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Management accounting innovations in a time of economic crisis

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ABSTRACT

Although there have been several callings, research in Management Accounting has given very few or even no guidelines as regards the way enterprises can handle the economic crisis in their everyday operations (e.g. Hopwood, 2009). Zawawi and Hoque (2010) argue that the new economic environment forces enterprises to adopt Management Accounting Innovations- MAIs. The purpose of this study is to cover the gap in the literature about the effect of the economic crisis on the adoption and the extent of use of MAIs. For this reason, a quantitative research with the use of questionnaires was carried out. Data analysis showed that those business units that have been most affected by the economic crisis tend to adopt more and use MAIs more extensively than those companies that have been less affected by it. Management Accounting Innovations provide broader and better information to handle the uncertainty that the economic crisis has created.

1. Introduction

The economic crisis, which emerged in 2008 has been a constant threat for the enterprises (Waymire & Basu, 2011). According to James, Wooten, and Dushek (2011), the economic crisis causes problems in cash flows, reduces available resources and demand, as well as causes political turmoil. Moreover, it raises uncertainty in the enterprises (Pearson & Clair, 1998) and makes the decision-making process and the exercise of management control more difficult (e.g. Mangena, Tauranga, & Chamisa, 2012).

In the literature, it is argued that the economic crisis has had an impact on the operation of Management Accounting and this is something that should be studied in more detail (Arnold, 2009; Van der Stede, 2011). Although there have been several callings (Hopwood, 2009; Abernethy & Mundy, 2014; Van der Stede, 2011), the relevant research in Management Accounting has given very few or even no guidelines as regards the way to handle the economic crisis on behalf of the enterprises. The new economic environment that has been now formed calls for new management tools, in order to achieve better crisis management (Arnold, 2009).

Zawawi and Hoque (2010) argue that the new economic environment forces the enterprises to adopt innovative Management Accounting techniques (Management Accounting Innovations- MAIs), which should be further investigated. Recently, Chenhall and Moers (2015) argued that Management Control Systems should incorporate Management Accounting Innovations, in order to be able to handle the uncertainty of the external environment and make management control more effective. There have been several works that study the adoption and the use of MAIs (e.g. Chiwamit et al., 2017; Al Sayed & Dugdale, 2015; Naranjo -Gil et al., 2009), but to the best of our knowledge none of them has linked them to the economic crisis.

Van der Stede (2011) introduces opportunities and threats in Management Accounting research in a crisis environment. This study attempts to give an answer to those challenges, by providing knowledge about the effect of the economic crisis and the adoption and the

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extent of use of MAIs. According to Van Der Stede, the economic crisis provides opportunities for research that are not present in a “normal change” period (Van der Stede, 2011).

Pavlatos and Kostakis (2015) report that there are differences between the level of importance and the extent of use of Management Accounting tools before and during the economic crisis. They found that the importance and the usage of Activity Based Costing, Planning, and Strategic Management Accounting tools increased during the crisis, while at the same period, the usage and the importance of traditional cost accounting practices were decreased. Most of the budgeting techniques are still considered important and are still widely used by firms.

The aim of this study is to cover the gap in the literature about the effect of the economic crisis on the adoption and level of use of MAIs, by formulating the following research question:

RQ1 How does the perception about the intensity of the economic crisis affects the adoption and the extent of use of MAIs?

One of the countries that has been most affected by the economic crisis is Greece. The country has been under recession for the last 7 years. In 2010, Greece requested and received financing from the IMF and the European council, with the condition to start a strict austerity program and fiscal discipline, in order to reduce its deficits. Under the threat of the economic crisis, the Eurozone countries introduced the European Stability Mechanism (ESM) to warrant the economic stability of the Eurozone. The country signed 2 memorandums of understanding (MoU), which are periodically evaluated by the troika (now the so-called Institutions) (European Commission, 2010; 2011). Due to the changing environment in the political scene in Greece, the program was not implemented and, finally, the country applied capital controls' scheme. The new government that was elected in the next elections signed a 3rd MoU for the years 2015–2018 (European Commission, 2015). It is widely known that the business activity in Greece has been shrunk since 2008, which makes the enterprises difficult to survive. The crisis has led to the reduction in demand, sales, production, as well as problems in cash flows and loan repays (Capital, 2016). Under those circumstances, Greece is the ideal environment to study the effect of the economic crisis in the adoption and use of MAIs.

This paper extends the previous research in many ways. Firstly, it examines for the first time, the impact of the economic crisis on the adoption and the extent of use of MAIs. Previous surveys examined the level of importance and the extent of use of traditional and innovative management accounting practices at different periods of time (i.e. before and during the economic crisis) and identified differences between them. This study measured the perceptions regarding the intensity of the economic crisis, as a new construct, and investigated the impact of crisis' perception on the adoption and the extent of use of MAIs. Secondly, this research used more powerful statistical tests, such as multivariate data analysis techniques, compared to previous surveys, which mainly they used *t* tests. Thirdly, the choice of only one sector (the manufacturing sector) guarantees internal validity and allow to control for industry effects, as compared to previous studies, that were performed among different sectors (e.g. Becker, Mahlendorf, Schäffer, & Thaten, 2016; Janke, Mahlendorf, & Weber, 2014; Pavlatos & Kostakis, 2015).

Furthermore, it extends the limited knowledge about the effect of the economic crisis in Management Accounting, by providing insights about the adoption and the extent of use of MAIs in a period of economic crisis. This means that his paper gives relevant answers to Hopwood's challenges (2009) about how the economic crisis affects Management Accounting. Lastly, it gives insights about the use of Management Accounting techniques in Greece, which has not been extensively studied.

This work is divided into the following sections: The next section is about literature review and hypothesis development. In the third section, a description of the methodology is provided. The fourth section presents the findings of the study, while the last section discusses the findings and concludes.

