MESTRADO EM

CONTABILIDADE, FISCALIDADE E FINANÇAS EMPRESARIAIS

TRABALHO FINAL DE MESTRADO

DISSERTAÇÃO

THE DIAGNOSTIC AND INTERACTIVE USES OF MANAGEMENT CONTROL SYSTEMS IN THE PORTUGUESE FINANCIAL SERVICES INDUSTRY – AN EXPLORATORY ANALYSIS.

FLORENCE MENDES CORREIA CARP PINTO BASTO

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ORIENTAÇÃO:

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ABSTRACT

The purpose of this research is to explore the relationships between perceived environmental uncertainty (PEU), organizational structure, technology and management control systems (MCS) diagnostic and interactive uses in the Portuguese financial services industry. The study is built upon the Contingency Theory and the Levers of Control framework and employs PLS-SEM to conduct the analyses on data from a survey of 50 firms.

Results indicate that higher levels of PEU are associated with organizational structures that are more decentralized and that exhibit a higher degree of specification and specialization of tasks. This study also finds that higher levels of PEU are associated with a more intense use of MCS for diagnostic and interactive purposes. Additionally, results suggest that firms exhibiting higher centralization and lower levels of task specification and specialization will tend to use more intensively a lower number of MCS than more decentralized firms with higher levels of specification and specialization of tasks. Finally, the association between technology and MCS diagnostic and interactive uses were not found to be statistically significant.

Keywords: Portugal, financial services, contingency theory, levers of control, management control systems (MCS).

RESUMO

Este estudo teve como objectivo analisar as relações entre *perceived environmental uncertainty* (PEU), estrutura organizacional, tecnologia e a utilização diagnóstica e interactiva dos sistemas de controlo de gestão (SCG) no sector financeiro português. O estudo é desenvolvido tendo por base a Teoria da Contingência e os *Levers of Control* e utiliza PLS-SEM para realizar as análises tendo por base dados de um inquérito realizado a 50 empresas do sector.

Os resultados indicam que níveis mais elevados de PEU estão associados a estruturas organizacionais mais descentralizadas e com maiores níveis de especificação e especialização de tarefas. O estudo também indica que níveis mais elevados de PEU estão associados a uma utilização mais intensiva dos SCG de forma diagnóstica e interactiva. Adicionalmente, os resultados sugerem que as empresas mais centralizadas e com níveis mais baixos de especificação e especialização de tarefas tendem a utilizar de forma mais intensiva um menor número de SCG quando comparadas com empresas mais descentralizadas e com maiores níveis de especificação e especialização de tarefas. Finalmente, a associação entre tecnologia e a utilização diagnóstica e interactiva dos SCG não é suportada estatísticamente.

Palavras-chave: Portugal, sector financeiro, teoria contingencial, *levers of control*, sistemas de controle de gestão.

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LIST OF ABBREVIATIONS

ABC – *Activity-based costing*

ABM - *Activity-based management*

AVE – *Average Variance Extracted*

BSC – *Balanced Scorecard*

CRD - *Capital Requirements Directive*

CRR - *Capital Requirements Regulation*

CT – *Contingency Theory*

LOC – *Levers of Control*

LV – *Latent Variable*

MAS – *Management Accounting Systems*

MCS – *Management Control Systems*

MV – *Manifest Variable*

PEU – *Perceived Environmental Uncertainty*

PLS-SEM – *Partial Least Squares Structural Equation Modeling*

LIST OF APPENDICES

1. INTRODUCTION

This research draws on the Contingency Theory (CT) of the firm and on Simons' Levers of Control (LOC) framework. It represents an exploratory effort to identify the relationships between perceived environmental uncertainty (PEU), organizational structure, technology, and diagnostic and interactive uses of management control systems (MCS) in the Portuguese financial services industry (e.g. commercial banks, investment banks, cooperative banks, insurance and asset management companies, insurance brokers).

Most of the studies on MCS have been carried out in the non-financial sector and research conducted in the financial services industry is scant. MCS characteristics and use has evolved throughout the past 30 years shifting from accounting systems that served primarily the purpose of results measurement and reporting to regulators to more sophisticated MCS used by management to assure efficiency and effectiveness in tackling the increasing globalization and competition in the sector (Soin & Scheytt, 2008). From the 1990's onwards regulation has intensified in Europe as well as in the United States of America. This was triggered by events such as the bankruptcy of Barings Bank in 1995, the conscience that there was a high degree of interconnection between financial institutions in different countries and the important role played by financial institutions in the increasingly globalized economies. In the European banking context the Basel I and Basel II Accords put forth by the Basel Committee on Banking Supervision and officially adopted by the European Parliament and Council through Capital Requirements Directives (CRD), and afterward transposed to national settings, have played an important role. Basel III regulatory framework reflected in the European Union through the CRD IV package is expected to be introduced in stages from 2013 to 2019 bringing on additional

risk-related demands for institutions (CDR, 2011; CRR, 2011). As for the European insurance market, Solvency Directive I focused on the capital adequacy requirements for insurers and Solvency Directive II, expected to replace the former as of January 1st 2014, establishes new capital requirements along with risk management standards devised for the protection of policyholders. Recent events, such as the United States' subprime crisis that led to the financial crisis and recession that began in 2008, have proved the economic importance of this sector beyond dispute.

In order to examine the relationships of interest to this study a survey on the Portuguese financial services sector was conducted. The survey yielded 50 usable responses, corresponding to a response rate of 12%. Data indicate that the most widely used systems for coordinating and monitoring outcomes in relation to preset goals (diagnostic use) are operating budgeting (66%), profitability analysis (64%), financial performance analysis in relation to targets (48%), sales forecasting (40%), cash flow forecasting (36%), investment budget (34%), costing systems (30%), sales objectives systems (28%), complaints control systems (26%), and risk management systems (24%). Respondents also indicated that profitability analysis (40%), financial performance analysis in relation to targets (28%), customer and market development plans (28%), benchmarking (26%), market research (24%), sales forecasting (22%), marketing policy (22%), and development of new product and services systems (22%) were the most used MCS for outlining new strategies (interactive use).

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for analyzing data not only due to the small sample size but also because of the exploratory nature of the study. The analysis of the data suggests that PEU (hostility and unpredictability) has a positive effect on the intensity of diagnostic and interactive uses of MCS. This means that managers perceiving higher levels of environmental uncertainty

tend to use more MCS for monitoring and controlling as well as for outlining new strategies. The present study also found a positive effect of PEU (hostility and unpredictability) on organizational structure, meaning that higher levels of PEU are associated with higher levels of delegation of authority (decentralization) and task specification and specialization. As for the effect of organizational structure on MCS diagnostic and interactive uses results suggest that the first has a negative effect on the latter. A possible interpretation is that managers from more centralized firms, with lower levels of task specification and specialization, tend to use more MCS for diagnostic and interactive purposes probably due to the fact that they are using a lower number of MCS and therefore the intensity of use of those MCS for diagnostic and interactive purposes is higher for these firms. Technology and size effects on diagnostic and interactive uses of MCS were not found to be significant. Additionally, alternative models suggest that the relationships between environmental dynamism and organizational structure, MCS diagnostic use and MCS interactive use are not statistically significant.

In a recent review of the literature on management control research in the banking sector, Gooneratne & Hoque (2013) highlighted the need for more research using the survey method, using multiple theories in partnership and considering the relationship between risk management and MCS. Other authors also refer the connection between risk management and MAS/MCS as being understudied (Soin & Collier, 2013). Thus, this dissertation contributes to the existing literature by using the survey method and by joining the Contingency Theory (CT) and the Levers of Control (LOC) framework as a theoretical basis for exploring MCS use. Additionally, this study also considers risk management systems as part of the MCS as a result of a «regulated hybridization process», as defined by Miller *et al.* (2008), in the financial services sector. Finally, this

study provides cross-sectional evidence of the relationships between PEU, organizational structure, technology, and MCS diagnostic and interactive uses.

