	Number of firms	Firms in advantage status (%)
1531	Operative Builders	16	0%
4924	Natural Gas Distribution	23	0%
4941	Water Supply	12	0%
4911	Electric Services	104	1%
4931	Electric and Other Serv Comb	55	2%
7990	Misc Amusement and Rec Service	27	7%
7389	Business Services, Nec	26	15%
5812	Eating Places	47	17%
3663	Radio, TV Broadcast, Comm Eq	39	18%
7372	Prepackaged Software	116	23%
1311	Crude Petroleum and Natural Gs	136	29%
3674	Semiconductor, Related Device	102	36%
3845	Electromedical Apparatus	45	44%
2834	Pharmaceutical Preparations	108	52%
3577	Computer Peripheral Eq, Nec	18	56%
1040	Gold and Silver Ores	24	58%
3826	Lab Analytical Instruments	16	69%
2821	Plastics, Resins, Elastomers	12	75%

FIGURES

Figure 1

Firms and industry performance comparison

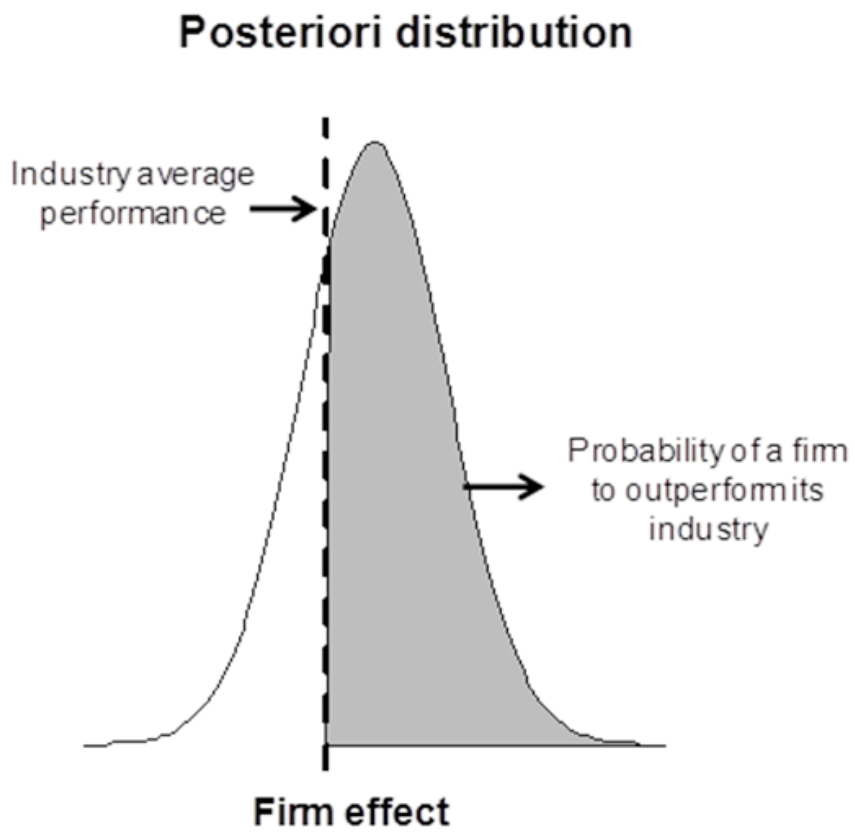


Figure 2

Competitive status identification map

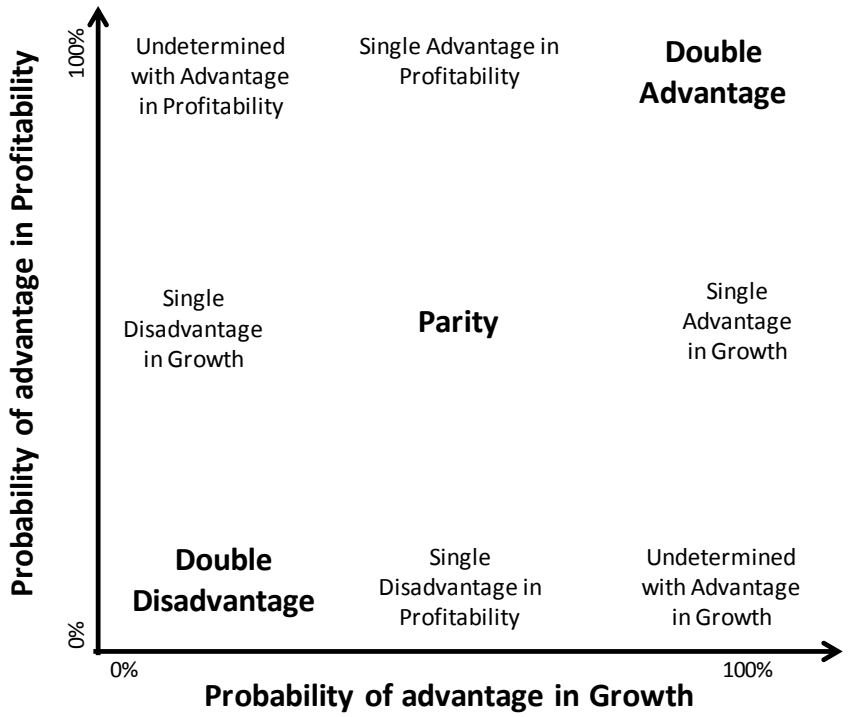
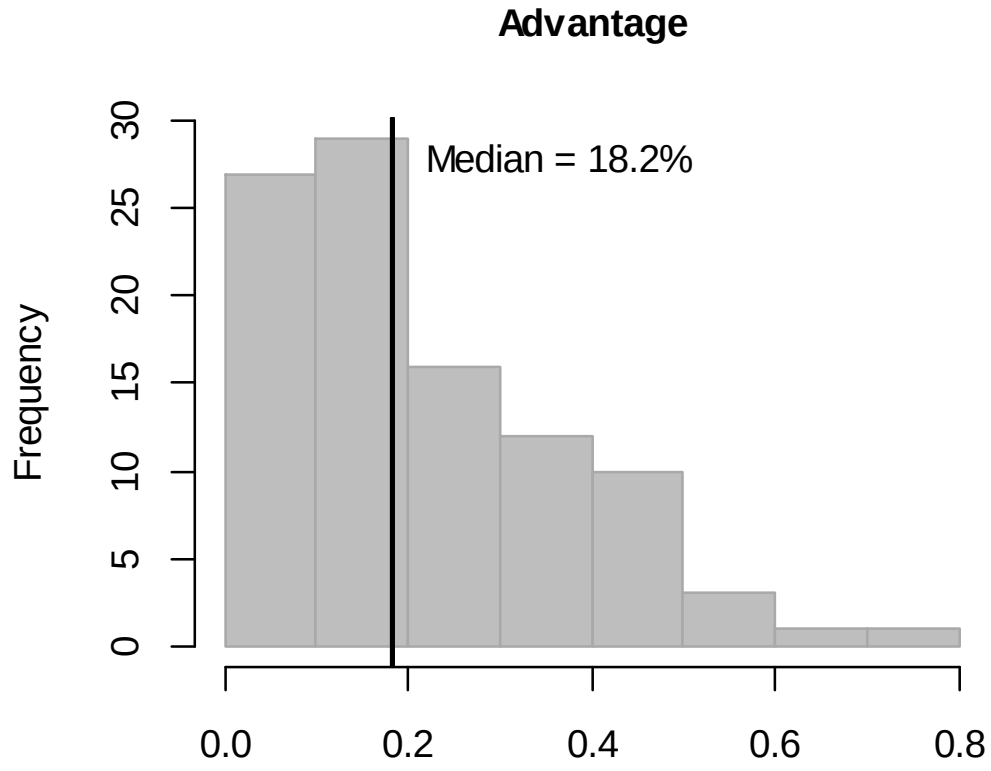