2. Theory and hypothesis development

It is widely accepted that innovation is a prerequisite for a business to succeed (e.g. Naranjo -Gil et al., 2009). According to the relevant literature, innovation is the adoption of an idea or a behavior, which is linked to a product or a service, or a technical procedure, which is something new for the business that adopts it (Damanpour, 2014). Innovation in Management Accounting (Management Accounting Innovation- MAI) is the adoption of a practice in Management Accounting for the first time by an enterprise (Zawawi & Hoque, 2010).

Innovative Management Accounting tools, such as activity-based costing (ABC) (e.g. Al-Omiri & Drury, 2007; Al Sayed & Dugdale, 2015), target costing (e.g. Ansari, Bell, & Okano, 2007), lifecycle costing (e.g. Cravens & Guilding, 2001), EVA (e.g. Chiwamit et al., 2017) and Balanced scorecard (BSC) (Ax & Greve, 2016; Kaplan & Norton, 1996) have been studied empirically by many researchers (e.g. Ax & Greve, 2016; Zawawi & Hoque, 2010). A great number of those researches have focused on the underlying features of the enterprises that affect the adoption of MAIs (e.g. Chenhall, 2007; Naranjo -Gil et al., 2009; Reid & Smith, 2000; Brown et al., 2004). It is also argued that the contingencies of the enterprises affect the adoption of MAIs (Naranjo -Gil et al., 2009).

This work is based on contingency theory. This theory is principally derived from organizational theory and it was later implemented in Management Accounting. According to contingency theory, environmental factors affect Management Control Systems design (Chenhall, 2003). One of these factors is uncertainty. Uncertainty is the difference between the information that is needed to execute an operation or an activity and the information that is available at this point of time (Janke et al., 2014). Gordon and Narayanan (1984) present various types of uncertainty that are linked to changes in technological, competitive, economic and customer-based environment of the company.

The economic crisis has created a condition of increased uncertainty for the organizations (Ury & Smoke, 1991). Janke et al. (2014) argue that there is a positive relationship between the intensity of the economic crisis and the level of uncertainty that the companies experience. They regard that the companies that have been most affected by the crisis, experience greater levels of uncertainty in the

allocation of their limited resources, as compared to the period before the crisis. This is due to the fact that one cannot forecast with accuracy how customers will decide to allocate their limited income or if suppliers will be able to manage their orders (Janke et al., 2014). Consequently, the decision-making process is becoming more difficult, as more and better quality of information is needed (Lin, Xia, Ismail, & Carley, 2006). Due to this uncertainty and the limited information, there is difficulty in forecasting certain components of the company's environment. Concluding, as the uncertainty for the external environment increases and the future is becoming more unclear, more analytical information is needed to be used in the decision-making process and in management control (Hopwood, 2009). In other words, companies need better quality of information to manage their goals and fulfil their strategic plans (Becker et al., 2016; Collins, Holzmann, & Mendoza, 1997).

Hopwood (2009) argues that the economic crisis has led to changes in the design of Management Accounting Systems, which now provide better quality of information (more analytical, more precise and more frequent) to manage the economic crisis. This information has to originate from the internal, as well as the external environment and has to be used to cover the information gap, in order to reduce the uncertainty that the companies experience due to the economic crisis. All this means that organizations have become more complex (Hopwood, 2009).

There have been very few empirical researches in the literature up-to-date that relate the economic crisis to Management Accounting Systems. Initially, Collins et al. (1997) note that there is a relationship between a company's strategy and the budgets' practices in political and economic crisis in Latin America. They found that high economic crisis reduced the usefulness of budgeting system. Reid and Smith (2000) also note that cost management systems are affected by the economic crisis. They report that in young firms, the experience of externally caused cash flow economic crises is associated with the introduction of cost management techniques.

Moreover, Janke et al. (2014) argue that there is a relationship between the perception of the upper level management about the crisis and Management Control Systems. They report that the perception of negative external economic crisis effects leads to more interactive use of Management Control Systems. Their findings support a positive effect of the interactive use of Management Control Systems on senior managers' perception of negative external crisis effects. Furthermore, Becker et al. (2016) examine the impact of economic crisis on budgeting. They found that during economic crisis budgeting practices became more important for planning and resource allocation but less important for performance evaluation. Results shows that firms emphasize in certain budgeting functions during economic crisis (Becker et al., 2016).

In addition, Pavlatos and Kostakis (2015) report that during economic crisis in Greece, the management accounting techniques that are used more are strategy (e.g. industry analysis), budgeting (e.g. budgeting for planning cash flows, budgeting for controlling costs), planning (e.g. long-range forecasting, strategic plans) and strategic management accounting (e.g. competitor cost assessment, customer profitability analysis), while those that are used less are traditional cost accounting systems (e.g. absorption costing, process costing, job order costing), performance evaluation (e.g. cash flow return on ROI, residual income) and decision-support systems (e.g. operations research techniques).

According to Chenhall and Moers (2015), Management Control Systems have to adopt innovations, in order to deal with uncertainty. Specifically, they mention that those systems have to become more complex and include not only traditional tools (i.e. budgets and variances analysis), but also new and innovative Management Accounting techniques, such as ABC, BSC, Target costing and Lifecycle costing. The latter improve the decision-making process and contribute to a more effective exercise of management control. They also provide rich information for materializing formal controls (Chenhall & Moers, 2015) and finally contribute to the improvement of a company's profitability. Moreover, Zawawi and Hoque (2010) argue that recent global economic developments and uncertainty may affect the adoption of MAIs. Adversely, more analytical and more integrated information that MAIs provide to the companies may also reduce uncertainty (Simons, 1995).

In this study, it is assumed that, in order to deal with uncertainty, the companies that have been most influenced by the economic crisis adopt and use MAIs in their everyday operations to a greater extent than those companies that have been less affected by the crisis. This happens because those tools give better quality of information and, finally, improve the decision-making process. Therefore, those companies are able to handle the crisis in a better way and, ultimately, survive.

Based on the contingency theory and on the conceptual framework of the crisis, the following research hypotheses are formulated:

H1. The perception about the intensity of the economic crisis has a positive impact on the adoption of the following MAIs: a) ABC b) BSC c) Target Costing d) Lifecycle costing e) EVA

H2. The perception about the intensity of the economic crisis has a positive impact on the extent of use of MAIs. (See Fig. 1).

