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The Impact of Business Intelligence Tools on Performance: A User Satisfaction Paradox?

Bernhard Wieder[1], Maria-Luise Ossimitz[2] and Peter Chamoni[3]

Abstract

While Business Intelligence (BI) initiatives have been a top-priority of CIOs around the world for several years, accounting for billions of USD of IT investments per annum (IDC), academic research on the actual benefits derived from BI tools and the drivers of these benefits remain sparse.

This paper reports the findings of an exploratory, cross-sectional field study investigating the factors that define and drive benefits associated with the deployment of dedicated BI tools.

BI is broadly defined as an analytical process which transforms fragmented data of enterprises and markets into action-oriented information or knowledge about objectives, opportunities and positions of an organization; BI tools are software products primarily designed and deployed to support this analytical process (e.g. data warehouse software, data mining software, digital dashboards applications).

Building upon DeLoneand McLean's (1992; 2002; 2003) information systems success model, we develop, test and refine a BI quality and performance model adapted for the specific purpose, application, user group and technology of BI tools. The ultimate performance predictors in this model are user satisfaction and the impact of BI tools on managerial decision quality, both of which are determined by data quality.

Partial Least Square (PLS) modeling is used to analyze data collected in a survey administered to IT executives of large Australian Stock Exchange (ASX) listed companies.

The results confirm some of the theoretical relationships established in – especially the original – DeLone-McLean model in the specific context of BI. More importantly, the results also confirm the important role of explicit BI management as antecedent of benefits derived from BI tools, and the key impact of data quality on managerial decision making and organizational performance.

However, the results also reveal a 'user satisfaction paradox': In contrast to the predictions derived from the DeLone-McLean model, organizational performance is negatively associated with user satisfaction with BI tools. Financial performance data collected for

[1] UTS Business School - Accounting, University of Technology, Sydney, Australia, bwieder@uts.edu.au

[2] UTS Business School - Accounting, University of Technology, Sydney, Australia, maria.ossimitz@uts.edu.au

[3] Mercator School of Management, University Duisburg-Essen, Germany, peter.chamoni@uni-due.de

ex-post verification of this unexpected result confirm this paradox. We discuss BI-specific interpretations of these unexpected findings and provide avenues for future research.

Keywords: Business Intelligence (BI), information systems success, data quality, user satisfaction, IT impact analysis

JEL Classification: M10, M15, M40

1. Introduction

`Business Intelligence (BI) has been a top priority of IT executives for several years and this trend is expected to continue (Gartner Research, 2011). While both the basic concept and also the term 'business intelligence' date back many decades[1], the emergence of the data warehouse as new infrastructure for reporting and analysis combined with OLAP and new of fact-based support decision support systems (DSS) (Power 2003)leveraged interest in BI in the past decade, and what was initially considered another 'consulting fad', is now considered a potential source of competitive advantage (Wixom et al., 2008; Hocevar and Jaklic, 2010; Gonzales, 2011).

The academic research community only gradually embraced the topic of BI, and today research on BI is still fragmented and sparse. While a research time lag on emerging IS concepts or innovations is a generally observable phenomenon[2], which can be explained by e.g. academic caution, risk aversion and publication time lags, we assume that the absence of a generally accepted definition of the term BI contributed and still contributes to this time lag. And while there is some convergence in the most widely used definitions of BI, the rapid developments of new 'BI tools' and technologies increasingly blurs the practical understanding and meaning of the term BI. It is therefore particularly important to operationalize the meaning of BI (and related terms) for the purpose of our research.