This dissertation consists of five chapters. The following chapter provides a literature review for the subject under study and the development of the hypotheses. The third chapter is dedicated to the research model, sample selection and variable measurement. Chapter 4 presents the main findings concerning the hypotheses and its discussion. The final chapter brings forward the conclusions of the study, its limitations, and suggests fields for future research.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

There are several definitions of MCS in the literature. One of the first definitions was provided by Anthony (1965, p. 27) as «the process by which managers ensure that resources are obtained and used effectively and efficiently in the achievement of the organization's objectives». Several other authors elaborated on this seminal view of MCS either by introducing a more technical point of view, by emphasizing its behavioral aspects or by viewing them as socially constructed phenomena (Gooneratne & Hoque, 2013). Recently, Gooneratne & Hoque (2013) proposed a definition that encompasses most of the aspects previously mentioned: MCS are defined as «the formal organizational systems designed and implemented by management to ensure that organizational goals are achieved».

2.1. MANAGEMENT CONTROL SYSTEMS IN THE FINANCIAL SERVICES SECTOR

Research on MCS in the financial services sector has covered a wide range of topics throughout the years. Historical perspectives (e.g. Billings & Capie, 2004; Soin &

Scheytt, 2008) are useful in understanding the global evolution of the industry and the factors that triggered the changes in MCS use. Research on planning practices address issues such as strategic/long-range planning (e.g. Gup & Whitehead, 1989; Kudla, 1982; Sokol, 1993; Wood Jr., 1980) and the link between corporate planning and shorter term budgeting (Dugdale, 1978). Vast research on activity-based costing (ABC) and activity-based management (ABM) has been conducted. Innes & Mitchell (1997) studied ABC's adoption among British largest financial institutions (banks, building societies, insurance/investment organizations) and found it to be relatively late but enthusiastic (54% of respondents were applying ABC). Revell *et al.* (2003) contributed with insights on implementation and benefits of ABC systems based on two US case studies and Sweeney & Mays (1997) found that activity-based management had a positive impact on corporate performance in the case study of a US regional bank holding company. The relationship between ABC and organizational change was the focus of several studies (Soin, 1996; Soin *et al.*, 2002; Vieira & Hoskin, 2005) mainly through case study analysis. Kocaküläh and Crowe (2005) studied the relationship between ABC and loan portfolio profitability and Norris (2002) examined the introduction and usage of activity-based information in two British banks. Performance measurement systems were widely researched. The use of non-financial measures was vigorously explored (Hussain, 2003; Hussain, 2005; Hussain & Gunasekaran, 2002; Hussain *et al.*, 2002) revealing a more intense use of financial measures in detriment of non-financial measures. Also performance measurement practices were studied (McNamara & Mong, 2005; Hussain & Hoque, 2002; Zineldin & Bredenlow, 2001). Hussain & Hoque (2002)'s case studies of four Japanese banks indicate that several institutional forces (economic constraints, central bank's regulatory control, accounting standards/financial legislation, management's strategic focus, bank size, competition, etc) influenced the banks to

implement a particular performance measurement system, being economic constraints the most significant. Ittner *et al.* (2003)'s findings suggest that firms using a broader set of financial and non-financial measures strategic performance measurement systems achieve higher performances. Other research topics include the balanced scorecard (Aranda & Arellano, 2010; Davis & Albright, 2004), budgetary control systems (Lau & Tan, 1998), profitability reporting (Helliar *et al.*, 2002); evolution of internal measurements and its relationship with accounting regulations (Barretta & Riccaboni, 1998), management accounting systems (MAS) and risk management (Bhimani, 2009; Huber & Scheytt, 2013; Siti Zaleha *et al.*, 2011; Soin & Collier, 2013), and MAS and organizational change (Cobb *et al.*, 1995; Euske & Riccaboni, 1999; Guerreiro *et al.*, 2006; Middaugh, 1998). In light of the contingency theory, Lenz (1980) concluded that combinations of environment, strategy and organizational structure of high-performance firms differed from combinations associated with low-performance firms. Finally, Mundy (2010) analyzed a case study with the levers of control framework and found that managers attempt to balance «controlling and enabling uses» of MCS in order to manage organizational conflicts and to generate dynamic tensions.

Based on the above literature review, one may conclude that there is a significant absence of research, in the financial services industry, analyzing the relationships between the variables under study. Therefore, the present work is exploratory in nature.

2.2. LEVERS OF CONTROL FRAMEWORK

There are four types of MCS that together work as *levers of control* (LOC): beliefs systems, boundary systems, diagnostic control systems and interactive control systems,

which should be balanced in order to implement strategy effectively (Simons, 1994, 1995, 2000).

Beliefs systems are used by managers to formally «define, communicate and reinforce values, purpose and direction for the organization» (Simons, 1994, p. 170) (e.g. mission statement, vision and credos). Core values are broad in nature since they should appeal to everyone working in the organization and are only effective when employees believe that they represent real «rooted values». The top management's behavior is of extreme importance to this end since their actions contribute toward making these values meaningful (Simons, 1995, 2000). Mission statements and credos give employees a «sense of pride and purpose» (Simons, 2000).

Boundary systems serve as a means of avoiding risks by establishing limits and enforcing rules (e.g. codes of conduct, strategic planning systems, operating directives). Establishing clearly «what not to do» is, according to Simons (2000), the best way to limit employees' actions without hampering creativity and innovation. Codes of conduct, for example, are needed to ensure ethical behavior and may be extremely valuable in organizations where trust is a fundamental value for doing business. As for strategic planning it plays a pivotal role in restricting actions in areas that turn away from the organization's strategic goals and that may impair performance. Therefore, beliefs systems and boundary systems work together as «the yin and yang» of Chinese philosophy that «create a dynamic tension» between «commitment and punishment» (Simons, 1995).

Diagnostic control systems suit the purpose of monitoring critical variables, such as revenue growth and market share, and enable organizations to identify and interpret deviations from preset goals (e.g. business plans and budgeting systems). These systems

allow management to monitor situations of inappropriate goal setting and inability to achieve goals due to unexpected changes (Simons, 2000).

Finally, interactive control systems are formal systems used by top management to get involved regularly and personally in the decisions of their subordinates in order to focus attention on strategic uncertainties (e.g. technology, regulation and competition), to excite dialog and organizational learning which, in turn, originate proactive responses, such as, the development of emergent strategies (Simons, 1995). The establishment of regular meetings with subordinates to discuss main issues is an example of this type of MCS.

2.3. CONTINGENCY-BASED RESEARCH AND MCS

The contingency-based approach on MCS emphasizes the idea that MCS are implemented in order to assist managers achieve the desired organizational objectives and that MCS design is influenced by the context in which the company operates (Chenhall, 2007). Several studies have examined the relationship between MCS and a number of contextual variables, such as the external environment, organizational structure, technology and size (Chenhall, 2007), which will be further analyzed.

2.3.1. The relationship between PEU and Organizational Structure

Khandwalla (1977) presents the environment as exerting pressures on the organizations in the form of «constraints, contingencies, opportunities and problems». The author identifies in the external environment five attributes which impact the organizations' structure and strategy: turbulence (dynamism and unpredictability), hostility (intensity of competition), diversity, complexity (technology) and restrictiveness (legal, political, social and economic constraints). Additionally, Duncan (1972) identified

two environmental dimensions, the simple-complex dimension (homogeneity or heterogeneity of the factors) and the static-dynamic dimension (changes in the factors over time), and found that a dynamic-complex environment leads to the greatest amount of uncertainty in decision making.

Previous studies have focused on understanding the most adequate organizational structure in relation to environmental uncertainty. According to Chenhall (2007), organizational structure is the way roles of organizational members and tasks for groups are formally specified to ensure that the activities of the organization are carried out. Several definitions of organizational structure have been proposed focusing on different dimensions such as differentiation and integration (Lawrence & Lorsch, 1967), mechanistic and organic system (Burns & Stalker, 1961), bureaucratic and non-bureaucratic type (Perrow, 1970). One of the most adopted typologies in research is the one put forward by Burns & Stalker (1961). According to these authors, in a mechanistic system tasks and roles are highly defined and the structure of control, authority and communication is highly hierarchical. Instead, an organic form of organization is characterized by higher flexibility and adaptability of tasks and a network structure of control, authority and communication. Burns & Stalker (1961) suggested that an organic structure would better fit an organization in a changing environment and research conducted in the non-financial sector found a positive association between the competitive environment and a more organic organizational structure (Baines & Langfield-Smith, 2003; Chenhall, 2007; Gordon & Naranayan, 1984; Khandwalla, 1972a). On the other hand, some authors argue that the lack of organizational structure, as in the situation of a pure organic type, may result in role ambiguity and uncertainty, which may hamper organizational and individual action. These authors advocate that the formalization of roles may reduce ambiguity, and enable individual focus and decision

making (Sine *et al.*, 2006). Research conducted indicates that new ventures in turbulent and emergent economic sectors with higher formalization and specialization of roles outperform those with more organic structures (Sine *et al.*, 2006) and that mechanistic structures are successful in coping with change when these changes are more technical and structural in nature (Waldersee *et al.*, 2003). Thus, the formalization of roles may also be important in responding to change. Therefore, organizational structure in the financial services industry should be viewed as a blend of two traits: delegation of authority and task specification/specialization since some degree of delegation of authority and some degree of task specification/specialization may be needed for coping with uncertainty. Therefore, the following hypothesis is proposed:

H1: PEU is **positively** associated with Organizational Structure in the financial services industry.