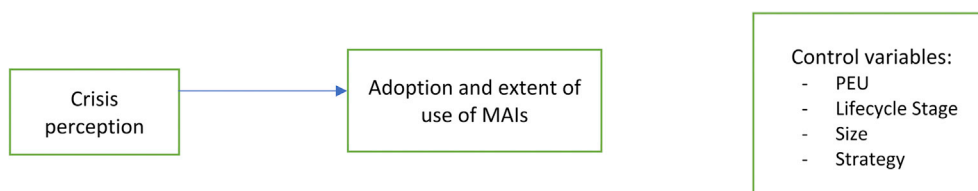


Fig. 1. Research model.

With the purpose of avoiding mistakes by omitting variable bias, this study incorporates variables that have been previously used in similar surveys for the adoption of MAIs (e.g. [Naranjo -Gil et al., 2009](#); [Burkert & Lueg, 2012](#)), as well as similar surveys that study the effect of the economic crisis ([Becker et al., 2016](#); [Janke et al., 2014](#)). The control variables, which have been used are a) the size b) the lifecycle stage c) the perceived environmental uncertainty - PEU and d) the business strategy. According to contingency theory, those variables are assumed to influence Management Accounting System design.

3. Methodology

3.1. Data collection

This work is about the effect of economic crisis in the adoption and the extent of use of management accounting innovations (MAIs). Data collection was performed with a web-based survey approach. This approach has many advantages as compared to traditional data collection techniques, i.e. questionnaires that are posted, such as reduction in data collection times, higher response rate, reduction in the total cost of the survey etc.

The questionnaire was divided into sections. After responding to one question, the respondent was automatically transferred to the next relevant question. The questionnaire was sent and filled on a business unit level. This was done because the use of management accounting techniques may differ among the business units within the same organization ([Burkert & Lueg, 2012](#)) or because different characteristics of business units may differ among them ([Al-Omiri & Drury, 2007](#)).

The questionnaire was sent to manufacturing companies that operate within the Greek territory. The choice of only one sector of production guarantees a better control of the variables, which are incorporated in the survey, as well as guarantees internal validity, as compared to a survey that is performed among different sectors of production ([Davila, 2000](#)). It also allows for a firm comparison with other relevant surveys (e.g. [Al Sayed & Dugdale, 2015](#); [Ax & Greve, 2016](#)). The reason for choosing the manufacturing sector is the fact that it is the one most affected by the economic crisis, as compared to the service sector, i.e. tourism ([Imerisia, 2017](#)).

The sampling frame was collected from ICAP database in Greece. The type of enterprises that consist of the manufacturing sector in Greece has diversified over the last years due to the economic crisis and as such this work was based on the newly formed data in the manufacturing sector in Greece ([INR-Greek Manufacturing Industry, 2017](#)). It also focused on big enterprises, as indicated by the number of their employees, i.e. at least 200 employees ([Ax & Greve, 2016](#)). In line with the above, 454 business units were formed that fulfilled the criteria and were selected for the survey. Finally, 122 business units returned the questionnaire. From those, six didn't fill the questionnaire and five finally replied that their unit consisted of less than 200 employees. Those units were not incorporated in the data sample; 111 questionnaires were used in the analysis (response rate 24%).

It should be noted that [Dillman's \(2000\)](#) procedures for questionnaires were adopted, as a strategy in the development of the questionnaire. Before sending the relevant email to each business unit, the questionnaire was pilot-tested. It was sent to three academics in the area of Management Accounting and five management accountants and CFOs. Pilot-testing suggested improvements in the design of the questionnaire, such as some word replacements that were confusing, changes in the sequence of questions, better description of innovative management accounting techniques etc. This would ensure clearer understanding of the relevant MA tools. The interviews with the management accountants and the CFOs also helped with the understanding of the adoption stages of innovative MA tools.

Managers of the relevant business units were first contacted by phone and were asked whether they wished to participate in the survey, after they were informed about its purpose. Many enterprises declined, due to time constraints, although they responded that the survey was, in fact, very interesting.

The email was sent to the General Managers of the business units, accompanied by a letter with a brief reference of the scope of the study. It also politely requested to forward the email to another business executive for completion, if they thought appropriate. After ten days from the original email, a reminder email was sent and 15 days later, the General Managers were contacted by phone and were politely asked to fill the questionnaire, if they wished. Those who positively responded were sent an email with the relevant hyperlink that included the questionnaire, to be completed on-line.

Data collection was performed between September–December 2016 and the quality check of the questionnaires was done between January–March 2017. The representativeness of the sample was checked with regards to the population from ICAP database, as far as the sub-industries and the number of employees are concerned and no statistical significant differences were found on a 5% level.

In order to determine whether early and late respondents gave different responses, statistical tests for non-response bias were performed. Chi-square tests indicated that there were no significant differences in the demographic characteristics. In the following table, demographic statistics indicate the profile of the business units that participated in the survey.

[Table 1](#) shows that more than 50% of the enterprises employ between 200 and 350 employees, while the majority belong to the food sub-industry. The fewer belong to the oil, minerals and basic metals industries. Panel A in the table also shows that the majority of the questionnaires was filled up by chief controllers (58%), followed by CFOs (31%). Chief controllers are in fact information managers, as they interact with all the managers in the enterprises and can therefore provide organizational and technical details, which are essential for this study ([Brown, Booth, & Giacobbe, 2004](#)).

3.2. Variables measurement

3.2.1. Management accounting innovations adoption and extent of use

In this study, we chose to incorporate innovative management accounting tools, which are clearly defined ([Ax & Greve, 2016](#)). As mentioned in the relevant literature, management accounting tools, such as BSC, ABC, EVA, Target costing and Life cycle costing not

Table 1
Demographic characteristics of the enterprises that participated in the survey and managers who filled the questionnaires.