For Foley and Manon (2010), for example, 'business intelligence (BI) is a combination of processes, policies, culture, and technologies for gathering, manipulating, storing, and analysing data collected from internal and external sources, in order to communicate information, create knowledge, and inform decision making', while Watson and Wixom (2010) provide a narrower definition, focusing more on technology aspects of BI, which they define as 'umbrella term that is commonly used to describe the technologies, applications and processes for gathering, storing, accessing and analyzing data to help users make better

[1] Both the academic and practitioner literatures on BI often ignore the fact that the term 'Business Intelligence' was not 'invented' by the Gartner Group, but rather emerged in 1958 in a visionary article by Luhn (1958), in which he presents a 'Business Intelligence System' as an 'automatic system … to disseminate information to the various sections of any industrial, scientific or government organization' (Luhn, 1958). His description of such a system very closely resembles current state-of-the-art BI systems – approximately half a decade ahead of its time.

[2] In the case of enterprise resource planning (ERP) the time lag was more than 15, if not 20, years.

decisions'. Following their definition, BI could also be described as *'special purpose' information system*, the purpose being decision support[3]. The Data Warehouse Institute (TDWI) uses a similar definition, but ads that 'BI programs usually combine an enterprise data warehouse and a BI platform or tool set to transform data into usable, actionable business information' (TDWI, 2012).

Merging these definitions, we understand BI as an analytical process which transforms fragmented data of enterprises and markets into action-oriented information or knowledge about objectives, opportunities and positions of an organization.*BI software* describes software products primarily designed to support this analytical process (e.g. data warehouse software, data mining software, digital dashboards software), *BI tools* are BI software products *deployed* in an organization, and a *BI system* is a collective of BI tools and related technologies, applications and processes used in support of BI.

Early research related to BI was largely descriptive or normative and focused on either on the emerging data warehouse concept (Gardner, 1998; Inmon, 2000; Rekom, 2000; Watson, 2001; Wixom and Watson, 2001; Watson et al., 2002; Sammon et al., 2003; Zeng et al., 2003; Hugh et al., 2004; Inmon, 2004; Shankaranarayanan and Even, 2004; Williams, 2004; Wixom, 2004; Sammon and Adam, 2005; Solomon, 2005; Tseng and Chou, 2006), or adapted the established stream of research on decision support systems (DSS) to the new data warehouse environment (e.g. Ellis, 2004; March and Hevner, 2007; Baars and Kemper, 2008)[4].

Earlier empirical research on BI or data warehousing (DW) explored *user satisfaction* with DW (Chen et al., 2000), factors affecting *DW success* (Wixom and Watson, 2001) and factors influencing the adoption of DW (Hwang et al., 2004). More recently, studies emerged investigating the determinants of *information and systems quality* in the context of DW (Nelson et al., 2005), the effects of DW on *decision performance* (Yong-Tae, 2006), the *measurement of BI* (Lönnqvist and Pirttimäki, 2006), the *effects of BI on performance* (Elbashir et al., 2008), the status of BI in certain countries, e.g. Australia (Foster et al., 2005; Dodson et al., 2008), DW success factors (Hwang and Xu, 2008), the impact of BI on orga*nizational decisions* (Davenport, 2010) and *costs and benefits associated with BI* (Hocevar and Jaklic, 2010).

The *purpose of this research* is to integrate and extend the findings of previous DW/BI research by developing, testing and refining an information systems success model for the specific purpose, application, target group and technology of BI.

The remainder of this paper is organized as follows: Section 2 identifies the drivers of BI success and establishes predicted relationships between the constructs (path model). Section 3 reports on the research design and method used in our study, and reports the

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[3] Definitions of 'information system' typically refer to interaction between people, procedures and technology in the process of capturing, transmitting, storing, retrieving, manipulating and displaying data and information for a specific purpose.

[4] Watson (2010) provides an analysis of the development of DSS in the context of data warehousing and Clark et al. (2007) provide a comprehensive literature analysis of research on management support systems (MSS), including BI.

results of our statistical analysis. The results and limitations of our study are discussed in section 4.

2. Theory development

What all the above-mentioned definitions of BI have in common is that BI is a broad concept of managing and providing data for improved (managerial) decision making[5]. This implies that BI success or BI quality is to be measured around the *quality or quality increase of data* provided and the *quality or quality increase of decisions* made in an organization.