2.3.2. The relationship between PEU and MCS Use

Environmental hostility (intensity of competition) has been associated with the use of sophisticated management controls (Khandwalla, 1972b). As for environmental complexity (when derived from suppliers and government), it has been associated with reduced emphasis on budgets (Brownell, 1985). Environmental dynamism and unpredictability have been negatively associated with the extent of use of written budgets (King *et al.*, 2010). Additionally, evidence has been collected regarding the combination of tight controls and more open, informal, flexible and interactive systems in organizations (Ahrens & Chapman, 2004; Chapman, 1998; Chenhall, 2007; Ezzamel, 1990; Merchant, 1990; Simons, 1987). This appears to add up when considering that diagnostic and interactive control systems are interconnected since the strategy that stems

from interactive systems is ultimately incorporated in the goals monitored by diagnostic systems (Simons, 2000; Widener, 2007). Despite the fact that most of these studies were carried out in the non-financial sector, there is evidence of the influence of the changing environment on MCS use in the financial services sector (e.g. Cobb *et al.*, 1995; Euske & Riccaboni, 1999; Helliar *et al.*, 2002; Soin, 1996; Vieira & Hoskin, 2005). It is vastly documented that increasing regulation and competition has contributed to the development of more sophisticated MCS in this industry. Thus it may be reasonable to assume that changes in the environmental setting have contributed to both a more intense diagnostic and interactive use of MCS in the financial services industry despite the lack of research on this issue.

Therefore, the following hypotheses are proposed:

H2a: PEU is **positively** associated with the intensity of MCS Diagnostic Use in the financial services industry.

H2b: PEU is **positively** associated with the intensity of MCS Interactive Use in the financial services industry.

2.3.3. The relationship between Organizational Structure and MCS Use

Large and decentralized firms, with sophisticated technologies, have been associated with an emphasis on formal MCS (Bruns & Waterhouse, 1975); and larger, diverse, more decentralized firms, were found to use more formal and sophisticated budgeting practices while smaller, more centralized firms tended to rely more on direct supervision and more frequent personal interaction and less on formal budgets (Merchant, 1981). Khandwalla (1972b, 1977) found that large decentralized firms used sophisticated controls along with high levels of participation and human relations approaches to coordinate activities. Gul

et al. (1995) found an association between decentralization and participative budgeting. Organic structures (higher decentralization and lower task specification) have been found to be associated with broad scope and future-oriented information (Gordon & Narayanan, 1984).

Studies conducted in the financial services industry suggest that changes in the environment have led to adjustments in strategy, organizational structure and MCS (e.g. Euske & Riccaboni, 1999; Vieira & Hoskin, 2005) but research studies directly relating organizational structure and MCS diagnostic and interactive use are lacking. For the financial services firms, it may be reasonable to assume that a more centralized organization, and characterized by a low degree of specification and specialization of tasks, will need to use a smaller number of MCS. Additionally, one may expect that these firms use MCS diagnostically and interactively in a relatively intense way since they are not using many MCS. On the other hand, a more decentralized organization, and with high levels of specification and specialization of tasks, will most probably use a considerable number of MCS and exhibit a lower intensity in the use of MCS for diagnostic and interactive purposes when compared to the first type of firms.

Therefore, the following hypotheses are proposed:

H3a: Organizational Structure is **negatively** associated with the intensity of MCS Diagnostic use in the financial services industry.

H3b: Organizational Structure is **negatively** associated with the intensity of MCS Interactive use in the financial services industry.

2.3.4. The relationship between Technology and MCS Use

Technology is defined as the processes organizations use to translate resources (hardware, software, materials, human resources and knowledge) into output and is usually analyzed in MCS research regarding three characteristics: process automation/standardization, task uncertainty and interdependence (Chenhall, 2007).

Theoretically, standardized/automated processes are linked to more formal MCS (Khandwalla, 1977), high budget use (Merchant, 1984), high budgetary controls (Dunk, 1992) and less budgetary slack (Merchant, 1985).

Task uncertainty (in terms of difficulty, analyzability and/or variability) has been associated with more informal controls (Chenhall, 2007), high reliance on standard operating procedures, programs and plans (Daft & Macintosh, 1981), and broad scope information (Mia & Chenhall, 1994). Research conducted on the services sector by Auzair & Langfield-Smith (2005) found that professional service firms (e.g. corporate banking) place greater emphasis on less bureaucratic forms of MCS (informal, flexible and interpersonal controls) than mass service firms. This is attributed by the authors to a higher task uncertainty in professional services firms due to greater human involvement in the processes. Additionally, Lau & Tan (1998) advocate that the financial services industry's task difficulty levels are expected to be higher in comparison to manufacturing and merchandising sectors which they attribute to the diversity and complexity of services offered. They find that high budgetary participation is associated with improved managerial performance in high task difficulty situations.

Finally, low levels of interdependence have been associated with budgets, operating procedures and statistical reports (Macintosh & Daft, 1987), and high (low)

interdependence was associated with broad (narrow) scope MCS (Chenhall & Morris, 1986).

In the financial services industry research studies directly relating technology and MCS diagnostic and interactive uses are lacking. It may be reasonable to assume that firms exhibiting lower levels of task uncertainty, higher levels of process standardization and automation and of interdependence will use MCS diagnostically more intensively. On the other hand, firms exhibiting higher levels of task uncertainty, lower levels of process standardization and automation and of interdependence will engage in a more interactive use of MCS.

Therefore, the following hypotheses are proposed:

H4a: Technology is **positively** associated with the intensity of MCS Diagnostic use in the financial services industry.

H4b: Technology is **negatively** associated with the intensity of MCS Interactive use in the financial services industry.

2.3.5. Size

According to Chenhall (2007), large organizations have been associated with more diversified operations, formalization of procedures and specialization of functions, and an emphasis on and participation in budgets and sophisticated controls. Therefore it is expected that as firms grow and become more complex to manage its organizational structures become more decentralized and exhibit higher levels of task specification and specialization. It is also expected that larger organizations will use a higher number of MCS and therefore that the intensity of use of these systems for diagnostic and interactive purposes might be different between larger and smaller firms. Therefore, this variable was included in the model as a control variable.

3. RESEARCH METHOD

3.1. SURVEY DESIGN AND ADMINISTRATION

In order to examine the relationships between PEU, organizational structure, technology, and MCS diagnostic and interactive uses in the Portuguese financial services sector, a survey was conducted. The survey consisted of 44 questions based on literature review and adapted to the financial services sector through meetings with the directors of the management control departments of Banco Espírito Santo de Investimento (Investment Banking) and Companhia de Seguros Tranquilidade (Insurance). Since this study is part of a larger research project, only 11 of the 44 questions were used.

The list of companies was supplied by Informa D&B, a company specialized in the collection of corporate information, but only data for the small and medium-sized companies (having 10 or more and less than 250 employees) were obtained. The larger companies were identified through information supplied by the Bank of Portugal (Portuguese banking regulator) and Instituto de Seguros de Portugal (Portuguese insurance regulator). The resulting target population consisted of 800 companies. Due to the fact that some of them were part of the same group of companies, were extinct, were not possible to reach (the telephone number was invalid and no additional information was available in the internet), or did not wish to participate in the study, the number of usable companies was brought down to 423. Phone-calls were made to every company in order to obtain the name and e-mail of the most qualified person to answer the survey (usually a Board member, CEO, CFO or controller). However, many companies did not supply the most adequate information and only an institutional e-mail was obtained, possibly contributing to a lower response rate.