	N	%
Panel A: Job position		
CFO	35	31
Chief controller	64	58
Other	12	11
	111	100
Panel B: No of employees (size)		
200–350	58	52
351–500	38	35
501–650	10	9
651–800	4	4
801–950	1	1
	111	100
Panel C: Sub-industry		
Food	29	26
Beverages	15	13
Oil	3	3
Minerals	4	4
Basic metals	4	4
Chemicals	9	8
Drugs	9	8
Tobacco	10	9
Electronics/Electrical equipment	9	8
Paper	8	8
Plastic	6	5
Other	5	4
	111	100

only are innovative tools (Chenhall & Moers, 2015) and have been used to measure Management Accounting Innovations – MAIs (e.g. Chiwamit et al., 2017; Ax & Greve, 2016; Al Sayed & Dugdale, 2015; Naranjo -Gil et al., 2009), but they also have a lower degree of interpretative viability as compared to Strategic Management Accounting or Value Based Management (Ax & Greve, 2016).

As Ax and Greve (2016) mention, the study of a specific MAI tool presupposes its widespread use in the business environment. In order to measure the adoption and the extent of use of innovative MA tools, we examined management accounting practices that have been analyzed in other surveys, such as ABC and BSC, but we also incorporated innovative tools, which have been studied in a less empirical way, such as EVA, Target Costing and Life Cycle costing and need to be examined in more details (Chiwamit et al., 2017). Also, another reason for choosing those five specific MA innovative tools was the popularity of those tools in the Greek business environment (Pavlatos & Kostakis, 2015).

Recent studies have analyzed the adoption of MAIs in two different ways: a) at the implementation stage (e.g. Ax & Greve, 2016) and b) the extent of use of a specific MAI tool (e.g. Naranjo -Gil et al., 2009). In this study, both measurements were used separately for each MAI tool. Similar measurements can also be found at (Al Sayed & Dugdale, 2015).

Adoption of MAIs: The level of adoption of MAI tools was measured with an instrument that has been utilized in other studies, also taking into account the implementation stages of MAIs (Brown et al., 2004). The stages that were incorporated are: 1) We have never used this innovative tool in the past and we do not intend to adopt it 2) We have used this innovative tool in the past but we have abandoned it 3) We have not use this innovative tool in the past, but we intend to adopt it 4) We somewhat use this innovative tool today 5) We intensively use this innovative tool today. Those who answered (4) and (5) were considered as adopters; the rest as non-adopters.

Extent of use of MAIs: In order to measure the extent of use for each MAI tool, we used a measurement scale that has also been utilized in other studies (e.g. Al Sayed & Dugdale, 2015; Naranjo -Gil et al., 2009). Respondents were asked to determine the use for each MAI in their business unit, by using a 7-point Likert scale with values starting from 1 «not at all», to 7 «to a great extent». According to Baird, Harrison, & Reeve (2004) this measurement tool ensures a wide measurement of the extent of use of MAI tools. Variables that were measuring the extent of use of those particular five MAI tools were modeled to be manifest indicators reflective of a latent construct called 'Extent of use of MAIs' (Naranjo -Gil et al., 2009). Factor analysis was performed on the construct "Extent of use of MAIs", in order to reduce the number of items. All variables were loaded on one single factor. This factor explained 65% of the variance. Since Cronbach's alpha of this scale (0.78) was satisfactory (Nunnally, 1978), we decided to adopt the mean value for this construct.

Responds relevant to the extent of use of MAIs were cross -tabulated with the adoption stages for each MAI tool separately, in order to ensure maximum validity. Statistical analysis showed that no business unit that claimed to have adopted a specific MAI tool, were not using it and vice versa. If such a case existed, it would have been excluded from the analysis (Al Sayed & Dugdale, 2015).

3.2.2. Economic crisis' perception

As we reported above, the key features of an economic crisis are a shock element, along with uncertainty regarding different factors such as market demand and availability of capital (Becker et al., 2016). The construct "economic crisis' perception" was measured with 6 items, which were adopted by Janke et al. (2014) and used by Becker et al. (2016). One item addressed the impact of the perceived crisis on the respondent's company. The other items focused on more specific aspects, as we report below. It was also adjusted to fit into the

Greek economic environment. This construct related to perceptions of context-specific on-going crisis. It measured the actual impact of the current economic crisis. These items reflected the threat which the crisis posed to the organizations and the uncertainty which management was facing.

Respondents were asked to indicate their degree of agreement and disagreement on statements regarding the perceived effect of economic crisis on their business unit: 1) To what extent is your business unit impacted by the economic crisis? 2) Please indicate the extent to which your business unit faces the following impacts of the economic crisis (a) Have orders declined? (b) Have sales declined?

(c) Have customers increasingly failed to pay? (d) Have suppliers increasingly been unable to provide good or services? (e) Is your business unit affected by capital controls? All were measured on a scale of (1) 'not at all' to (7) 'to a great extent'.

The economic crisis impacted the companies in our sample most severely in terms of declining orders and sales and affected by capital controls. For the subsequent analysis, the mean score was calculated from these six items. Factor analysis was performed for the construct "crisis perception", in order to reduce the number of items. All variables were loaded on one single factor. This factor explained 72% of the variance. Cronbach's alpha (0.83) was acceptable (Nunnally, 1978); therefore, we decided to adopt the mean value of this construct. The following table shows the descriptive statistics for economic crisis' perception. Table 2 shows a clear decline in sales, as perceived by top-level managers and a clear impact of the economic crisis in the industry, as indicated by the mean value of the construct.

3.2.3. Control variables

This work has utilized previously used control variables to test the impact of the economic crisis in Management Accounting tools and Management Control Systems (Becker et al., 2016; Janke et al., 2014). The construct 'perceived environmental uncertainty' was measured by Gordon and Narayanan (1984) on a Likert scale, full-anchored instrument. The following statements regarding the perceived environmental uncertainty were given to participants, in order to indicate their strong agreement/disagreement: (1) The external environment of your business unit is rapidly changing (2) Many new products in the industry have been marked during the past 5 years (3) It is becoming more difficult to predict the market activities of your competitors during the past 5 years (4) It is becoming more difficult to predict the tastes and preferences of your customers during the past 5 years These statements were measured on a scale from '1' (strongly disagree) to '7' (strongly agree). Factor analysis was performed for this construct, in order to reduce the number of variables. All items loaded on one single factor with an Eigenvalue that is above 1. This factor explains 62% of total variance. Cronbach's alpha of this scale was 0.82, therefore we decided to adopt the mean value for this construct.