Data/Information Quality and Quality of Managerial Decision Making

Data or information[6] quality research has a long history in the IS discipline, with DeLone and McLean's (1992; 2002; 2003) information systems success model receiving most attention and attracting many followers in the past two decades (Petter and McLean, 2009). Data quality is undoubtedly a key aspect of every information system, but considering the very nature and purpose of BI systems, maintaining and providing high quality data appears to be a relatively more important concern in BI systems than in other business information systems, in particular OLTP systems (e.g. ERPS), which typically have a very large non-managerial user base and often provide high levels of transaction automation and control. The importance of data quality for BI was already confirmed in Wixom and Watson's (2001) first comprehensive empirical investigation of the factors affecting data warehousing success.

Partial Least Squares analysis of the data identified significant relationships between the system quality and data quality factors and perceived net benefits.

Many attempts have been made to operationalize data or information quality substantially[7]. Nelson et al. (2005) provided the first and so far only comprehensive analysis of information quality in the specific context of data warehousing. Following a comprehensive literature review, they aggregate the large number of quality attributes into the following four dimensions of information quality: *Accuracy* (intrinsic), *completeness, currency* and *format* (all extrinsic). Their measurement model validation using PLS modeling reveals, however, that *currency* does not load significantly on information quality. They provide a possible explanation for the insignificance of currency, but our alternative interpretation is in increasingly real time data environments, currency has become a minor data quality concern. We build on their work with minor variations (see measurement model below).

[5] This notion is also reflected BI software vendor promises and selling lines.

[6] While we are aware of the differences between data and information, research on those constructs does not usually draw a clear line and research on the antecedents or determinants of data quality and information quality overlap substantially (see Nelson et al. 2005, in particular their analysis of prior literature). We therefore use the terms data and information as de facto synonyma for the purpose of this research.

[7] See Nelson et al. (2005), in particular their systematic analysis of prior literature.

Data quality is not an aim in itself, but rather a means to the key aim of BI: Providing (better) support for decision making, resulting in faster, better informed and more accurate decisions. This leads to our first hypothesis:

H1: BI data quality impacts positively on managerial decision quality.

Good (or better) decisions are decisions which create competitive advantage, be it in the form of entrepreneurial rents (Schumpeter, 1950; Rumelt, 1987), or a sustained competitive position. The widely accepted short-term operationalization of competitive position is performance *relative to rival firms* (Arend, 2003). Accordingly, we predict as follows:

H2: Managerial decision quality impacts positively on relative organisational performance.

User Satisfaction and BI System Use

In all versions of DeLone and McLean's (1992; 2002; 2003) information systems success model, user satisfaction and system use are key links between information quality and individual impacts or net benefits respectively. Considering that BI systems are discretionary 'informational' systems in a sense that they are not required for business process execution or other forms of transaction processing, the particular importance of addressing *user satisfaction* and (the relationship with)*actual use* of the system is obvious. Further to that, BI systems are often deployed as alternatives to 'islands of spreadsheets', with the latter often remaining in place as some form of shadow systems. We therefore expect a large variation in BI system *use* across organizations, even if they deploy similar BI solutions, and we concur with DeLone and McLean's assessment of the important role of IS use in terms of achieving benefits associated with the system. Finally, Cox's (2010) recent research confirms the positive association between frequent BI use and quality and speed of decisions. We therefore predict as follows:

H3: The scope of use of a BI system impacts positively on managerial decision quality.

While improving decision support is the main purpose of BI, there are also other benefits associated with BI, including reductions in total cost of ownership (TOC), efficiency and quality increases in information processing, improved customer satisfaction, improving internal communication and collaboration (Hocevar and Jaklic, 2010; Imhoff and White, 2010; Watson and Wixom, 2010). Those benefits can only be realized, if the BI tools implemented are actually used. Accordingly, we predict a direct impact of BI use on performance:

H4: The scope of use of a BI system impacts positively on organisational performance.