The survey was administered by e-mail. E-mails enclosed a cover letter, since it is documented as contributing to higher response rates (Dillman, 2000; Schaefer & Dillman, 1998), and a link to the online survey. The cover letter described the confidentiality and purpose of the study and indicated that participants would have access to the results of the study, be invited to a results' presentation session and be eligible to participate in the draw of 8 vouchers with values ranging from € 24.90 to € 89.90. Participants were informed that completion of the questionnaire would take not more than 10 to 20 minutes. Follow-ups were used with the objective of increasing the response rate since they have been reported as contributing to that end, both in mail and online surveys (Dillman, 2000; Schaefer & Dillman, 1998). Additional phone calls were made to companies highlighting the importance of participating in the study and several reminders were sent by e-mail.

3.2. RESPONSE RATE AND NON-RESPONSE BIAS

In total, 60 questionnaires were completed. Data was analyzed for straight lining and for the proportion of missing responses for a single construct which resulted in the removal of 10 observations from the data file. The reason for having such a high proportion of unusable responses may be attributed to the length of the questionnaire and the inclusion of the option of not answering or not knowing the answer to the questions. The final sample size consisted of 50 observations yielding a 12% response rate consistent with the response rate of less than 20% reported in several recent studies (e.g. Baines & Langfield-Smith, 2003; Widener, 2007). Sample's details, respondents' profile, sample companies' size (measured by the number of employees) and type of activity are summarized in appendices 1, 2, 3 and 4, respectively.

To test for non-response bias, respondents were compared from the first 15 respondents and the last 15 respondents (as a proxy for non-respondents) and results

showed that overall there were no significant differences between the distributions and medians of the two groups. The exceptions were items measuring Technology which exhibited significant differences. Results of the Mann-Whitney and Median tests are presented in appendix 5.

3.3. RESEARCH MODEL

Data were analyzed using PLS-SEM with SmartPLS 2.0 software (Ringle *et al.*, 2005). PLS-SEM is considered a second-generation technique and is primarily used to develop theories in exploratory research (Hair *et al.*, 2013; Gefen *et al.*, 2011). By estimating iteratively and simultaneously the measurement and structural models PLS-SEM allows for a better estimation process in comparison to first-generation modeling techniques such as principal components analysis, factor analysis, discriminant analysis or multiple regression (Gefen *et al.*, 2011; Lee *et al.*, 2011; Chin *et al.*, 2008). Additionally, the method generally achieves high levels of statistical power with small samples (Hair *et al.*, 2013). The minimum sample size for PLS path model estimation should, according to the 10 times «rule of thumb» (Hair *et al.*, 2013; Barclay, Higgins & Thompson, 1995), be equal to the larger of: (1) 10 times the largest number of formative indicators used to measure a single construct; or (2) 10 times the largest number of structural paths directed at a particular construct in the structural model (Hair *et al.*, 2013). Another characteristic of PLS-SEM is that it is a non-parametric method thus making no data distributional assumptions and works with a variety of measurement scales (e.g. metric, ordinal scaled data and binary coded variables).

The PLS path model is formed by two models: (1) a measurement model that relates the manifest variables or indicators to their respective latent variables and (2) a structural model which relates the various latent variables. The measurement model may be

reflective or formative. A reflective measurement model was chosen for all of the constructs since it was considered that the indicator items are manifestations of the underlying constructs, following the guidelines proposed by Hair *et al.* (2013, p. 47, exhibit 2.9). Therefore, it is expected that indicators of a construct are highly correlated, are interchangeable and that one of them can be left out without changing the meaning of the construct as long as the construct has sufficient reliability (Hair *et al.*, 2013).

In the reflective measurement model, each manifest variable (x_{pq}) reflects its latent variable (Y_q) and they are related by a simple regression:

$$(1)\ X_{pq} = \lambda_{p0+} \lambda_{pq} Y_q + \varepsilon_{pq}$$

where λ_{pq} represents the loading associated with the *p*-th manifest variable in relation to the *q*-th latent variable and ε_{pq} indicates the measurement error for the *p*-th manifest variable.

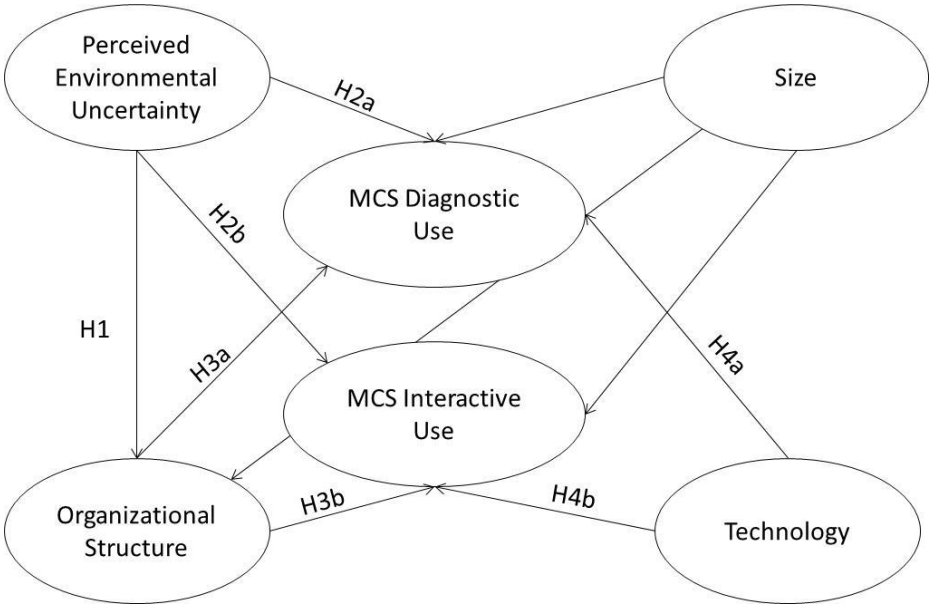
The structural model may be written as:

$$(2)\ Y_j = \beta_{0j} + \sum_{q:\ \xi_q \rightarrow \xi_j} \beta_{qj} Y_q + \zeta_{pq}$$

where ξ_j represents each of the endogenous latent variables, β_{qj} is the path coefficient relating the *q*-th exogenous latent variable and the *j*-th endogenous latent variable and ζ_{pq} is the error term in the inner relation.

The path model used in this research is depicted in Fig. 1.

Figure 1 – Research model with control variables



In the present structural model the maximum number of paths directed at a latent variable is 4 indicating that 40 is the minimum number of observations needed to estimate the path model according to the previously mentioned «rule of thumb».

Hair *et al.* (2013)'s suggestions regarding missing value treatment, algorithm and bootstrapping settings were followed. Missing data was handled through mean value replacement since there were less than 5% values missing per indicator. When running the algorithm, the selected weighting scheme for inner weights estimation was the path weighting scheme and the chosen data metric was standardized data (Mean 0, Var 1). The stop criterion was set at 1.10^{-5} and the maximum number of interactions at 300. Initial weights were set at the default value of 1.0. Bootstrapping procedures were conducted with the no sign changes option, 50 cases (equal to the number of observations in the original sample) and 5.000 samples.

3.4. CONSTRUCT MEASUREMENT

3.4.1. Measurement of constructs

A literature review was conducted to identify existing measurement scales for the constructs under study. Additionally, as previously mentioned, they were subject to validation by the directors of the management control departments of 2 firms operating in the Portuguese financial services sector.

Appendix 6 presents a summary of the items included in the questionnaire for constructs PEU, Structure and Technology, the scales and the source. The questions relating to the measurement of PEU, aiming to assess unpredictability, hostility and dynamism, were drawn from Gordon & Narayanan (1984). The ones used for assessing Organizational Structure, in terms of delegation of authority and task specification and specialization, were derived from Gordon & Narayanan (1984) and King *et al.* (2010). Technology was measured by questions adapted from Chenhall (2007). The validation of the measurement model led to the reduction of the number of indicators used per variable. PEU was ultimately measured by 4 indicators: the degree of predictability in competitor's actions, degree of predictability of customers' preferences and tastes, the intensity of competition in the diversity of marketed products/services and the intensity of competition in accessing human resources. Structure was measured by 4 items: the degree of delegation of authority in budgeting and pricing decisions, the specification of tasks and the specialization of tasks. Technology was measured by 3 indicators: degree of task uncertainty (reversed score), degree of process standardization and automation, and degree of process interdependency.