The variable 'organizational strategy' was based on Porter's classification scheme (Porter, 1980). It was measured on a single question adopted from Govindarajan (1988), which asks the participants to indicate which best describes their view on the company's strategic emphasis, ranging from cost leadership (1) to product differentiation (7).

The variable 'organizational life-cycle stage' was based on the Kazanjian and Drazin (1990) self-categorization measure. This measure was slightly modified to fit current research, as the original one is designed for technology-based enterprises. It was also used by Ansari, Fiss, and Zajac (2010). Respondents were asked to assess the lifecycle of their firm on a 5-point Likert scale. The lifecycle consists of 5 stages: formation/birth, growth, mature stage, realignment/revival and decline. Higher values mean more mature companies. Finally, "Company size" was measured using the natural logarithm of the number of employees according to Janke et al. (2014).

4. Results

4.1. Adoption and extent of use of MAIs

Table 3 shows the results for adoption and extent of use of MAIs. Table 3 clearly shows that the adoption rate of MAIs is high. This is shown from all MAIs individually, if we compare the adopters versus non-adopters. The results confirm the findings from the research performed by Pavlatos and Kostakis (2015), which explained that MAIs are, indeed, used in the Greek business environment. BSC has the higher adoption rate and use, followed by Target Costing.

Table 4 shows that there is a positive and statistically significant correlation between the extent of use of MAIs and crisis' perception.

Table 2
Descriptive statistics of economic crisis' perception.

	Mean	S.D	Min	Max
1. To what extent is your business unit impacted by the economic crisis?	5.65	1.60	2	7
2. Please indicate to what extent your business unit faces the following impacts of the economic crisis:				
a. Have orders declined?	5.61	1.82	2	7
b. Have sales declined?	5.74	1.94	2	7
c. Have customers increasingly failed to pay?	5.12	1.53	1	7
d. Have suppliers increasing been unable to provide good or services?	5.24	1.90	2	7
e. Is your business unit affected by capital controls?	5.52	1.84	2	7

Table 3
Adoption and extent of use of MAIs.

Adoption	ABC	BSC	Target Costing	EVA	Lifecycle costing
	N (%)	N (%)	N (%)	N (%)	N (%)
We have never used this MAI tool in the past and we do not intend to use it	15 (13%)	8 (7%)	12 (11%)	13 (12%)	16 (14%)
We have use this MAI tool in the past but we abandoned it	8 (7%)	4 (4%)	2 (2%)	10 (9%)	2 (2%)
We have never used this MAI tool in the past, but we have decided to adopt it	14 (13%)	8 (7%)	15 (13%)	12 (11%)	19 (17%)
We somewhat use this MAI tool today	30 (27%)	35 (32%)	31 (28%)	31 (28%)	28 (25%)
We intensively use this MAI tool	44 (40%)	56 (50%)	51 (46%)	45 (40%)	46 (42%)
Adopters	74 (67%)	91 (82%)	82 (74%)	76 (68%)	74 (67%)
Non- adopters	37 (33%)	20 (18%)	29 (26%)	35 (32%)	37 (33%)
Extent of use (N = 111)					
Mean	5.14	5.44	5.24	5.08	4.92
S.D.	1.82	2.02	2.12	1.74	2.24
Minimum	1	1	1	1	1
Maximum	7	7	7	7	7

Table 4
Descriptive statistics and Pearson correlation coefficients (N = 111).

	Mean	S.D	Min	Max	1	2	3	4	5	6
1.Extent of use of MAIs ^a	5.16	1.98	1	7	1.00					
2. Crisis' perception	5.48	1.78	2	7	0.28*	1.00				
3. PEU	5.12	1.65	1	7	0.14	0.12	1.00			
4. Strategy	5.08	1.44	1	7	0.18	0.23	0.18	1.00		
5. Lifecycle stage	3.44	1.82	1	5	0.18	0.15	0.07	0.13	1.00	
6. Size (No of employees)	306,5	121,5	201	924	0.15**	0.08	0.03	0.11	0.05	1.00

Notes: ^a Variable values are calculated as mean scores.

Significance (two-tailed t-test): *p < 0.1; **p < 0.05.

This means that, as the intensity about crisis' perception is increasing, the extent of use of MAIs is also increasing. There is a positive and significant correlation between the extent of use of MAIs and the size of the company. Moreover, there is no statistically significant correlation between PEU and crisis' perception about the intensity of the economic crisis. This confirms the findings of Janke et al. (2014), as crisis' perception about the intensity of the economic crisis is a different kind of uncertainty than PEU. Generally, the correlations are relatively low, and no multicollinearity issues arose (no correlation exceeds 0.30).

Table 5 shows correlations between adoption of MAIs and independent variable. There are positive and statistically significant correlations between almost all MAIs (except EVA). This means that when a business unit adopts one tool, it usually adopts another one. There are positive and significant correlations between the adoption of almost all MAIs with the crisis' perception about the intensity of the economic crisis. Furthermore, there are positive and significant correlations between some MAIs and the size of the business unit. There is a positive and significant correlation between ABC adoption and the business strategy. Moreover, the correlations are relatively low, and no multicollinearity issues arose.

4.2. The method of analysis

In order to test the 1st research hypothesis, binary logistic regression was used with the aid of SPSS Version 18. Binary logistic regression is used, when the dependent variable is dichotomous (e.g. adopters/non-adopters), using a number of independent variables

Table 5
Pearson correlation coefficients between adoption of MAIs and independents variables (N = 111).