In line with DeLone and McLean (1992; 2002; 2003) we argue that user satisfaction with a system is likely to increase usage, even more so with discretionary systems.

H5: User satisfaction with a BI system impacts positively on the scope of use of the system.

Scope of BI System

As mentioned in the introduction, BI 'is an umbrella term that is commonly used to describe the technologies, applications and processes for gathering, storing, accessing and analyzing data to help users make better decisions' (Watson and Wixom, 2010). The range of software products offered in support of BI is broad and varies significantly in terms of purpose or role within a BI architecture, detailed functionality, functional scope and level of sophistication. Examples of BI software include data warehouse (management) software, extraction transformation and loading (ETL) tools, simple query tools, OLAP engines, data mining software and visualization tools such as digital dashboards (Turban and Volonino, 2011).

Many BI software products are either by functional design or by deployment subject oriented, i.e. they have a functional focus (e.g. market analysis or sales forecasting). Enterprise data warehouses, however, can potentially support a broad range of business functions in an organization. Accordingly, BI systems deployed in organizations will have a great level of variation in terms of functional scope, which will have a direct impact on the scope of use of the BI system.

H6: The scope of a BI system impacts positively on the scope of use of the system

Quality of BI Management

The importance of proper management was already emphasized in early studies on critical success factors of data warehouse projects (Wixom and Watson, 2001), and still remains a critical dimension of BI maturity (TDWI-Research, 2008).

Wixom and Watson (2001) found that management support and resources help to address organizational issues that arise during warehouse implementations, and that adequate resources, user participation and highly-skilled project team members increase the likelihood that warehousing projects finish on-time, on-budget and with the right functionality. Standard development and implementation methodologies are also commonly cited as critical success factors of BI projects (Hwang and Xu, 2008). Managing BI systems 'scalable' has been a major quality aspect of BI management from the earlier days of data warehousing (Gardner, 1998) to the area of BI (Imhoff, 2005), and is still considered to be an ongoing and future trend in BI (Watson, 2009).

Finally, TDWI (2008) emphasizes the importance of standards for developing, testing, and deploying BI/DW functionality to be defined, documented, and implemented.

While the early literature focused on quality as aspects of DW/BI project management, the more recent – especially practitioner oriented – literature increasingly deals with BI management (and governance) as an ongoing process (BI management as a sub-function of IT management).

Following from the above, we expect that high quality BI management has a positive impact on various aspects of BI: Through end user involvement, timely completion of BI projects and provision of adequate resources and support, we expect a positive impact on user satisfaction and a steady increase in BI scope in an organization. Adherence to standards and the provision of adequate resources and scalable solutions is expected to result in higher levels of data quality, which is expected to indirectly contribute to user satisfaction.

H7: BI management quality impacts positively on BI data quality.

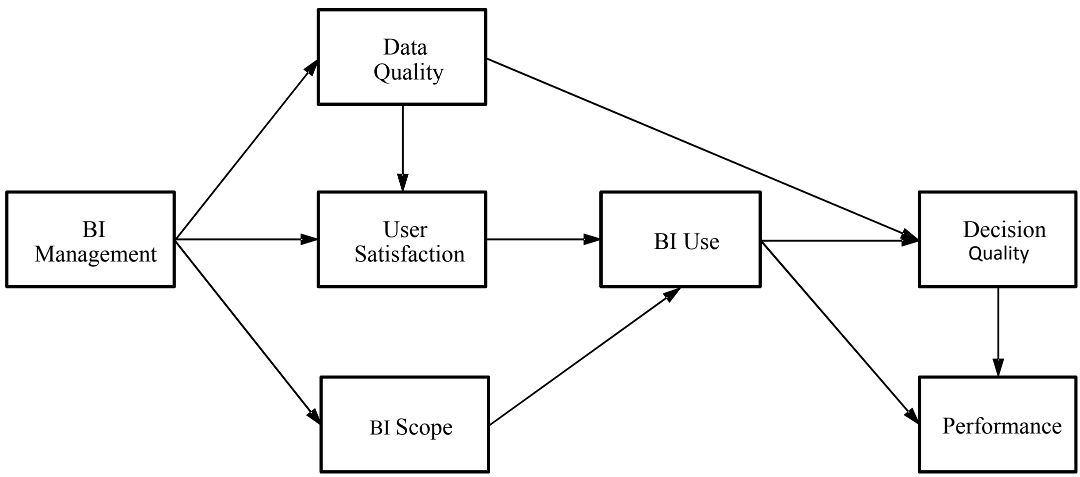
H8: BI management quality impacts positively on the scope of the BI system.