Figure 3

Distribution of the percentage of firms in competitive advantage by industry (4-digit SIC Code)



Appendix H - Winbugs code for multinomial model

Model code is presented below:

```
model  { #Starts model configuration
        #  PRIORS
          alpha[1] <- 0;       # zero contrast for baseline parity
          for (k in 2 : K) { alpha[k] ~ dnorm(0, 0.00001)} # vague priors
          for (k in 1 : K){  beta[1, k] <- 0 }
         for (i in 2 : I) {     beta[i, 1] <- 0 ;  # zero contrast for baseline
               for (k in 2 : K){  beta[i, k] ~ dnorm(0, 0.00001)} # vague priors        }
          for (k in 1 : K){  gamma[1, k] <- 0}
          for (j in 2 : J) {     gamma[j, 1] <- 0 ;
          for ( k in 2 : K){ gamma[j, k] ~ dnorm(0, 0.00001)}  }

         # LIKELIHOOD
          for (i in 1 : I) {
                  for (j in 1 : J) {
                    X[i,j,1:K] ~ dmulti( p[i,j,1:K] , n[i,j]  ) # Multinomial response
                              n[i,j] <- sum(X[i,j,])
                             for (k in 1:K) {  p[i,j,k]        <- phi[i,j,k] / sum(phi[i,j,])
                                                log(phi[i,j,k]) <- alpha[k] + beta[i,k]  + gamma[j,k] }}
                           }
        } #End of model configuration
```

Appendix I – Model fitting metrics

Below we present some graphical information related to model convergence information. First posteriori distributions of model parameters are presented.