	1	2	3	4	5	6	7	8	9	10
1.ABC adoption ^a	1.00									
2. BSC adoption ^a	0.13**	1.00								
3. Target costing adoption ^a	0.11*	0.12*	1.00							
4. Lifecycle costing adoption ^a	0.14**	0.21**	0.18*	1.00						
5. EVA adoption ^a	0.18	0.15**	0.10**	0.17	1.00					
6. Crisis' perception	0.29*	0.27*	0.26**	0.25*	0.28*	1.00				
7. PEU	0.23	0.18	-0.14	0.22	0.16	0.12	1.00			
8. Strategy	0.10**	0.11	0.18	0.17	0.14	0.23	0.18	1.00		
9. Lifecycle stage	0.23	0.21	0.19	0.04	-0.05	0.15	0.07	0.13	1.00	
10. Size	0.18**	-0.18	-0.20	0.08*	0.11*	0.08	0.03	0.11	0.05	1.00

Notes:^aIntroduced as dummy variables.

Significance (two-tailed t-test): *p < 0.1; **p < 0.05.

(Hosmer & Lemeshow, 2000). It is mentioned that many researchers prefer to use binary logistic regression, rather than discriminant analysis, because it is more similar to linear regression and it doesn't have all those strict conditions that are incorporated in discriminant analysis. The sample of 111 observations meet the suggested minimum ratio 5 to 1 for logistic regression and discriminant analysis, and the minimum ratio 15 to 1, if the sample were not split into analysis and holdout samples (Hair, Anderson, Tatham, & Black, 1998). The sample, when split into analysis and holdout (validation) samples, provides approximately a 10 to 1 ratio of observations to independent variables. Moreover, both groups (adopters and non-adopters) exceeded the minimum size of 20 observations per group (Hair et al., 1998).

Logistic regression was performed for each MAI tool individually and for all those business units that participated in the survey. Crisis' perception was used as an independent variable and PEU, Strategy, Lifecycle stage and Size were used as control variables.

Table 6 presents results from the logistic regression. It presents the results the impact of crisis' perception on Individual Management Accounting Innovations. The analysis showed that crisis' perception about the intensity of the economic crisis influences ABC adoption ($p < 0.01$). Furthermore, the control variables Strategy ($p < 0.05$) and Size ($p < 0.05$) influence ABC adoption. The positive sign in logistic regression shows that crisis' perception about the intensity of the economic crisis has a positive effect in the adoption of ABC. The value of Exp.B (1.324) is greater than 1. This means that, as the values of the independent variables increase, the value of the dependent variable increases as well. The Chi-square statistics is the same as the F statistics in multiple regression (Hair et al., 1998). Our model is statistically significant in a 0.000 level. Moreover, the Hosmer and Lemeshow goodness of fit (0.772) indicates that the model does not differ significantly from the undeserved data (Hair et al., 1998). Nagelkerke R square (0.556) is a measure of the proportion of explained "variation" in the model (Pavlatos & Paggios, 2009). Our model classified correctly 88% of the observations in ABC adopters and non-adopters. Table 6 also shows results from logistic regression performed with BSC adoption/non-adoption as a dependent variable. The analysis showed that crisis' perception about the intensity of the economic crisis positively influences BSC adoption ($p < 0.01$). The positive sign in logistic regression shows that crisis' perception about the intensity of the economic crisis has a positive effect in the adoption of BSC. Our model classified correctly 89% of the observations in BSC adopters and non-adopters.

The analysis showed a positive influence of the crisis' perception about the intensity of the economic crisis and Target Costing (TC) adoption ($p < 0.05$). The positive sign in logistic regression shows that crisis' perception about the intensity of the economic crisis has a positive effect in the adoption of TC. The control variables didn't influence TC adoption in a significant level. Our model classified correctly 78% of the observations in TC adopters and non-adopters. Table 6 shows results from logistic regression model, when Lifecycle Costing was used as the dependent variable. The analysis showed that crisis' perception about the intensity of the economic crisis positively influences LCC adoption ($p < 0.05$). The control variable 'size' positively influences LCC adoption ($p < 0.05$). The positive sign in logistic regression shows that crisis' perception about the intensity of the economic crisis has a positive effect in the adoption of LCC. Our model classified correctly 86% of the observations in LCC adopters and non-adopters. Furthermore, the analysis showed that crisis' perception about the intensity of the economic crisis positively influences EVA adoption ($p < 0.01$). The control variable 'size' positively influences EVA adoption ($p < 0.05$). The positive sign in logistic regression shows that crisis' perception about the intensity of the economic crisis has a positive effect in the adoption of LCC. Our model classified correctly 72% of the observations in EVA adopters and non-adopters.

In order to test the 2nd research hypothesis about the extent of use of MAIs, we used Partial Least Squares (PLS), which is a multivariate analysis technique for testing structural models (Hulland, 1999). This tool is suitable for small sample sizes, less than 100 observations, and has less requirements than other techniques, such as AMOS (Chin, 1998). A PLS model was performed in two phases a) The reliability test and the validity of measurement model and b) the development of the structural model to test the relationship between the variables.

The measurement model in PLS checks whether there is individual item reliability, construct reliability and discriminant validity (Fornell & Larcker, 1981). Individual item reliability exists when a variable has a factor loading, which is greater than 0.700 in the construct where it belongs. Construct reliability is checked using internal composite reliability (ICR). Table 7 shows that all ICRs are well above 0.800, which leads us to conclude that reliability of the constructs is acceptable in our model. Cronbach's alphas lead us to similar conclusions. The average variance extracted (AVE) exceeded the criterion of 0.50 for all variables (Chin, 1998). The discriminant validity was also acceptable, as in all cases AVE was greater than the squared correlation. It can also be observed that the constructs Crisis' perception and PEU are different constructs and, therefore, measure different types of uncertainties (see Table 8).