H9a: BI management quality impacts positively on user satisfaction with a BI system.

H9b: This relationship is mediated by data quality.

Figure 1 provides a graphical summary of our hypotheses (path-model).

Figure 1: Research Model



3. Research Design and Method

Sample Selection and Data Collection

A cross-sectional research design was employed with a survey administered to the 500 largest Australian Stock Exchange (ASX) listed companies in terms of capitalization. Target respondents were the most senior IT managers (CIO or equivalent), because they were considered best suited to answer questions about both their management domain and firm performance. Contact details of the managers including email addresses were obtained from a private data provider.

In June 2009, an email invitation was sent to the target respondents inviting them to participate in the survey by completing a comprehensive web-based online questionnaire. The initial invitation was followed up by an invitation letter accompanied by a hard-copy of the survey. With many invitation emails not reaching their addressees ('bounce backs') and an almost equal number of invitation letters being returned to sender because of the addressees having left the company, a contact details review was performed in September 2009, and email and hard-copy invitations were sent out to the corrected contacts. Despite this review and follow-up, 69 of the 500 firms could not be reached, reducing the effective sample size to 431.

44 firms (10.21%) responded to the survey, but 11 had to be removed from the sample, because they failed to either complete all questions in the questionnaire or meet the minimum size criteria[8] of $50 million AUD annual revenue and 50 full-time equivalent (FTE) employees. A non-response bias was inherent to the study insofar as only firms which deployed BI software (as defined above) were encouraged to participate. In the absence of publicly available data on the use of BI software in the target group, the impact of this exclusion cannot be determined.

Table 1 provides a breakdown of the 33 use able responses by industry and firm size. The largest industry groups represented in the sample are mining and real estate with the rest of the respondents representing a broad cross-sectional sample of Australia's private sector industry.

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[8] Some of the respondents of the top-500 ASX listed companies completed the survey for their respective business units, and not all of them met the minimum size criteria for inclusion in the survey.

Table 1: Respondents by Industry and Firm Size

Industry	**N**	**%**
Materials – Mining	*5*	*15.2%*
Real Estate	*4*	*12.1%*
Capital Goods	*3*	*9.1%*
Food, Beverage & Tobacco	*3*	*9.1%*
Transportation	*3*	*9.1%*
Diversified Financials – Banks	*3*	*9.1%*
Commercial & Professional Services	*3*	*9.1%*
Consumer Services	*2*	*6.1%*
Retailing and Wholesale	*2*	*6.1%*
Media	*1*	*3.0%*
Energy	*1*	*3.0%*
Insurance	*1*	*3.0%*
Pharmaceuticals, Biotechnology & Life Sciences	*1*	*3.0%*
Software & Services	*1*	*3.0%*
Total	*33*	*100.0%*

Annual Revenue (in Millions)		**%**	**Employees (FTE)**		**%**
	< 50	*0.0%*		*< 50*	*0.0%*
50	*< 100*	*9.1%*	*50*	*< 100*	*3.0%*
100	*< 500*	*36.4%*	*100*	*< 500*	*21.2%*
500	*< 2,500*	*21.2%*	*500*	*< 1,000*	*27.3%*
2,500	*< 10,000*	*24.2%*	*1,000*	*< 3,000*	*9.1%*
10,000	*< 50,000*	*9.1%*	*3,000*	*< 10,000*	*21.2%*
> 50,000		*0%*	*> 10,000*		*18.2%*

Table 2 depicts the positions/roles of the respondents. Two thirds of the respondents were heads of IT, either in an explicit 'CIO' role or as heads of IT at the group or business unit level. The other respondents were managers of IT in general or BI in particular.