MCS Use was measured by 3 questions which aimed to reflect the intensity of MCS Diagnostic Use and MCS Interactive Use in the organizations. In the first question

respondents were asked to select the MCS used or implemented in the organization on the basis of a list of 47 commonly used MCS in the financial services sector. Respondents were asked to indicate, of the previously selected MCS, which were used to coordinate and monitor the organization's outcomes and correct deviations in relation to preset goals (diagnostic use) and which were used to stimulate and guide the emergence of new strategies (interactive use). Thus, MCS Diagnostic (Interactive) Use construct was measured by dividing the number of MCS used for diagnostic (interactive) purposes by the total number of MCS used by the organization. The resulting scale ranged from 0 to 1.

Size was measured by the natural logarithm of the number of employees supplied by Informa D&B Database, Instituto de Seguros de Portugal (Portuguese insurance regulator) and Associação Portuguesa de Bancos (a Portuguese banking association).

3.4.2. Reflective Measurement Model Evaluation

Indicator Reliability, Internal Consistency Reliability and Convergent Validity

Indicator reliability is achieved when indicators' outer loadings are greater than 0.708 meaning that the corresponding latent variable explains at least 50% of the indicator's variance. However, indicators with weaker outer loadings (between 0.40 and 0.70) may be retained subject to examination of item removal on composite reliability and average variance extracted (AVE) as well as on construct's content validity. Additionally, all outer loadings should be statistically significant (Hair *et al.*, 2013).

Internal consistency reliability refers to the degree items are free from random error and therefore to the consistency of the scale. For measuring internal consistency, composite reliability was used instead of Cronbach's alpha because the first takes into account indicators having different loadings and the latter assumes indicators having the

same importance. This fact makes composite reliability a more adequate measure of internal consistency since in PLS-SEM the more reliable indicators play a stronger role in the model. Composite reliability values of 0.70 are necessary to establish internal consistency reliability for the constructs but values above 0.90 are not desirable because they indicate that all indicators are measuring the same phenomenon and are unlikely to be a valid measure of the construct (Hair *et al.*, 2013).

Finally, convergent validity is the extent to which a measure correlates positively with alternative measures of the same construct and is assured when AVE's for each construct are above 0.50, meaning that at least 50% of the measurement variance is captured by the latent variables and therefore the set of indicators represent the same underlying construct (Henseler *et al.*, 2009).

After running the algorithm, only 7 of the indicators' outer loadings were above the threshold value of 0.70, 10 presented outer loadings between 0.40 and 0.70 and 4 had values below 0.40. Following Hair *et al.* (2013)'s recommendations, the 4 indicators with outer loadings below 0.40 were eliminated from the model. After removing these 4 indicators, composite reliability was above threshold value of 0.70 for the three latent variables (PEU: 0.813; Structure: 0.817; Technology: 0.800) but AVE was below the threshold value of 0.50 for PEU and Structure (PEU: 0.391; Structure: 0.398; Technology: 0.576).

According to Hair *et al.* (2013), indicators with outer loadings between 0.40 and 0.70 should be considered for removal from the scale only when deletion of the indicator(s) leads to an increase in composite reliability and/or AVE above threshold values. Therefore, 6 additional indicators had to be removed to obtain convergent validity. The remaining 11 indicators (4 for PEU, 4 for Structure and 3 for Technology) were tested for loadings' significance. Bootstrapping was conducted in order to determine the

significance level for each indicator and all of them were statistically significant at a 10 per cent level (p-value < 0.10). Even though 1 item presents a low loading (degree of delegated authority in budgeting: 0.458 < 0.50) this item was retained in order to guarantee content validity.

Appendix 7 summarizes the results of the measurement model evaluation in terms of indicator reliability, composite reliability, convergent validity and significance of indicator's loadings.

Discriminant validity

Discriminant validity is the extent to which two constructs that are conceptually different from each other exhibit sufficient difference (Henseler *et al.*, 2009). The analyses of cross loadings and the Fornell-Larcker criterion were conducted in order to check for discriminant validity. The analysis of cross loadings shows that each indicator's loading on a construct is higher than all of its cross loadings with other constructs, as required. Additional support for convergent validity is obtained by the Fornell-Larcker criterion since the square root of the AVE of each construct is higher than any of the construct's correlation with any other construct. Appendices 8 and 9 present the cross loadings and the latent variable correlations and the square root of AVE (diagonal), respectively.

Thus, overall the measurement model is adequate in terms of indicator reliability, internal consistency, convergent validity and discriminant validity.

3.5. DESCRIPTIVE STATISTICS OF THE VARIABLES

Descriptive statistics are summarized in appendix 10. Mean values for items measuring delegation of authority range from 2.23 to 3.94 indicating that firms may

exhibit relatively low levels of decentralization (below 4). Task specification and specialization appear to be relatively high (above 4) since mean values range from 4.60 to 5.00. This indicates a tendency for organizational structures in this industry to approximate to the mechanistic type. Mean values for items measuring unpredictability range from 3.77 to 3.96 meaning that the environment is assessed as being relatively predictable. Items measuring hostility (intensity of competition) present mean values ranging from 2.80 to 5.34. Analysis of the individual mean values indicates that the competitive environment is mainly influenced by decisions regarding pricing and the diversity of products and services offered by the firms. As for the assessment of the company's external environment (dynamism), mean values, ranging from 3.98 to 5.50, indicate that the legal and technological environments are viewed as being less dynamic than economic and political environments. Finally, task uncertainty was assessed by the respondents as being relatively low (mean value of 2.5). Degrees of process interdependency and process standardization and automation present similar mean values of 4.16 and 4.82, respectively. Finally, MCS diagnostic use exhibits higher mean and median values than MCS interactive use thus indicating the more intense use of MCS for coordination and monitoring purposes in comparison to MCS being used for outlining new strategies.

Assessment of skewness and kurtosis showed that 3 indicators used in the final measurement model exhibited significant non-normality (z-values > 1.96): Degree of task uncertainty, Size, MCS diagnostic use and MCS interactive use. This analysis is useful since extremely non-normal data inflate standard errors obtained from bootstrapping thus decreasing the likelihood of relationships being significant (Hair *et al.*, 2013).

4. RESULTS AND DISCUSSION

The latent variable scores were extracted and assessed for collinearity using IBM SPSS Statistics 20 software. By running a multiple regression with PEU, Structure, Technology and Size as independent variables and MCS Diagnostic Use (or MCS Interactive Use) as dependent variable the results were variance inflation factor (VIF) values below 5 (PEU: 1.566; Structure: 1.855; Technology: 1.581 and Size: 1.097) indicating that collinearity is not an issue in the structural model (Hair *et al.*, 2013).

The R^2 values obtained for the endogenous latent variables are considered weak for MCS Diagnostic Use ($R^2 = 0.159$) and MCS Interactive Use ($R^2 = 0.176$) and weak to moderate for Structure ($R^2 = 0.363$) (Henseler *et al.*, 2009). Despite that, the R^2 values are all above 0.10 thus assuring that the variance explained by the endogenous variables has practical and statistical significance (Lee *et al.*, 2011).

The structural model path coefficients significance was assessed through bootstrapping. Table 1 summarizes the significance testing results of the path coefficients.