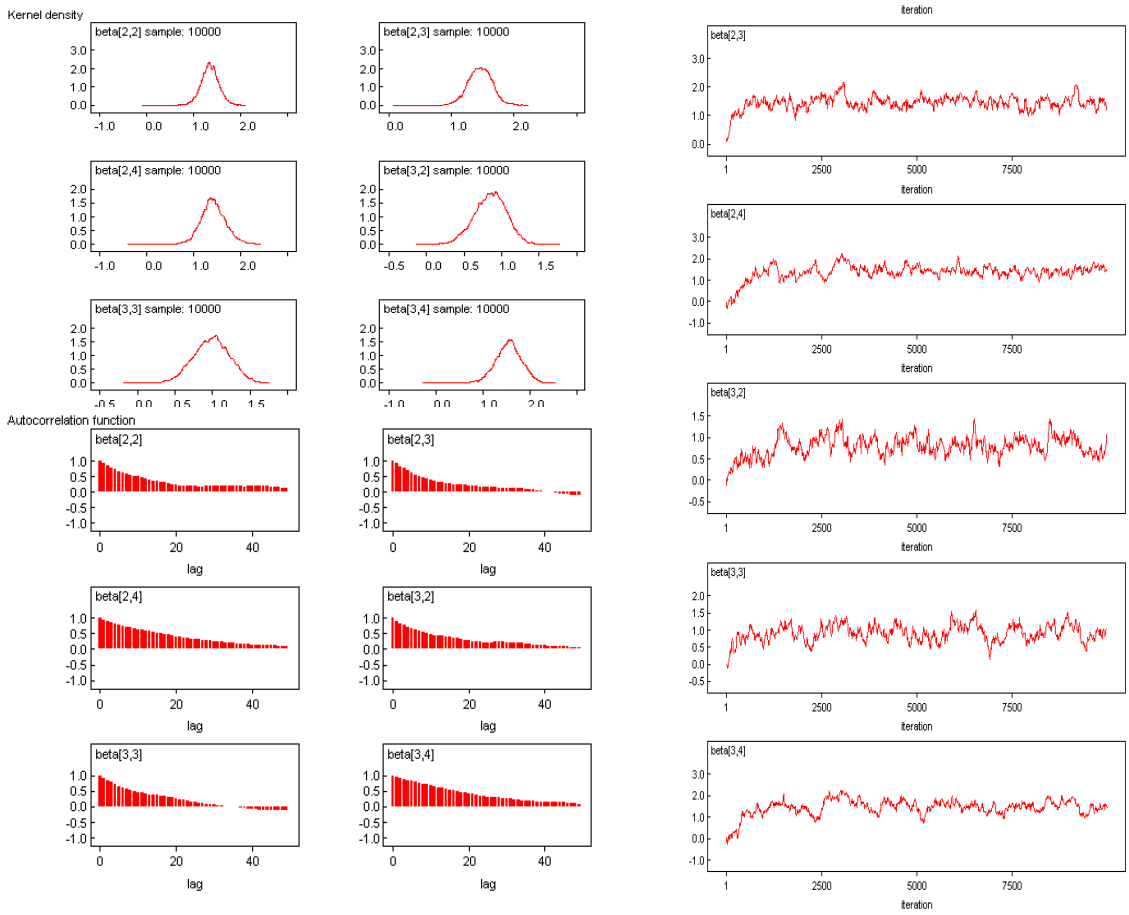


Figure 26. Beta parameter convergence results – All population

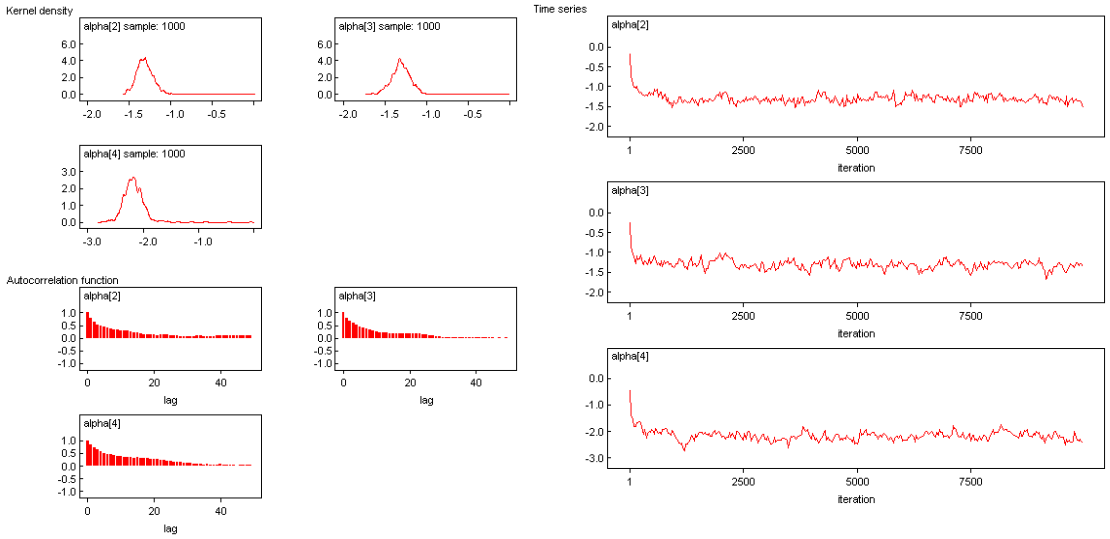


Figure 27 Alpha parameter convergence results – All population

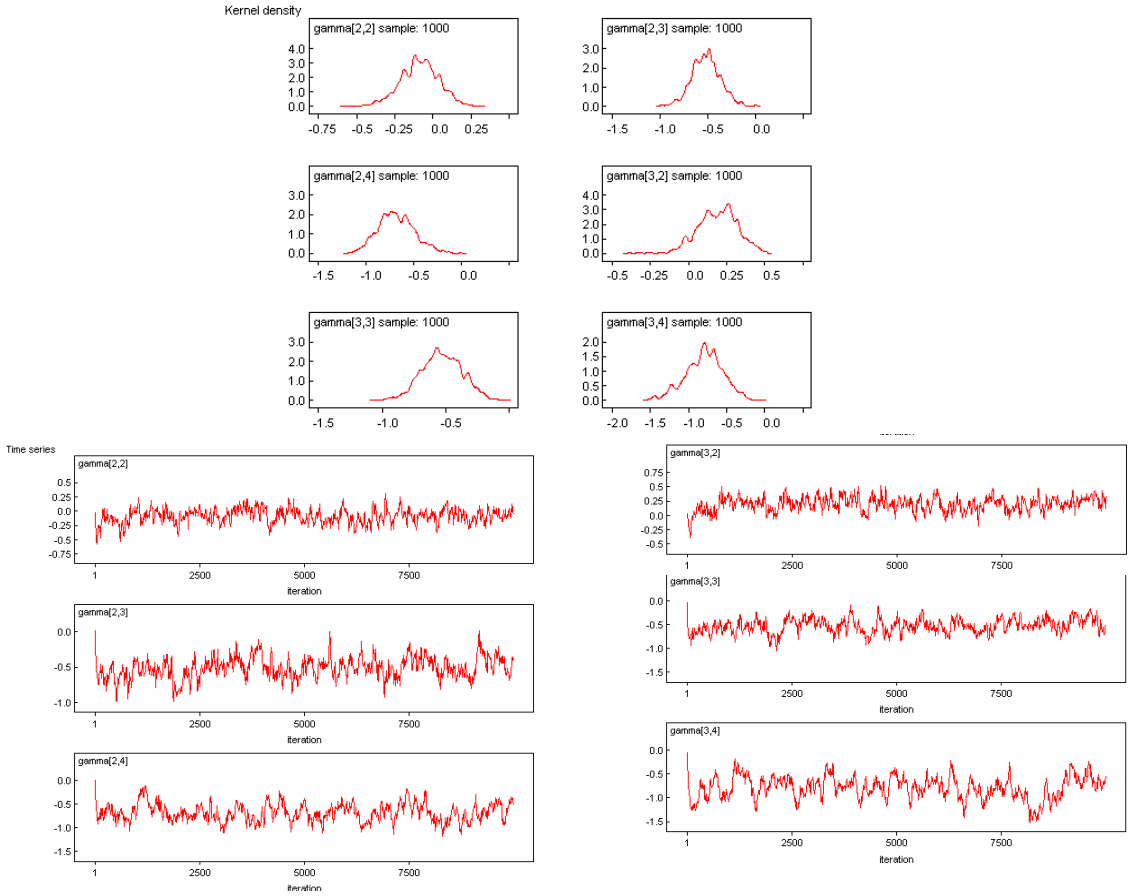


Figure 28 Gamma parameter convergence results – All population

Next table brings the Deviance Information Criteria of the model.

Table 26.Deviance information.

Dbar	Dhat	pD	DIC
157.302	143.214	14.087	171.389

Considering only the population of firms in Parity, graphical information related to model convergence information is presented next. Posteriori distributions of model parameters are:

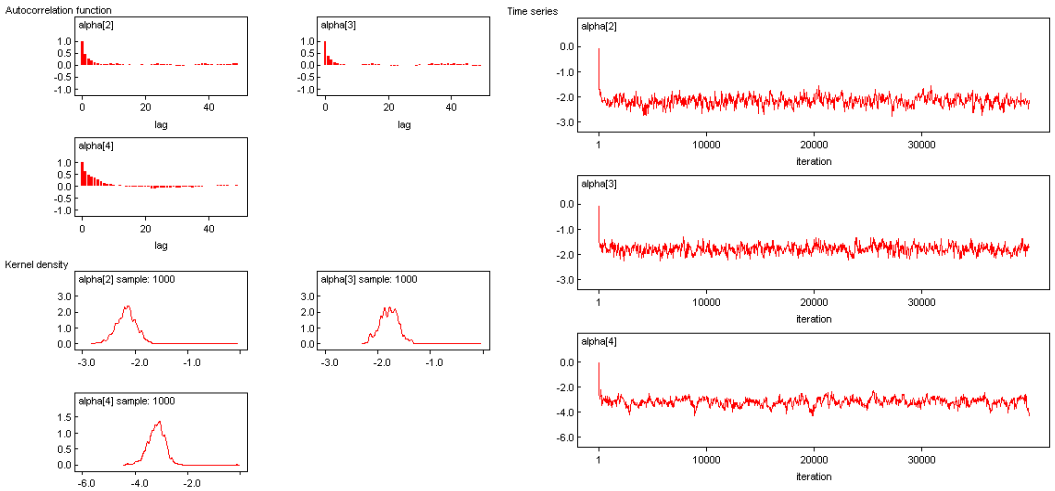


Figure 29 Alpha parameter convergence results – Parity population

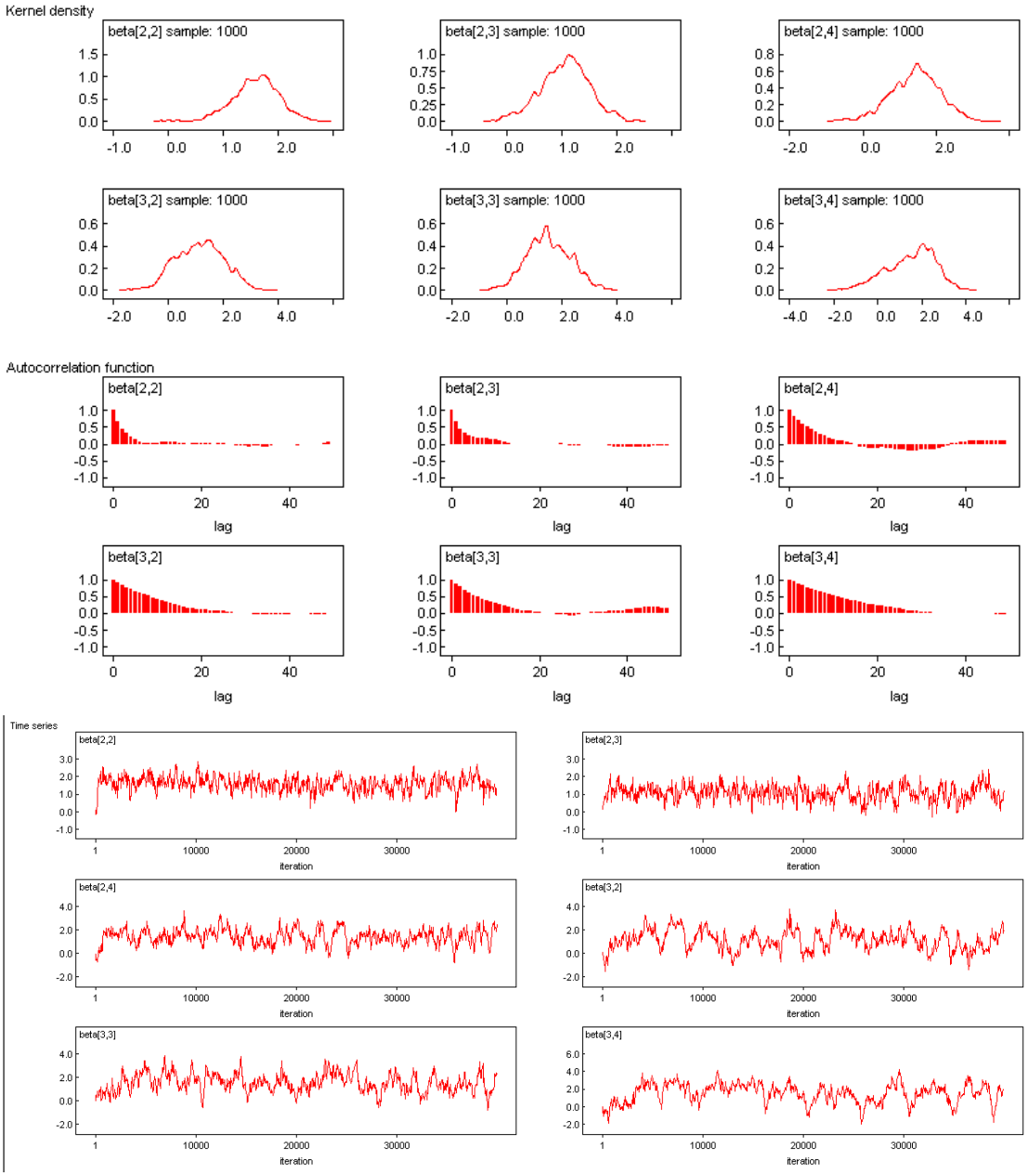


Figure 30 Beta parameter convergence results – Parity population

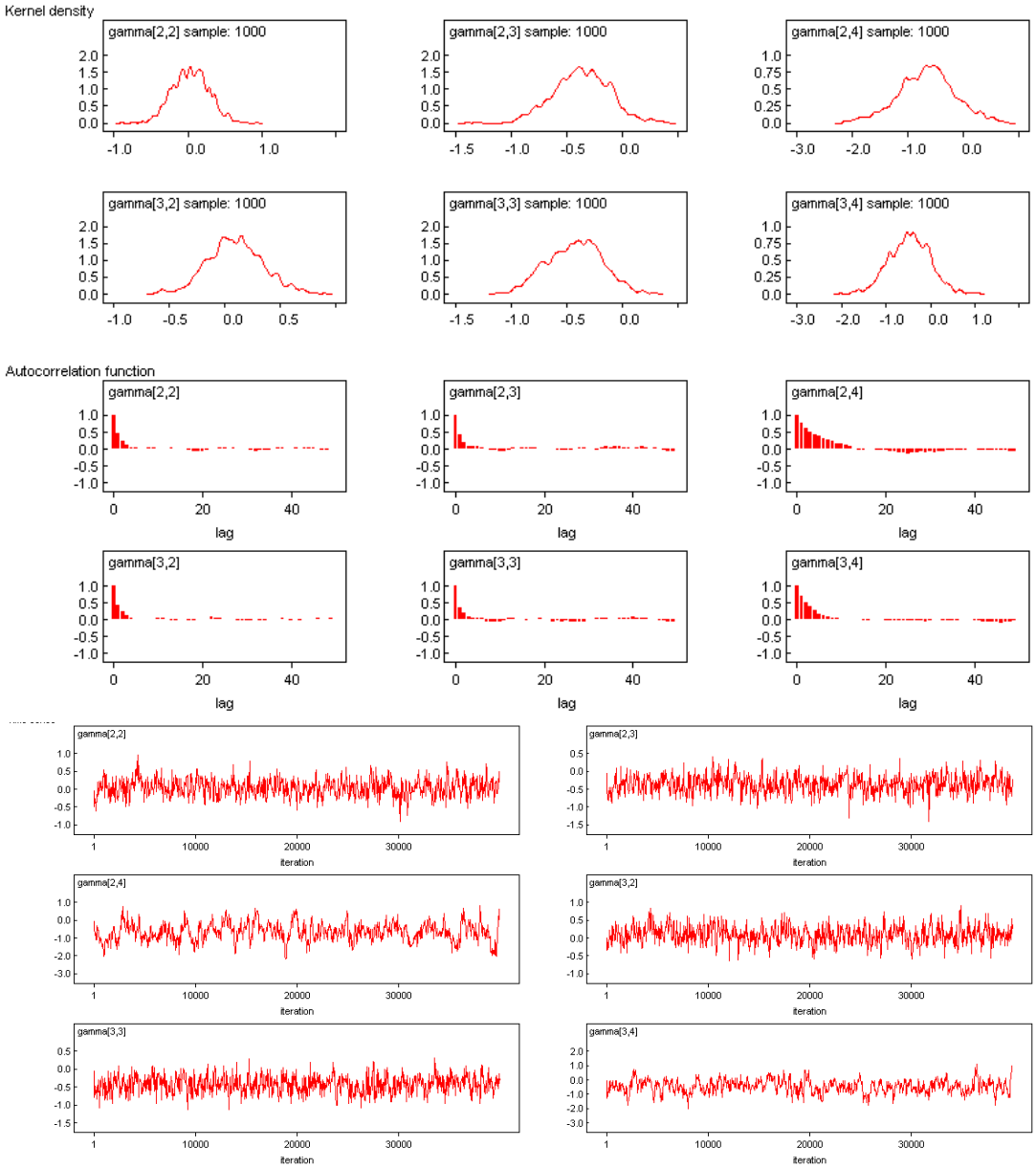


Figure 31. Gamma parameter convergence results – Parity population

And then, we shoe the descpritive statistics of posteriori distribution to the parameters estimates, considering all status inputs, are reported in Table 27.

Results considering only firms in Parity are reporeted in Table 28.

.

Table 27. Multinomial model estimates

Factor		Parameter	Mean	Standard deviation	Percentile 2.50%	Median	Percentile 97.50%
Intercept	Advantage	alpha[2]	-1.305	0.1211	-1.497	-1.317	-1.081
	Disadvantage	alpha[3]	-1.303	0.1287	-1.537	-1.308	-1.08
	Undetermined	alpha[4]	-2.169	0.1946	-2.476	-2.179	-1.815