Table 2: Respondents' Positions/Roles

Position	**%**
Head of IT – Group	*33.3*
Other IT Manager	*24.2*
CIO	*21.2*
Manager Business Intelligence	*9.1*
Head of IT Business Unit/Division	*6.1*
Other	*6.1*

Measurement Model

BI Management Quality

In the absence of an established measurement for *BI management quality*, reflective indicators were derived from the BI Maturity Model (BIMM), developed and used by the TDWI (Chamoni and Gluchowski, 2004; TDWI-Research, 2008). After the exclusion of some indicators used in this reference model but not loading on the construct of BI Management Quality in our survey, the following four indicators were used for analysis: (1) BI development standardization, (2) BI project management success (as evidenced by BI projects being delivered in time and within budget), (3) BI resources (the availability of resources in IT required for BI), and the scalability of BI solutions.

Respondents were asked to rate their firm's performance in terms of achieving the above-mentioned objectives on a five point Likert type scale (1 = not achieved at all; 5 = 'fully achieved').

Scope of BI

The measurement model for *Scope of BI* was also developed primarily based on technical practitioner literatures on BI or data warehousing.

The first dimension of *Scope of BI* refers to the number of BI tools available in an organisation. Respondents were asked to select or list commercial OLAP software, querying and frontend reporting software, digital dashboards anddata mining software (see Appendix) used in their organization. The count of software products deployed in each organization was used to measure '*BI tools available*'.

The second dimension of Scope of BI was '*BI functional scope'*, which refers to business functions or processes typically supported by BI solutions. The questionnaire items were derived from practitioner literature combined with our own software functionality analysis (see Appendix for items).We allowed for additional functions to be added as open items. The count of business functions or processes supported by BI solutions in each organization was used to measure *BI functional scope.*

Data Quality

The measurement model for data quality built on the extensive IS research on data or information quality, in particular the fundamental research provided by Nelson et al. (2005), who adapted general IS quality theory to the specific context of data warehousing.

We build on Nelson's et al. (2005) findings adopting elements of their broad definition of completeness, but refine the concept insofar as we emphasize the importance of avoiding information overload. The resulting dimension used in our study is *adequacy of data volume*, with *data relevance* – which is included in their definition of data completeness – measured separate in our study. We also adopt the dimension *accuracy or correctness* and *format* (*presentation*) of data, but extend the concept of format by also explicitly addressing transparency of data. The latter addition reflects concerns raised by traditional spreadsheet users that data warehouse based BI tools are black boxes which lack transparency. Related to those concerns is the question of trust in data, which has been raised in data quality literature before and appears to be particularly relevant for BI.

Following exploratory factor analysis and initial PLS testing, the following items scored significant loadings on the data quality construct used in our research: (1) Adequacy of data volume[9], (2) data relevance, (3) data transparency, and (4) trust in data. Accuracy/correctness and format/presentation had to be excluded from the measurement model.

Respondents were asked to rate their firm's performance in terms of achieving the above-mentioned information-related objectives on a five point Likert type scale (1 = 'not achieved' at all; 5 = 'fully achieved').

User Satisfaction

Considering the research method (survey) used in our study, we were unable to measure user satisfaction directly at the user level, e.g. by interviewing or surveying a sample of users within each organisation. Instead we asked our survey respondents about their assessment of user satisfaction with the BI system. While this is a limitation of our study, we argue that (most) senior IT managers in an organisation would have a reasonably good understanding of how satisfied users are with the BI solutions deployed in an organisation, even more so as BI solutions typically have a relatively small and more senior user group than large scale operational systems such as ERPS.