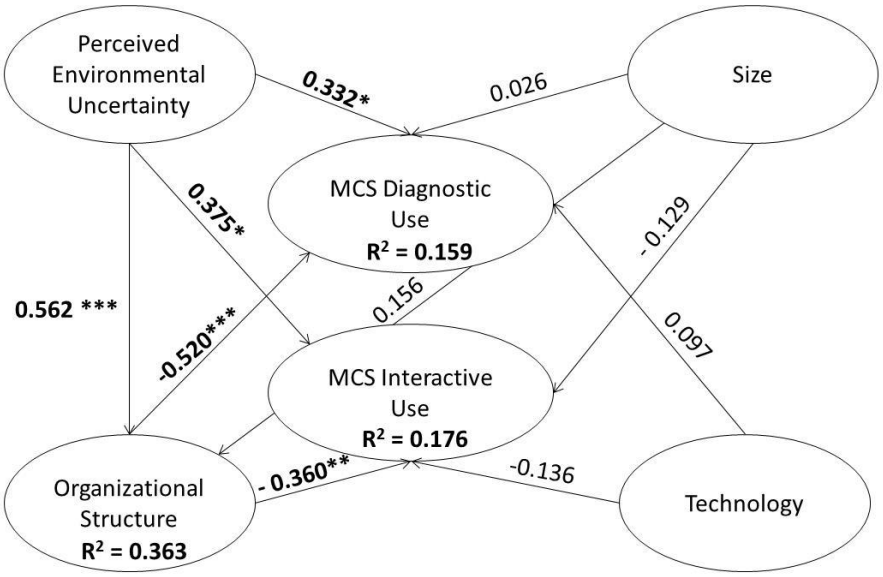
Table 1 – Significance testing results of the structural model path coefficients

Significance testing results of the structural model path coefficients					
Path	**Expected Sign**	**Coefficient**	**T Value**	***p*-value**	**Inference**
H1: PEU -> STRUCTURE	+	0.562	6.9385	0.000 *	Supported
H2a: PEU -> MCS DIAGNOSTIC USE	+	0.332	1.7093	0.094 *	Supported
H2b: PEU -> MCS INTERACTIVE USE	+	0.375	2.0013	0.051 *	Supported
H3a: STRUCTURE -> MCS DIAGNOSTIC USE	-	-0.520	3.1432	0.003 *	Supported
H3b: STRUCTURE -> MCS INTERACTIVE USE	-	-0.360	2.1085	0.040 *	Supported
H4a: TECHNOLOGY-> MCS DIAGNOSTIC USE	+	0.097	0.4062	0.686	Not Supported
H4b: TECHNOLOGY-> MCS INTERACTIVE USE	-	-0.136	0.7265	0.471	Not Supported
SIZE -> STRUCTURE	n/a	0.156	1.4549	0.152	n/a
SIZE -> MCS DIAGNOSTIC USE	n/a	0.026	0.1678	0.867	n/a
SIZE -> MCS INTERACTIVE USE	n/a	-0.129	1.0822	0.284	n/a

Note: * Significant path coefficient at *p*-value < 0.10 (two-tailed).

The estimated path model is depicted in Fig. 2.

Figure 2 – Estimated PLS path model



Note: *Significant at 0.10 (two-tail); **Significant at 0.05 (two-tail); ***Significant at 0.01 (two-tail)

The results indicate that PEU is positively associated with organizational structure thus supporting hypothesis H1 (p-value < 0.01). PEU was measured by 2 items measuring unpredictability and 2 items measuring hostility (intensity in competition) in the external environment. Organizational structure was measured by the degree of delegated authority in budgeting and pricing decisions, and by the degrees of task specification and specialization. The findings of the present study indicate decentralization and specification and specialization of tasks working together as means of coping with higher uncertainties of the external environment (path coefficient = 0.562). The results differ from the findings from previous studies in the non-financial sector relating competitive

environment to a more organic organization structure (e.g. Khandwalla, 1972a) thus highlighting the specific nature of the financial services industry.

There is also a positive significant association between PEU and MCS diagnostic and interactive uses which supports H2a (*p*-value < 0.10) and H2b (*p*-value < 0.10). These results are consistent with the findings from previous studies carried out in the non-financial sector indicating a positive association between PEU and MCS use (e.g. King *et al.*, 2010). Additionally, they are in line with Mundy (2010)'s conclusions regarding the existence of a close relationship between diagnostic and interactive uses of MCS drawn from a financial services firm case study. Therefore results suggest that when facing higher environmental uncertainties financial services' firms tend to use more intensively MCS for coordinating and monitoring outcomes (path coefficient = 0.332) as well as for outlining new strategies (path coefficient = 0.375) in a balanced way.

Additionally, the present study found a statistically significant negative association between organizational structure and MCS diagnostic and interactive uses thus supporting hypothesis H3a (path coefficient = 0.520; *p*-value < 0.01) and H3b (path coefficient = 0.360; *p*-value < 0.05). Results suggest that firms exhibiting higher centralization and lower levels of task specification and specialization will tend to use more intensively a lower number of MCS than more decentralized firms with higher levels of specification and specialization of tasks.

The hypotheses of technology being positively associated with MCS diagnostic use (H4a) and negatively associated with MCS interactive use (H4b) are not supported since path coefficients are not statistically significant despite the resulting signs of the path coefficients being consistent with the hypotheses. These findings are not in line with the existing literature suggesting that firms exhibiting lower (higher) levels of task

uncertainty and higher (lower) levels of process standardization will use MCS diagnostically (interactively) more intensively.

The analysis did not support a significant association between Size, measured by the natural logarithm of the number of employees, and organizational structure. The coefficient is positive, as expected, but not significant. Previous studies have suggested Size to be associated with more decentralized structures, with higher formalization of procedures, and the specialization of functions (Chenhall, 2007). The expected influence of Size on MCS use was also not supported by the results.

Additionally, the f^2 effect size analysis was conducted in order to assess the change in the R^2 value when an exogenous construct is omitted from the model. Guidelines for assessing f^2 indicate values of 0.02, 0.15 and 0.35 as corresponding to small, medium and large effects, respectively (Hair *et al.*, 2013). Table 2 summarizes the significance testing results of the f^2 effect size analysis. PEU has significant small to medium effect sizes on MCS Diagnostic Use (p-value < 0.10) and MCS Interactive Use (p-value < 0.05), and a significant large effect size on Structure (p-value < 0.01). Structure has a significant medium effect on MCS Diagnostic Use (p-value < 0.01) and a significant small to medium effect on MCS Interactive Use (p-value < 0.05).

Table 2 – Significance testing results of the f^2 effect size analysis

Endogenous Construct	Exogenous Construct	R^2 included	R^2 excluded	Effect Size (f^2)	Inference	F (1)	p-value
MCS DIAGNOSTIC USE	PEU	0.159	0.089	0.084	Small to medium Effect	3.767	0.058*
	STRUCTURE	0.159	0.013	0.173	Medium Effect	7.807	0.008*
	TECHNOLOGY	0.159	0.153	0.007	Small Effect	0.316	0.577
	SIZE	0.159	0.158	0.001	Small Effect	0.032	0.859
MCS INTERACTIVE USE	PEU	0.176	0.086	0.109	Small to medium Effect	4.916	0.032*
	STRUCTURE	0.176	0.106	0.085	Small to medium Effect	3.813	0.057*
	TECHNOLOGY	0.176	0.165	0.014	Small Effect	0.639	0.428
	SIZE	0.176	0.161	0.018	Small Effect	0.825	0.369
STRUCTURE	PEU	0.363	0.055	0.485	Large Effect	22.776	0.000*
	SIZE	0.363	0.338	0.040	Small Effect	1.861	0.179

Note: (1) $F = (f^2).(N-m-1)$ following a distribution with (1,N-m) degrees of freedom, where N is the total sample size and m the number of predictors of the dependent construct.

* Significant effect at p-value < 0.10.

Alternative structural models were tested and were compared on the basis of adjusted R^2. In one of those models environmental dynamism (measured by the assessment of the company's economic, legal and technological environment) was introduced and Size was removed (due to limitation of the small sample size). This model suggested that dynamism had a negative impact on MCS Diagnostic Use (path coefficient = - 0.234) and positive impacts on MCS Interactive Use (path coefficient = 0.021) and Structure (path coefficient = 0.151). However, these relationships were not found to be statistically significant (*p*-values > 0.10). Additionally, in this alternative model specification, the signs and statistical significance of relationships between the construct measuring hostility and unpredictability, and Structure, MCS Diagnostic Use and MCS Interactive Use remained unchanged thus confirming the results of the final research model.

The findings of this study are consistent with the expected signs of the theoretical model specified on the basis of literature review. This is an important issue to consider since misspecification may result in the reversal of the relationship's expected signs. The results are also meaningful in practical terms. Firms operating in the financial services industry, having to deal with risk on a day-to-day basis, need to develop sophisticated and reliable controls in order to be able to operate and survive in this industry. MCS use and development is further encouraged by regulators, demanding the existence of certain specific types of controls (e.g. controls for capital adequacy, stress testing and market liquidity risk for banks, controls for solvency and risk management for insurers), and enforcing the reporting of standardized information, in order to play their role effectively. This means that institutions are required to have a minimum number of MCS in this industry. The practical insight that may be drawn is that in the financial services sector

sophisticated MCS are available and managers use them not only for monitoring outcomes but also to look for new strategic options to cope with a changing external environment. Regulation and environmental uncertainty have also contributed to firms having a type of organizational structure that is not very decentralized but is relatively high on task specification and specialization. Higher levels of decentralization and of task specification and specialization contribute to a lower intensity in the use of MCS, especially for diagnostic purposes. A practical insight is that more complex organizations tend to use a higher number of MCS but in a less intensive way for diagnostic and interactive purposes. Alternatively, there is the possibility that some of these systems are being used as either beliefs systems or boundary systems.

5. CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

The present study represents an exploratory analysis of the relationships between PEU, organizational structure, technology and MCS diagnostic and interactive uses in the Portuguese financial services sector. Results show that PEU is an important variable for understanding the type of organizational structure adopted by firms in this sector. Higher PEU drives firms to become more decentralized and at the same time to engage in higher specification and specialization of tasks. This study also finds that PEU is associated with MCS diagnostic and interactive uses. Higher PEU intensifies the use of MCS both for coordinating and monitoring outcomes as well as for outlining new strategies. Results also support the negative association between organizational structure and MCS diagnostic and interactive uses. It suggests that firms exhibiting higher centralization and lower levels of task specification and specialization will tend to use more intensively a lower number of MCS than more decentralized firms with higher levels of specification

and specialization of tasks. The relationships between technology and MCS uses and Size and MCS uses were not found to be statistically significant.

The limitations of this research stem from the low response rate and small sample size. Because of the need to respect the 10 times «rule of thumb», the small sample size made the inclusion of separate variables measuring the 3 dimensions of PEU (dynamism, unpredictability and hostility) and the 2 dimensions of Structure (decentralization and task specification and specialization), in conjuntion with technology and size, impracticable, resulting in the reduction of indicators used. However the number of indicators used (≥ 3 indicators) for PEU, Structure and Technology in the final reflective measurement model may be considered acceptable (Lee *et al.*, 2011). Additionally, the fact that unpredictability and task specification and specialization were measured only by two items each led to the decision of not considering them in the model as separate constructs in order to reduce PLS-SEM bias (Hair *et al.*, 2013). Likewise other variables that according to the literature might be of relevance in explainig MCS Use, such as strategy and organizational culture, could not be included in the model. The low R^2 in the PLS structural model suggests ommited variables which may induce upward bias on the path coefficients. However $R^2 > 0.10$ ensures that the variance explained by the endogenous variables has practical, as well as, statistical significance (Lee *et al.*, 2011).

Despite the limitations, this study contributes to the existing literature by providing cross-sectional evidence of the relationships between PEU, organizational structure, technology and MCS Diagnostic and Interactive Uses in the financial services sector. It also develops a measure of MCS in a more comprehensive way by considering risk management systems as part of the MCS used in an industry where risk plays a fundamental role. The use of two theories in partnership (the Contingency Theory and the Levers of Control framework) is also a positive aspect of this study.

Future research on MCS diagnostic and interactive uses should include the relationship with strategy. Many authors advocate that diversification requires differentiated, divisional structures (Chandler, 1962; Chenhall, 2007; Thompson & Strickland, 2003) and that strategy may be constrained by the established organizational structure (Donaldson, 1987). This suggests that the relationship between strategy and organizational structure may be bi-directional (Ferreira & Otley, 2009). It is also expected that strategy has a relationship with MCS diagnostic and interactive uses (Chenhall, 2007; Naranjo-Gil & Hartmann, 2006). Finally, the relationship between MCS use and organizational culture should also be investigated in future research (Chenhall, 2007).

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APPENDICES

Appendix 1 – Sample Details

Target Population	800
Number of companies excluded	377
Number of questionnaires sent	423
No. of completed questionnaires	60
No. of unusable answers *	10
Total sample size	**50**

* 2 answers were eliminated from the sample due to quality reasons and 8 for not providing answers to the questions related to the constructs under study.

Appendix 2 – Respondents' Profile

Position Held	**N**	**Experience in current position (average number of years)**
Board member/CEO	12	9,33
CFO	10	11,10
Controller	13	7,85
Other	15	9,87
Total	**50**	**9,46**

Appendix 3 - Companies Size (no. of employees)

Companies' Size			
	No. of Companies	**No. of Usable Responses**	**%**
Small (10 to 49 employees)	297	32	11%
Medium (50 to 249 employees)	104	15	14%
Large (more than 250 employees)	22	3	14%
Total	**423**	**50**	**12%**

Appendix 4 - Financial Sector Activity Description

NACE	Activity	No. of Companies	No. of Usable Responses	%
64	**Financial Services Activities**	**276**	**36**	**13%**
641	Monetary intermediation	133	20	15%
642	SGPS	96	10	10%
649	Other financial services activities	47	6	13%
65	**Insurance, Reinsurance and Pension Funds**	**56**	**6**	**11%**
651	Insurance	54	5	9%
653	Pension Funds and Professional Complementary Regimes	2	1	50%
66	**Auxiliary activities of financial services and insurance**	**91**	**8**	**9%**
661	Auxiliary activities of financial services	16	3	19%
662	Auxiliary activities of insurance and pension funds	61	3	5%
663	Fund management activities	14	2	14%
Total		**423**	**50**	**12%**

Note: a full Activity Description is available at INE (Instituto Nacional de Estatística) - Classificação Portuguesa da Actividades Económicas (Rev. 3)

Appendix 5 – Mann-Whitney and Median test results for two Independent Samples: comparison between the first 15 respondents and the last 15 respondents

	Mann-Whitney U Test Sig. (2 tailed)	Median Test Sig. (2 tailed)
STRUCTURE		
Degree of delegated authority in hiring/firing employees	0.217	0.272
Degree of delegated authority in developing new products/services	0.345	0.143
Degree of delegated authority in operational management	0.285	0.245
Degree of delegated authority in investments' selection	0.775	0.700
Degree of delegated authority in budgeting (allocation of resources)	0.267	0.272
Degree of delegated authority in pricing decisions	0.233	0.466
Task specification	0.325	1.000
Task specialization	0.033*	0.264
PEU		
Degree of predictability of competitors actions	0.624	1.000
Degree of predictability of customers' preferences and tastes	0.148	0.466
Assessment of the intensity of competition in diversity of marketed products/services	0.161	0.215
Assessment of the intensity of competition in accessing suppliers	0.902	1.000
Assessment of the intensity of price competition	0.233	0.450
Assessment of the intensity of competition in accessing human resources	0.436	0.466
Assessment of the company's economic external environment	0.744	0.682
Assessment of the company's legal external environment	0.267	1.000
Assessment of the company's political external environment	0.486	0.462
Assessment of the company's technological external environment	0.653	1.000
TECHNOLOGY		
Degree of task uncertainty	0.015*	0.009
Degree of process interdependency	0.089*	0.710
Degree of process standardization and automation	0.067*	0.060
SIZE (Ln No. Employees)	1.000	1.000
MCS DIAGNOSTIC USE	0.902	1.000
MCS INTERACTIVE USE	0.624	0.466

* the distributions for the two groups are different at p-value < 0.10.

Appendix 6 - Summary of indicators, questions, scales, anchors and source

Construct	Indicator	Question	Scales	Anchors	Source
PEU	Degree of predictability of competitors actions Degree of predictability of customers' preferences and tastes	Considering the last 5 years, how do you assess the degree of predictability of the following factors? (1) Competitors' actions; (2) Customers' preferences and tastes.	7 point Likert Scale	"Very predictable" and "Very unpredictable"	Gordon & Narayanan (1984)
	Assessment of the intensity of competition in diversity of marketed products/services Assessment of the intensity of competition in accessing suppliers [a] Assessment of the intensity of price competition [a] Assessment of the intensity of competition in accessing human resources	How do you assess the intensity of the following factors in your company's sector? (1) Price competition; (2) Competition in relation to the diversity of marketed products and services; (3) Competition in accessing human resources; (4) Competition in accessing suppliers.	7 point Likert Scale	"Insignificant" and "Extremely Significant"	
	Assessment of the company's economic external environment [a] Assessment of the company's legal external environment [a] Assessment of the company's political external environment [a] Assessment of the company's technological external environment [a]	How do you assess your company's external environment considering the following dimensions: (1) economic environment; "legal environment"; "political environment" and "technological environment".	7 point Likert Scale	"Very stable (few changes)" and "Very dynamic (constant changes)"	
STRUCTURE	Degree of delegated authority in hiring/firing employees [a] Degree of delegated authority in developing new products/services [a] Degree of delegated authority in operational management [a] Degree of delegated authority in investments' selection [a] Degree of delegated authority in budgeting (allocation of resources) Degree of delegated authority in pricing decisions	Indicate the degree of delegated authority to operation's managers and/or employees in relation to the following decisions: (1) Development of new products/services; (2) Hiring/firing employees; (3) Investments' selection (intangible assets, tangible assets and financial investments); (4) Budget allocation of resources; (5) Pricing of products and services; 6) Operational management of the business (negotiation with clients, purchasing materials, control and planning of production, etc.).	7 point Likert Scale	"Not delegated" and "Fully delegated"	Gordon & Narayanan (1984) and King *et al.* (2010).
	Task specification Task specialization	How do you assess the company's structure of activities in relation to: (1) Activities are specified/described; (2) Tasks are specialized.	7 point Likert Scale	"Nothing" and "Very much"	
TECHNOLOGY	Degree of task uncertainty Degree of process interdependency Degree of process standardization and automation	Indicate the extent to which the company's technologies are characterized by: (1) Standardized and automated processes; (2) High levels of task uncertainty; (3) High levels of process interdependence.	7 point Likert Scale	"Very low" and "Very high"	Chenhall (2007)