Competitive momentum	Towards Advantage	beta[2,2]	1.324	0.2468	0.7469	1.342	1.805
		beta[2,3]	1.449	0.2406	0.9939	1.466	1.909
		beta[2,4]	1.367	0.3464	0.3103	1.396	1.943
	Towards Disadvantage	beta[3,2]	0.7961	0.233	0.3257	0.8036	1.259
		beta[3,3]	0.9098	0.2501	0.4126	0.907	1.358
		beta[3,4]	1.445	0.3712	0.281	1.498	2.038
Consistency	Consistency in one dimension	gamma[2,2]	-0.08687	0.1292	-0.3623	-0.08358	0.1602
		gamma[2,3]	-0.5141	0.1523	-0.8247	-0.5146	-0.2033
		gamma[2,4]	-0.6829	0.1901	-1.033	-0.6922	-0.2879
	Consistency in both dimensions	gamma[3,2]	0.1928	0.1296	-0.05667	0.2029	0.4357
		gamma[3,3]	-0.5265	0.1562	-0.8326	-0.5288	-0.2267
		gamma[3,4]	-0.7903	0.242	-1.291	-0.7781	-0.3344

Table 28. Multinomial model estimates – Only firms in parity

Factor		Parameter	Mean	Standard deviation	Percentile 2.50%	Median	Percentile 97.50%
