SMEs' Performance and IT Investment: A Structural Equation Modeling (SEM) Approach

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Abstract. In the knowledge-based and globalized economy, information provides value to firms and Information Technology (IT) is the mechanism through which this can be achieved. Firms that exploit endless possibilities of IT obtain the capacity to overcome future challenges. This study focuses on Greek manufacturing SMEs that face an extremely competitive and unfriendly macro environment. The performance of IT investments of Greek SMEs is examined through a survey-based methodology covering the time period of 2004-2010, derived into two sub-periods (pre and post crisis period). Financial and qualitative (primary) longitudinal data are used to examin the impact of IT investments on financial performance during the last eight years. Additionally, the relationship between firm profitability and European IT investment subsidies along with other factors such as crisis, leverage, size, are examined. Using structural equation modelling, the results indicate that Greek SMEs with higher IT investments present higher profitability than their rivals, while IT investment subsidies affect positively firms' performance. As SMEs are the backbone of national economy, their competitiveness plays a significant role to national development and growth. Therefore, the findings of this research are important for practitioners, managers and policy makers.

Keywords: IT investments, Greek manufacturing SMEs, competitiveness, profitability, SEM.

1. Introduction

Greece's growth rate in fixed assets of firms experienced significant decrease from the eruption of financial crisis in 2008 (European Commission, 2012a). Medium-sized enterprises generate a value of €10 Billion per year or 14.8% of the total value added, while 18.4% is the average of the 27 countries of the European Union. Although, Greek companies perform better than their European counterparts on Entrepreneurship indexes, there is evidence that they face more difficulties in receiving aid from the State and Public Procurement. Additionally,, they face difficulties in their access to banking finance because of the tightening of loans after the crisis, while they fall behind in EU funded research projects and use of the Internet as a channel to buy or sell products.

SMEs play a very important role in the Greek economy comprising almost 99,5% of total firms in the country and accounting for most job positions (Voulgaris, Agiomirgianakis and Papadogonas, 2014). The viability and growth of those firms and especially the manufacturing ones, is crucial for the country's upturn and the decrease of unemployment. Two major contributors to the Greek economy are Manufacturing and Hospitality Industry (McKinsey & Company, 2012). Manufacturing has been experiencing a reduction in the last 20 years and represents the 8% of Greek economy, but it is the third largest employer contributing to national's job creation. Hospitality industry, on the other hand, is a traditional strength of the Greek economy, accounting for 15% of the Gross Domestic Product. Small and Medium-size enterprises (European Commission, 2003) from these two industries are chosen.

According to the "7th Programme for Research and Technological Development 2007-2013" (European Commission, 2012b), almost €50 billion were allocated towards SMEs for only technology related projects alone. Greek SMEs are eligible to participate in various European programs subsidizing part of their investments, especially in the area of innovation and new technology. These funds can prove to be vital for Greek SMEs which currently are not able to use more traditional funding from financial institutions (European Commission, 2012a), since they operate in a country which lacks behind its European counterparts on expenditures on Information and Communication Technologies as a percentage of GDP (European Commission, 2011).

IT expenditures form a critical part of the annual budget of the modern business enterprise and its importance is increasing (Henderson et al., 2010). Therefore, IT investments behavior needs theoretical explanations and its performance should become visibly measurable by explaining differences on various performance indexes among firms. The two leading theories of explaining the

performance differences among firms are Porter's Competitive Strategy and the Resource Based View (Rivard et al., 2006).

The effect of IT investment on firms' profitability is dubious. According to some studies abroad (Rai et al., 1997; Bharadwaj, 2000; Stratopoulos & Dehning, 2000; Mithas et al., 2012) the effect of IT on profitability is positive suggesting that they do not present the "profitability paradox" (Beccali, 2007).

Another point of concern is whether identification of IT investments into their respective categories has an impact on the final results obtained. Theodorou and Florou (2008) found mixed results from CAD/CAM systems' implementation in the Greek manufacturing industry. Successful implementation of Supply Chain Management (SCM) systems and Customer Relationship Management (CRM) systems were most likely to follow prior successful implementation of Enterprise Resource Planning (ERP) systems (Aral et al., 2006). Several studies attempt to develop a broader framework of what consists IT and how it behaves (Sambamurthy, Bharadwaj & Grover, 2003; Melville, Kraemer & Gurbaxani, 2004), and empirical findings show that non exact identification of IT is related with observations of a positive impact on firms' performance (Kohli & Devaraj, 2003).