After the reliability test and the validity of measurement model were performed, the analysis focused on the structural model. Bootstrapping was based on 500 runs and was used to generate standard errors and t-statistics (Chin, 1998). Table 12 reports the results from PLS analysis for the whole sample ($n = 111$). There is strong evidence to support H2 hypothesis, as far as perception about the intensity of the economic crisis. The analysis showed that crisis' perception has a positive and statistically significant influence in the extent of use of MAIs ($\beta = 2.84$, $p = 0.003$) in a 5% level. Also, from the control variables used in the model, only the variable 'Size' of the company has a positive and statistically significant impact in the extent of use of MAIs ($\beta = 2.08$, $p = 0.026$). The other control variables (PEU, Strategy and Lifecycle stage) don't influence the extent of use of MAIs in a 5% level.

In order to confirm the robustness of our results, we checked two more models. We used discriminant analysis to test the 1st research hypothesis, where the dependent variable was binary. This type of analysis is used in similar problems; it was also used because its conditions for applying it are satisfied, such as the normality of the variables and the sample size compared with the number of independent variables (Hair et al., 1998). Discriminant analysis was performed for each MAI tool individually and for all those business units that participated in the survey. SPSS 18 was used. Data analysis gave similar results, as the ones produced by logistic regression. In order to test the 2nd research hypothesis for the effect of the economic crisis in the extent of use of MAIs, we used ordinal regression analysis, with the same independent variable as the ones that were used in PLS. Analysis gave similar results. Summarizing, the

Table 6
Binary Logistic Regression: The impact of crisis' perception on Individual Management Accounting Innovations.

	ABC (N= 111)				BSC (N=111)				TC (N=111)				LCC (N=111)				EVA (N=111)			
	B (p- value)	Exp.B	Tolerance (VIF)	Test of Hypothesis	B (p- value)	Exp.B	Tolerance (VIF)	Test of Hypothesis	B (p- value)	Exp.B	Tolerance (VIF)	Test of Hypothesis	B (p- value)	Exp.B	Tolerance (VIF)	Test of Hypothesis	B (p- value)	Exp.B	Tolerance (VIF)	Test of Hypothesis
Constant	-24.046 (0.002)	0			-18.036 (0.004)	0			-12.458 (0.012)	0			-18.032 (0.003)	0			-12.412 (0.009)	0		
Crisis' perception	0.306 (0.005)	1.247	0.743 (1.090)	H1a supported	0.378 (0.008)	1.324	0.758 (1.112)	H1b supported	0.412 (0.024)	1.424	0.852 (1.162)	H1c supported	0.382 (0.018)	1.247	0.799 (1.054)	H1d supported	0.507 (0.024)	1.154	0.844 (1.154)	H1e supported
Control variables																				
PEU	1.191 (0.135)	1.353	0.832 (1.184)		1.214 (0.142)	1.254	0.850 (1.174)		2.145 (0.185)	1.452	0.864 (1.162)		1.110 (0.150)	1.353	0.850 (1.172)		2.512 (0.214)	1.353	0.890 (1.144)	
Strategy	0.245 (0.042)	1.254	0.869 (1.156)		0.345 (0.095)	1.324	0.872 (1.148)		1.241 (0.144)	1.244	0.914 (1.114)		0.312 (0.612)	1.204	0.859 (1.163)		1.312 (0.134)	1.214	0.944 (1.101)	
Lifecycle stage	1.354 (0.312)	1.542	0.904 (1.104)		1.452 (0.232)	1.612	0.912 (1.087)		1.352 (0.310)	1.812	0.764 (1.312)		1.412 (0.218)	1.312	0.914 (1.098)		1.412 (0.344)	1.914	0.812 (1.234)	
Size	2.548 (0.038)	4.247	0.887 (1.128)		2.428 (0.105)	4.263	0.842 (1.134)		3.124 (0.188)	3.622	0.840 (1.152)		2.512 (0.040)	4.328	0.890 (1.115)		3.912 (0.038)	3.714	0.914 (1.098)	
Chi- square	0.000				0.000				0.000				0.000				0.000			
Hosmer – Lemeshow goodness of fit	0.772				0.752				0.748				0.758				0.724			
Cox and Snell R square	0.376				0.392				0.373				0.389				0.354			
Nagelkerke R square	0.556				0.546				0.528				0.587				0.488			
% correctly classified	88%				89%				78%				86%				72%			

Table 7
Reliability and validity analysis (n = 111).

Variable	ICR ^a	Alpha ^b	AVE ^c	Item	Loading
Extent of the use of MAIs	0.834	0.781	0.601	ABC	0.801
				BSC	0.784
				Lifecycle costing	0.772
				EVA	0.703
				Target Costing	0.805
Crisis' perception	0.864	0.830	0.624	To what extent is your business unit impacted by the economic crisis?	0.832
				Please indicate to what extent your business unit faces the following impacts of the economic crisis:	
				Have orders declined?	0.811
				Have sales declined?	0.789
				Have customers increasingly failed to pay?	0.795
				Have suppliers increasing been unable to provide good or services?	0.733
				Is your business unit affected by capital controls?	0.762
Perceived environmental uncertainty	0.834	0.821	0.618	The external environment of your business unit is rapidly changing	0.803
				Many new products in the industry have been marked during the past 5 years	0.786
				It is becoming more difficult to predict the market activities of your competitors during the past 5 years	0.810
				It is becoming more difficult to predict the tastes and preferences of your customers during the past 5 years	0.826

^a Internal composite reliability.

^b Cronbach's alpha.

^c Average variance extracted.

robustness checks supported Hypotheses 1_a, 1_b, 1_c, 1_d, 1_e and Hypotheses 2.

5. Discussion

The purpose of this study has been to investigate the effect of the economic crisis in the level of adoption and the extent of use of MAIs. Our incentive has been the callings of [Hopwood \(2009\)](#), to investigate the effect of the economic crisis in Management Accounting operations and of [Chenhall and Moers \(2015\)](#) to incorporate MAIs in Management Control systems. For this purpose, a survey was conducted in 111 enterprises, which operate in the Greek territory. In this research, five innovative management accounting tools were used: ABC, BSC, Target Costing, Lifecycle costing and EVA, because they are tools that are clearly defined and have been used in relevant surveys to measure MAIs (e.g. [Chiwamit et al., 2017](#); [Ax & Greve, 2016](#); [Al Sayed & Dugdale, 2015](#); [Naranjo -Gil et al., 2009](#)).