Intercept	Advantage	alpha[2]	-2.164	0.202	-2.564	-2.158	-1.796
	Disadvantage	alpha[3]	-1.783	0.183	-2.143	-1.779	-1.426
	Undetermined	alpha[4]	-3.186	0.331	-3.874	-3.166	-2.601
Competitive momentum	Towards Advantage	beta[2,2]	1.590	0.424	0.726	1.618	2.384
		beta[2,3]	1.067	0.442	0.129	1.095	1.954
		beta[2,4]	1.432	0.673	0.030	1.463	2.706
	Towards Disadvantage	beta[3,2]	1.143	0.875	-0.449	1.153	2.795
		beta[3,3]	1.543	0.800	0.042	1.496	3.149
		beta[3,4]	1.525	1.115	-0.855	1.680	3.410
Consistency	Consistency in one dimension	gamma[2,2]	0.041	0.245	-0.435	0.038	0.538
		gamma[2,3]	-0.362	0.252	-0.866	-0.360	0.122
		gamma[2,4]	-0.658	0.512	-1.735	-0.647	0.352
	Consistency in both dimensions	gamma[3,2]	0.097	0.247	-0.372	0.091	0.609
		gamma[3,3]	-0.425	0.246	-0.893	-0.415	0.042
		gamma[3,4]	-0.465	0.458	-1.371	-0.456	0.431