The present study attempts to examine the relationship of IT investments on financial performance of Greek SMEs firm profitability in the Greek market in line with other research studies abroad (Soh & Markus, 1995; Sambamurthy et al., 2003; Kohli & Grover, 2008; Mithas et al., 2012), introducing a new approach of utilizing data, i.e the structural equation modeleling approach.

Academic cycles have been calling for an extension of the existing theory about the nature of IT in order to keep pace with the new reality that has been created. Kohli & Grover (2008) suggest that new theory is more applicable when trying to explain the behavior of complex modern multinational firms and is not necessarily best when trying to examine companies which operate in a more old fashioned way.

The study adopts elements from prior theoretical and empirical research, incorporating new ones which can better reflect the particularities of the chosen case. More specifically, the study takes initiative from the fact that the changing nature of Information Technology makes it difficult defining answers forworld-wide applicability and particularly in the case of SMEs. Apart from contributing to the existing academic debate of the performance of IT investments, this paper also introduces the issue of subsidy programs which support technology investments European-wide opening a new area of discussion among scholars.

The structure of the paper is as follows: Section 2 provides a brief introduc-

tion in the related literature on the relationship between IT investments and performance. Section 3 describes the methodology, the data sets and the research structure of the study, while setting the research questions. Section 4 analyses and interprets the outcomes of the examined questions, explicitly presenting the results. Section 5 summarizes the main implications and conclusions of the study.

2. Literature Review

The bulk of literature is on theoretical frameworks, datasets, methodologies and estimation techniques used in order to answer the questions relating to the links between IT and business performance (Osei-Bryson & Ko, 2004).

In the beginning of the 1990'sthe topic attracted more attention after several empirical studies established what is now known in the literature as "productivity paradox" (Brynjolfsson, 1993). The "productivity paradox" described the difficulty that researchers had in observing a positive relationship between the ever increased IT investments on firms' performance. Hitt and Brynjolfsson (1996) suggest that previous research was misguided by posing the wrong questions. Their study concluded that there was a direct link between IT investments and production output, which, however, is not, necessarily, shown in firms' profitability ratios that operate in competitive markets where consumers can be the ultimately benefited ones. They showed that consumer surplus had increased alongside with firms' productivity.

Even with the "productivity paradox put to rest" (Dedrick et al., 2003), the question of whether IT investments should be mirrored on the bottom lines of the firms' Income Statements or in other market oriented measures still remained. Although an equally straightforward answer to this question, as the one given on productivity, is seemingly more difficult, it can be argued that it is of higher importance to business managers and investors.

Many authors adopted a Resource Based View (RBV) theory in order to establish a framework of relationship between IT investments and performance leading to enhancement of performance and becoming source of sustainable competitive advantage (Powell & Dent-Micallef, 1997; Bharadwaj, 2000; Wade & Hulland, 2004; Tanriverdi, 2005; Huang et al., 2006; Mithas et al., 2012). Although this approach improved information related to the behavior of IT investments, there have been others that do not exclude Porter's Competitive Advantage theory from the equation (Rivardet al., 2006). Porter & Millar (1985) recognize IT as a source of obtaining Competitive Advantage suggesting that IT investments should not be seen in isolation from the rest of the world, and trying

to incorporate the competitive environment into its empirical part.

Many scholars select large companies in order to use matched pairs technique. Because of lack in qualitative data on firms' IT characteristics scholars make primary research survey through questionnaires (Byrd et al., 2006; Rivard et al., 2006). Even whether the sample size limitation is offset by the superiority of the technique, seeking examination of SMEs finds no reliable third party data to distinguish IT leaders from their counterparts. Because of lack in qualitative data on firms' IT characteristics scholars make primary research survey through questionnaires (Byrd et al., 2006; Rivard et al., 2006). The studies using primary data are more likely to show a positive relationship between IT investments and firm performance (Kohli and Devaraj, 2003). Another limitation for scholars examining behavior of IT investments on SMEs is the lack of publicly available data of their value in the market. One widely used in the literature market ori-ented measure utilized is Tobin's q (Bharadwaj, Bharadwaj&Konsisky, 1999; Tanriverdi, 2005) concluding that IT investments have a positive effect on firms' value.Kohli, Devaraj and Ow (2012) Tobin's q using data from the American healthcare industry having access to market value data of hospitals that changed ownership and conclude that Tobin's q ratio better reflects the im-pact of IT investments. Although Tobin's q can better capture a firm financial performance, many scholars used of book value ratios (Kohli &Devaraj, 2003; Tanriverdi, 2005; Beccali, 2007).