Data analysis showed that the extent of use of MAIs is very high. These findings also confirm the findings by [Pavlatos and Kostakis \(2015\)](#), who concluded that those tools are considered very important and are used extensively by Greek enterprises. BSC has the higher adoption rate and use, as compared to the rest of MAIs, which didn't differ much among them, as far as the adoption rate and the extent of use is concerned. Statistical analysis showed that business units usually adopt more than one MAI. This finding confirms the findings by [Chenhall and Moers \(2015\)](#), who argue that Management Control Systems incorporate new and innovative Management Accounting tools, which results in securing a more complex control of businesses' activities.

Data analysis also showed that those business units that have been most affected by the crisis, tend to adopt and use MAIs more extensively, as compared to those companies that have been less affected by it. Economic crisis has affected the operation of the companies and has increased their uncertainty. Due to the uncertainty that the economic crisis has created, more and better information is needed to reduce this uncertainty. For this reason, companies have adopted and tend to use MAIs more intensively, as those tools give

Table 8
Results from PLS analysis (n = 111).

Path to:	Extent of the use of MAIs		Test of Hypothesis
Path from:	Path coefficient	p values	
Crisis' perception	0.284	0.003	H2 supported
Control variables			
PEU	0.147	0.131	
Size	0.208	0.026	
Strategy	0.003	0.212	
Lifecycle stage	0.182	0.081	
	R ² = 0.235		

better information for the internal and the external environment of the company. As a result, the decision-making process is improved, and management control becomes more effective.

Our findings confirm the findings of Hopwood (2009), who argue that in order to better deal with the economic crisis, more and better quality of information is needed; also, better information may reduce uncertainty (e.g. Chenhall, 2003). As Chenhall and Moers (2015) mention, by adopting and using those tools, which can be used supplementary to each other, companies can now manage their limited resources and survive.

As far as MAIs are concerned, BSC is an integrated system that is used to measure business performance and is considered a cornerstone to materialize its strategy. It also combines various elements of the company that have been considered as independent in the past (i.e. customer satisfaction, cost reduction, group work) and, by applying this technique a better coordination and control of management's and employer's actions is achieved (e.g. Kaplan & Norton, 1996). This tool uses data from the internal and the external environment of the company and contributes to the reduction of the uncertainty that the economic crisis has created. Target Costing is a tool, which can be linked with the management of the economic crisis effectively, as it takes into account those product attributes that the customers wish to buy, as well as the price they want to buy them. Based on the customers' demands, companies start a process of cost reduction in order to satisfy their customers and achieve a desirable profit margin (Ansari et al., 2007). ABC gives analytical and precise information about the cost of the activities of a company and the elimination of those that are of no value (value added) for the customer, so as to achieve an effective cost management, which is essential in a period of economic crisis. EVA seeks to estimate the real financial value of the company and to measure the profitability of its capital employed. It helps manager focus on the profitability, facilitates decision-making in decentralized management structures and the achievement of the company's goals through a reward system and it generally constitutes the most accurate measure of a company's profitability (Bouwens & Spekle, 2007). It also provides important information during the economic crisis, as it 'translates' profit to elements of economic production, which allows for a comparison with the competition. Lifecycle costing brings together, classifies and manages all cost elements of the products in all of their life-cycle phases (research and development, production, distribution, customer service and withdrawal). The analytical information about the cost in every stage of the life-cycle of the product may reduce uncertainty, contributes to decision-making and cost reduction, which is a prerequisite in a period of economic crisis.

Our findings confirm the findings of Janke et al. (2014) and Becker et al. (2016), that the economic crisis 'produces' a different kind of uncertainty than PEU. According to contingency theory, even though it refers to the external environment and covers areas, such as competition and technological change, PEU is not necessarily linked to an economic crisis (i.e. Becker et al., 2016; Janke et al., 2014).

Our research has its limitations. Initially, it was performed in the manufacturing industry and its sub-categories. No data from the services industry were collected (i.e. tourism, hospitality) or the sales industry. This was done in order to achieve comparison with relevant studies (e.g. Al Sayed & Dugdale, 2015) and for internal validity purposes (i.e. Davila, 2000). It was also done, because this industry was mostly affected by the crisis in Greece and because some of those techniques are most widely applied in the manufacturing industry (Chenhall & Moers, 2015). Secondly, in our survey, data were collected at one time point only during the crisis. It might have been better if data were collected in another time point or even at more time points, in order to allow for better investigation in changes in the adoption and the extent of use of MAIs in different time periods (Janke et al., 2014). Thirdly, the measurement of some constructs was performed with single item measure. This measurement doesn't allow for the check of validity of those constructs. Fourthly, there are firms in the sample that were using MAIs prior the crisis, but these were not considered in the analysis performed. Future research should focus on them, as they can be considered as a specific group that needs to be investigated. Finally, this questionnaire was filled in by the respondents. We tried to limit the potential effects of this methodology, by following the instructions of Dillman (2000). Regardless of these limitations, this work provides knowledge on management accounting and economic crisis and especially on the adoption and use of MAIs.

We anticipate that the findings of this study will become an incentive to future researchers. More powerful and analytical theories are needed to study the effect of the economic crisis in the operation of Management Accounting. Also, incentives that lead to the adoption of MAIs during the crisis need to be studied in depth, using new-institutional theory (Abrahamson, 1991) or new theories about the adoption of innovation (Kennedy & Fiss, 2009). Also, the services sector should be studied or even the start-ups, which are under-researched (Chenhall & Moers, 2015) and investigate how the perception about the economic crisis has affected the adoption and the use of MAIs. Lastly, research should focus on the attributes (age, educational background, tenure) of the Chief Controllers or the upper managers (CFOs and CEOs), as, according to Upper Echelon literature, those characteristics tend to influence the adoption and the extent of use of MAIs during a period of economic crisis (Naranjo-Gil et al., 2009).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jeca.2018.e00106>.

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