Exploratory factor analysis and initial PLS testing revealed that the following four (out of initially seven) items revealed highly significant loadings on the user satisfaction construct: Users' perceptions about (1)the effectiveness and efficiency of the BI system, (2) the suitability/task relevance of information provided by the BI system, (3) the extent to which the BI system meets user requirements and (4) general user satisfaction with BI system.

Respondents were asked to rate the user satisfaction with the BI system on a five point Likert type scale (1 = 'very negative'; 3 = 'neutral'; 5 = 'very positive').

BI System Use

In the absence of an established measurement model for *BI system use*, reflective indicators were – once again – derived from the BI Maturity Model (BIMM), developed and used by the TDWI (Chamoni and Gluchowski 2004, TDWI-Research 2008). Based on this reference, two aspects of BI system use were captured: (a) the functional scope of BI, and (b) level of sophistication of BI use (see Appendix). For the measurement of the latter aspect, we distinguished between the following usage levels: Passive use, ad-hoc reporting, OLAP use and analytics expert use. While we argue there is an implicit rank in this measurement in terms of level of sophistication, we acknowledge that it does not reflect an ordinal scale for statistical purposes. We therefore generated a separate score

[9] 'Adequacy' captures both the notion of *having enough data* and *not experiencing data overload*.

for each level of use across each function. Out of the resulting four diffusion scores, only 'passive use' and 'ad-hoc reporting use' were included in our analysis, because OLAP use and analytic use were negligible across the sample and therefore did not load significantly on our construct of BI system use.

Quality of Managerial Decision Making

Considering the research method (survey) used in our study, we were unable to measure user satisfaction directly at the user level, e.g. by interviewing or surveying a sample of users within each organisation. Instead we asked our survey respondents about their assessment of user satisfaction with the BI system.

Like in the case of user satisfaction, the research method used only allowed us to measure the impact of the deployment of BI solutions at a very aggregate level and only indirectly by asking respondents about their perceptions about the said impact; another limitation of our study.

The indicators used to measure this construct were derived from decision science (Yong-Tae, 2006) and comprised five aspects of decision making quality, four of which loaded significantly on our 'impact' construct: (1) Effectiveness of decision making, (2) accuracy/correctness of decision making, (3) timeliness/speed of decision making, and making rationale/informed decisions.

Respondents were asked to rate the impact of the BI system on the quality of managerial decision making along the five aspects mentioned above on a five point Likert type scale (1 = 'very negative'; 3 = 'neutral'; 5 = 'very positive').

Relative Performance (Competitive Advantage)

Respondents were asked to rate their firm's performance relative to their main competitors. One of the advantages of using relative measures it that they control for differences in performance that are due to industry, environment, and strategy effects (Govindarajan and Fisher, 1990; Garg et al., 2003).

Profitability, *revenue growth* and *market share* are well established indicators of financial performance (e.g. Kaplan and Norton, 1996; Slater and Olson, 2000) and were therefore adopted in our study. Following a balance scorecard approach (Kaplan and Norton, 1996), leading performance indicator closest[10] to financial performance were also included in the form of relative *customer satisfaction* and *customer loyalty*.

Considering the mix of leading and lagging performance indicators used, the measurement model was also specified as reflective, following Tippins and Sohi (2003) and Johansson and Yip (1994).

[10] The other antecedents of firm performance (business process performance and learning and growth) were not included acknowledging the static nature of our research.

Financial Performance (ROA)

To overcome some of the weaknesses inherent to perception based measures of firm performance and to increase the reliability of our performance measures, we collected publicly available financial data of the firms in our sample to determine the return-on-assets (ROA) in the financial year prior to the completion of the survey.

This additional financial performance variable was not considered a main testing variable for two reasons: First, we could only derive the ROA at the company level (as listed at the ASX), but not at the business unit level (some of the respondents referred to). The second reason is that ROA is a directly observable and well established performance construct in itself, and therefore strictly speaking not a *latent* variable. In spite of these limitations, the inclusion of an 'ROA-based firm performance indicator' allowed us to establish a link between perceived performance and traditional archival financial performance indicators.