The most widely accepted and used accounting ratio as dependent variable is the Return on Assets (ROA). However, this ratio has produced mixed results in empirical works. Some researchers found a negative correlation of IT with ROA (Sircar, Turnbow & Bordoloi, 2000; Aral, Brynjolfsson & Wu, 2006; Beccali, 2007), while others found positive correlation (Rai, et. al., 1997; Bharadwaj, 2000). Additionally, some studies found the relationship of IT to ROA to be insignificant (Shin, 2001; Aral & Weill, 2007; Kohli et al, 2012), while others were inconclusive due to different results in sign and significance with different models or populations (Hitt & Brynjolfsson, 1996; Tam, 1998).

The sample sizes of the studies reviewed differ and are usually related to the estimation method used. Kohli and Devaraj (2003) in their meta-analysis of previous studies found evidence that larger sample sizes are usually correlated with the studies reporting a positive relationship between IT investments and firm performance. Moreover, longitudinal data are preferred to cross-sectional data because they control for lag effects from the time the IT investments are made till the time that their impact on the firm's performance can become measurable. Many popular studies choose an up to a six years period of longitu-

dinal data (Hitt & Brynjolfsson, 1996; Tanriverdi, 2005; Beccali, 2007; Mithas et al, 2012).Although researchers would always prefer to be able to employ as much data as possible, a six years period is considered satisfactory enough in order to control for lag effects since IT investments are not expected to start making their impact visible a long time after they are implemented (Voulgaris et al., 2015). In fact, Stratopoulos and Dehning (2000) argued that the benefit from IT investments on firm performance, although significant, is only valid for a short period of time, with a period of two years being the usual upper limit.

Several factors have been found that contribute to the successful implementation of IT projects. Brynjolfsson and Hitt (2000) suggested that the degree of devotion of the top management to incorporate IT as part of their strategic decisions plays a significant role in the positive results of IT investments, because it is believed that IT leverages its impact on a firm's performance when aligned with the broader strategic plans (Byrd et al, 2006). Mithas et al. (2012) recognize IT investments as discretionary expenditures and find that they affect positively and significantly firm performance. Classifying IT investments as discretionary expenditures as it is widely accepted that managers use in order to maximize their own utility function, taking into consideration the constraints of satisfactory profits required by stakeholders (Jones, 2004). In fact, agency theory was proposed as a possible explanation for the "productivity paradox" (Brynjolfsson, 1993). Ho, Wu and Xu (2011) also raise agency theory questions investigating the role of the board of directors' independence in the performance of corporate IT investments in the Taiwanese market. Even though this viewpoint is beyond the scope of the present paper, lending from behavioral economics' theory can be useful in order to examine a particular moral hazard aspect that can arise in the case of our study population.

Blanes and Busom (2004) present evidence that European R&D Subsidy Programs have produced mixed results in Spain arguing that there is a gap in the literature of Information Technology investments to control real life aspects of SMEs. It is reasonable to be assumed that the subsidy programs should increase the profits of the beneficiated companies. However, it could also be the case that businesses misuse these third party funds and do not take the necessary actions to align these investments with the corresponding human IT resources and other complementary resources as theory suggests (Melville et al, 2004; Wang,et al., 2012). Melville et al (2004) suggest that a comprehensive model on IT investments should take into account, apart from the various IT resources, the business processes and performance, the competitive environment and the macro environment.

3. Data and Methodology

The data sample consists of 88 Greek SMEs from hospitality and manufacturing industry. Quantitative data covering the time period of 2005-2010 are obtained from ICAP, the largest business database of Greece, while the qualitative data required are obtained through a survey questionnaire answered from firms' managers via telephone interviews. The questionnaire dealt with significant issues relating to IT investments, their characteristics, internal and external environment. Additionally, issues about external funding to subsidize IT investments are extracted.