Note: The option of not answering/not knowing the answer to the questions was included for every item.
a Items eliminated from the final measurement model

Appendix 7 – The PLS measurement model

The PLS measurement model		
	Loading	*p* -values
PEU (*composite reliability: 0.818; AVE: 0.532*)		
Degree of predictability of competitors actions	0.650	0.000
Degree of predictability of customers' preferences and tastes	0.636	0.000
Assessment of the intensity of competition in diversity of marketed products/services	0.837	0.000
Assessment of the intensity of competition in accessing suppliers [b]	-	-
Assessment of the intensity of price competition [a]	-	-
Assessment of the intensity of competition in accessing human resources	0.776	0.000
Assessment of the company's economic external environment [a]	-	-
Assessment of the company's legal external environment [b]	-	-
Assessment of the company's political external environment [a]	-	-
Assessment of the company's technological external environment [b]	-	-
STRUCTURE (*composite reliability: 0.808; AVE: 0.525*)		
Degree of delegated authority in hiring/firing employees [a]	-	-
Degree of delegated authority in developing new products/services [b]	-	-
Degree of delegated authority in operational management [b]	-	-
Degree of delegated authority in investments' selection [b]	-	-
Degree of delegated authority in budgeting (allocation of resources)	0.458	0.024
Degree of delegated authority in pricing decisions	0.695	0.000
Task specification	0.811	0.000
Task specialization	0.866	0.000
TECHNOLOGY (*composite reliability: 0.800; AVE: 0.576*)		
Degree of task uncertainty (reversed score)	0.631	0.096
Degree of process interdependency	0.792	0.054
Degree of process standardization and automation	0.838	0.004

Note: [a] items removed because their outer loadings were below 0.40.

[b] items (with outer loadings between 0.40 and 0.70) removed in order to increase AVE above threshold value (> 0.50).

Appendix 8 – Cross Loadings

Cross-Loadings						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
(1) MCS DIAGNOSTIC USE	**1**	0.5671	0.0759	-0.0233	-0.2661	-0.0418
(2) MCS INTERACTIVE USE	0.5671	**1**	0.0875	-0.2005	-0.2480	-0.2076
(3) PEU						
Degree of predictability of competitors actions	0.0856	0.0784	**0.6499**	-0.0584	0.3315	0.2430
Degree of predictability of customers' preferences and tastes	0.0535	0.0587	**0.6355**	-0.0319	0.2646	0.2961
Assessment of the intensity of competition in diversity of marketed products/services	0.0571	0.0084	**0.8369**	0.1999	0.5484	0.5561
Assessment of the intensity of competition in accessing human resources	0.0375	0.1232	**0.7764**	0.1703	0.4771	0.1787
(4) SIZE	-0.0233	-0.2005	0.1321	**1**	0.2306	0.2824
(5) STRUCTURE						
Degree of delegated authority in budgeting (allocation of resources)	-0.1978	-0.0429	0.2630	-0.0351	**0.4581**	0.0439
Degree of delegated authority in pricing decisions	-0.2024	-0.0970	0.3176	0.1454	**0.6948**	0.1852
Task specification	-0.2664	-0.2888	0.4691	0.1796	**0.8110**	0.5924
Task specialization	-0.1357	-0.2092	0.5635	0.2805	**0.8657**	0.5912
(6) TECHNOLOGY						
Degree of task uncertainty (reversed score)	0.1298	-0.1083	0.0011	0.1303	0.1605	**0.6305**
Degree of process interdependency	-0.1409	-0.1814	0.4834	0.2204	0.5719	**0.7917**
Degree of process standardization and automation	0.0271	-0.1632	0.3551	0.2658	0.4140	**0.8379**

Appendix 9 – Latent variable correlations and square root of AVE (diagonal)

Latent Variable Correlations						
	(1)	(2)	(3)	(4)	(5)	(6)
(1) MCS DIAGNOSTIC USE	-					
(2) MCS INTERACTIVE USE	0.5671	-				
(3) PEU	0.0759	0.0875	**0.7297**			
(4) SIZE	-0.0233	-0.2005	0,1321	-		
(5) STRUCTURE	-0.2661	-0.2480	0,5825	0,2306	**0.7246**	
(6) TECHNOLOGY	-0.0418	-0.2076	0,4499	0,2824	0,5669	**0.7586**

	Minimum	Mean	Median	Maximum	Std. Deviation	z-value* Skewness	z-value* Kurtosis
STRUCTURE							
Degree of delegated authority in hiring/firing employees [a]	1.00	2.23	1.00	7.00	1.75	3.60	0.22
Degree of delegated authority in developing new products/services [a]	1.00	3.11	3.00	7.00	1.69	0.96	1.19
Degree of delegated authority in operational management [a]	1.00	3.94	4.00	7.00	1.71	0.46	0.74
Degree of delegated authority in investments' selection [a]	1.00	2.74	2.50	7.00	1.79	2.62	0.02
Degree of delegated authority in budgeting (allocation of resources)	1.00	3.04	3.00	7.00	1.64	1.00	1.25
Degree of delegated authority in pricing decisions	1.00	3.07	3.00	7.00	1.70	1.94	0.00
Task specification	2.00	5.00	5.00	7.00	1.48	0.58	1.21
Task specialization	1.00	4.60	5.00	7.00	1.60	0.79	1.21
PEU							
Degree of predictability of competitors actions	1.00	3.96	4.00	7.00	1.47	0.22	0.09
Degree of predictability of customers' preferences and tastes	1.00	3.77	4.00	7.00	1.25	1.21	1.43
Assessment of the intensity of competition in diversity of marketed products/services	1.00	4.42	4.50	7.00	1.73	0.72	1.06
Assessment of the intensity of competition in accessing suppliers [a]	1.00	2.80	6.00	7.00	1.75	2.88	0.76
Assessment of the intensity of price competition [a]	1.00	5.34	3.00	7.00	1.86	3.14	0.08
Assessment of the intensity of competition in accessing human resources	1.00	3.31	3.00	7.00	1.62	1.13	0.60
Assessment of the company's economic external environment [a]	1.00	5.39	6.00	7.00	1.64	2.91	0.09
Assessment of the company's legal external environment [a]	1.00	4.12	4.00	7.00	1.53	0.10	1.23
Assessment of the company's political external environment [a]	1.00	5.50	6.00	7.00	1.71	3.09	0.19
Assessment of the company's technological external environment [a]	1.00	3.98	4.00	7.00	1.66	0.23	0.90
TECHNOLOGY							
Degree of task uncertainty	1.00	2.57	2.00	7.00	1.67	3.30	0.93
Degree of process interdependency	2.00	4.16	4.00	7.00	1.49	1.08	1.28
Degree of process standardization and automation	1.00	4.82	5.00	7.00	1.65	1.30	0.79
SIZE (Ln No. Employees)	2.30	3.89	3.54	8.72	1.35	6.24	7.91
MCS DIAGNOSTIC USE	0.00	0.34	0.31	1.00	0.20	3.92	4.08
MCS INTERACTIVE USE	0.00	0.29	0.22	1.00	0.22	5.45	5.21

Note: [a] Items not included in the final measurement model

* Absolute z-values are presented. Significant skewness/kurtosis if absolute z-value >1,96.