Structural Equation modelling (SEM) approach (López-Nicolás & Meroño-Cerdán, 2011) is used in order to examine the relationships between IT investments, IT investments subsidies and firm performance. In addition, the impact of other factors such as crisis, leverage and size on performance are examined. SEM is an extension of the general linear model (GLM) and consists of a series of multiple regression equations that are fitted simultaneously. SEM is a multivariate extension of the multiple linear regression models that has the following form:

$$y = i + Xb + e$$

where: y - dependent variable, i- intercept of y, X - a matrix of continuously distributed or categorical (dummy-coded) independent variables, b- regression weights, and e- error term of the model.

The variables selected for the SEM are provided in table 1.

Table 1: Variables selection

Variables	Symbol	Variable Description
Dependent Variable	ROA	Return On Assets (ROA) = Pre-tax profits over firm's Total Assets
Explanatory Variables	CRISIS	Dummy variable taking value equals to 0 for pro crisis period (2005-2007) and 1 for post crisis period (2008-2010)
	GDP	Gross Domestic Product in fixed prices (in billions euro)
	LEVERAGE	Total Debt over Total Revenue
	SIZE	Natural logarithm of firm total assets
	GPM	Gross Profits over Total Revenues
	ITINV	IT investments level against competitors, taking values from 0 (low to 4=high)

	PAR_INV	Existence of firms'parallel investments along with IT investments
	SUB	A six point discrete longitudinal variable taking the values from 0=low to 5=high for IT investments subsidies

Return on Assets (ROA) is the dependent variable, the behavior of which is intended to be examined. In the absence of abundant market data, this is a very popular book value measure of how the firm's assets performed throughout the year (Mahmood & Mann, 1993; Barua, Kriebel & Mukhopadhyay, 1995; Huang et al, 2006; Lemonakis et al., 2013). The nominator of the ratio is comprised by the reported pre-tax earnings (Dickerson, Gibson, & Tsakalotos, 1997) in order to minimize any discrepancies in the ratio coming from the tax code. The denominator is comprised by the book value of the total assets in the end of the year (Tam, 1998).

CRISIS is a dummy variable in order to control for the structural break that the recent economic downturn caused in the Greek Economy after the year 2008. Melville et al (2004) suggest that a comprehensive model should take account of the macroeconomic variables GDP as well as CRISIS.

LEVERAGE is a risk variable, a ratio to control for risk effects. It is comprised of the total long term and short term debt in the numerator and the total revenues in the denominator (Henderson, Kobelsky, Richardson and Smith, 2004).

SIZE is a variable of the firm's volume estimated by the natural logarithm of the total assets (Kalkan, Erdin & Celtinkaya, 2011).

Also, a five point discrete longitudinal variable also included, taking values from 0 to 4 indicating relation of IT investments with firm competitiveness. Wang et al. (2012) suggest that IT investments should show a positive impact on profitability. Therefore, a five point discrete longitudinal variable (ITINV) taking values from 0 to 4 for IT investment level is used and a six point discrete longitudinal variable (SUB) taking the values from 0 to 5 for IT investments subsidies. Finally, a dummy variable (PAR_INV) takes the values zero and one for existence or not of parallel investments together with the IT investment.

4. Results

It is well known that the Greek financial crisis affects extremely negative firms' profitability. Using Structural Equation Approach with multiple indicator variables, the relationship of IT investments on Greek SMEs' performance is exam-

ined. Data were processed using SPSS (Statistical Package) and AMOS 21 (Analysis of Moment Structures software). The results show that Gross Domestic Product has a small positive but statistically significant impact on Returns on Assets effect. Leverage shows a moderate negative impact on ROA, while the firms' size (measured by the log of firms' Total Assets) depicts a positive impact on SMEs' profitability. Firms' operational ability as measured by the Gross Profit Margin has a small but positive relationship with profitability, suggesting that higher gross profits will normally lead to firms' higher net profits (e.g. see table 2).

Table 2: SEM Results with ROA as dependent variable

Variable	Estimate	S.E.	P
ROA→ CRISIS	-1.221573	0.010962	0.0000(**)
ROA→ GDP	0.385512	0.016548	0.0000(**)
ROA→ LEVERAGE	-0.211121	0.014758	0.0340(*)
ROA→ SIZE	1.421686	0.011258	0.0000(**)
ROA→ GPM	0.143323	0.004681	0.0212(*)
ROA→ ITINV	0.800312	0.000335	0.0012(**)
ROA→ SUB	2.355497	0.011454	0.0023(**)
ROA→ PAR_INV	-1.002000	0.002751	0.0000(**)
R-squared	0.521121		
**: statistical significant at 1%, *: statistical significant at 5% level of significance			

There is evidence that the technology used in organizational practises, foreign ownership, exporting orientation and innovation affect Greek SMEs competitiveness. The most significant findings of this study come from the regressed variables of the questionnaire. IT investments in higher levels than the competition generate significantly higher returns. Parallel investments of strategic importance decrease profitability in the short run. The subsidies for IT investments did not seem to affect profitability.

The findings of this study about the impact of IT investments on Greek SMEs profitability are significant which can be validated also form previous research (Rai et al, 1997; Bharadwaj, 2000). However, other studies found insignificant relationship of IT investments and firms' perfomance (Shin, 2001; Aral & Weill, 2007; Kohli et al, 2012) or negative effects on ROA (Sircar et al, 2000; Aral et al, 2006; Beccali, 2007), while there are studies that question the explanatory

power of models with quantitative data (Bharadwaj et al, 1999).

Lacking behind in the utilization of Information Technology-IT, compared to multinational corporations, Greek SMEs which use IT may have a comparative advantage. Their incremental gains from investments in IT solutions may be much higher than the gains of companies who operate in the cutting edge of the technological developments. They may have the luxury to have better information about the performance of the IT projects they would like to engage in. By minimizing the risks that the implementation of cutting edge technology bears, they can make more "educated" choices, acquire IT solutions that are previously "tested" by the market leaders and provide better value for money.

The strong positive relationship between IT investments and profitability that is found in this study does not, by any means, imply that firms investing more than their competitors on IT will necessarily guarantee future success. IT investments in general terms do not generate profits. The literature has repeatedly expressed the opinion that a proper alignment of IT investments with the internal environment and the broader firms' strategic choices should get aligned in order to leverage the benefits (Shin, 2001; Tanriverdi, 2005; Byrd et al, 2006). However, the findings are a strong indicator of the growing importance that IT investments have for the modern SMEs as a factor of firms' viability especially during the crisis period.

5. Conclusions

The scope of the study was to find the relation between profitability and IT investments in the Greek SMEs in the Hospitality and Manufacturing sectors, along with European economic subsidies for IT investments and other factors such as size of the firm, financial leverage, parallel to IT investments, economic crisis and Gross Domestic Product growth, using structural equation modeling (SEM) methodology on quantitative and qualitative data.

The research study is innovative in the methodology used and contributes to the relevant academic field. The results of the study indicate that IT investments have positive impact on firms' profitability in line with some previous academic studies and do not present the "profitability paradox". In addition, it is found that financial crisis period and high leverage affect negatively financial performance of Greek firms as it was expected. In addition, it is found that parallel investments in other activities along with IT investment affect negatively SMEs' performance, indicating that investments should focus on information technology. European subsidies seem to have a positive impact on SMEs profitability. From the SEM we can see that the most important effect on profitabil-

ity comes from the size of the firm, IT investments and subsidies on IT financing.

The present research shows that investments on IT deserve more attention from creditors.

Besides the concrete evidence from Greece, this study enriches the existing literature giving an open discussion on the nature of IT investments and how these can be measured. Moreover, the questions posed on IT subsidy programs that stated through this paper is an opportunity for future research focused on SMEs viability and profitability issues.

Policy implications

The State should support EU funding as, well as domestic funding for investments on ERP and Information Technology for Hospitality and Manufacturing firms in order for them to be profitable , grow and create job positions, thus helping the big problem of unemployment in the economy.

A strong financial condition along with large size allows firms to apply IT and take advantage of its benefits.

The Management of the Greek SMEs should struggle to get adequate financing to support this type of investments

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sity of Crete. He has co-authored in several books on financial management and banking issues, credit and operational risk and money laundering and published his work in international journals.

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