Partial Least Square Modeling (PLS)

Structural equation models (SEM) are strongly suited to testing both theories and measurement models (Bagozzi, 1980). The partial least squares (PLS) procedure was used, because it is most appropriate for the non-normal datasets and small sample sizes in the current research (Wold, 1982; Chin, 1998). PLS uses very general soft distributional assumptions and non-parametric prediction-orientated model evaluation measures (Wold, 1982; Chin, 1998).

The next section herein evaluates the measurement models, and then the following section assesses the structural model to determine the results. Chin and Dibbern's (2010) guidelines for reporting on PLS analyses were followed[11].

Evaluation of the Measurement Model

The adequacy of reflective measurement models is examined via; (1) individual item reliability, (2) convergent validity, and (3) discriminant validity (Chin, 1998; Hulland, 1999). First, individual item reliability is assessed by examining the item's loading on its construct as opposed to the other latent variable constructs in the model. As shown in Table 3, all construct-specific loadings are above 0.60, with many in the 0.80 and 0.90 'high' range (Chin, 1998; Hulland, 1999). Table 3 also confirms that each indicator's load is highest for the relevant latent variable construct.

[11] SmartPLS version 2.00 M3 was used (Ringle et al., 2005).

Table 3: Measurement Model – Discriminant Validity

	BI Mgt	BI Scope	Data Quality	User Satisf.	BI Use	Decision Quality	Perf. Ind.	Perf. ROA
BI development standardisation	**0.8553**	0.2358	0.7238	0.6212	0.0392	0.2558	-0.2210	0.0840
BI projects on time	**0.8668**	0.3796	0.6673	0.5111	0.1356	0.2717	-0.2301	-0.3579
BI resources	**0.7964**	0.3514	0.5586	0.5354	0.0000	0.3485	-0.1179	-0.1895
BI scalability	**0.9209**	0.2831	0.7115	0.6471	0.0453	0.2541	-0.2772	-0.1754
BI tools available	0.2027	**0.9140**	0.0616	-0.2077	0.6837	0.1184	0.3353	0.0225
BI functional scope	0.4607	**0.8912**	0.2999	0.2842	0.4538	0.3219	0.1809	-0.0827
Data volume adequacy	0.7124	0.2129	**0.9138**	0.6512	0.0418	0.3567	-0.1556	0.1333
Data relevance	0.6528	0.1499	**0.8916**	0.6528	0.0268	0.5137	-0.0976	0.0225
Data transparency	0.6714	0.1145	**0.8875**	0.5902	-0.0610	0.4626	-0.1828	-0.0392
Data trusted	0.7517	0.2134	**0.9021**	0.5897	0.0655	0.5047	-0.0539	-0.1337
Effectiveness & efficiency of BI system	0.6940	0.0442	0.6469	**0.9486**	-0.1788	0.3423	-0.4717	-0.2979
Suitability/task relevance of BI info.	0.5007	0.0113	0.6165	**0.9265**	-0.1327	0.3350	-0.3764	-0.2721
BI system meeting user requirements	0.6583	0.0481	0.6670	**0.9395**	-0.0878	0.3754	-0.3713	-0.1287
General end-user satisfaction	0.6674	-0.0020	0.6676	**0.9512**	-0.2606	0.3052	-0.4405	-0.2634
Scope of passive use	0.0356	0.4896	-0.0468	-0.3134	**0.8573**	-0.0204	0.2287	0.0467
Scope of ad-hoc reporting	0.0749	0.6136	0.0784	-0.0105	**0.8829**	0.1491	0.2589	0.0016
Decision effectiveness	0.3459	0.3532	0.4996	0.4232	0.1085	**0.8432**	0.0787	-0.0465
Accuracy/correctness of dec. making	0.2914	0.1622	0.4389	0.1768	0.0796	**0.7724**	0.2193	-0.0693
Timeliness/speed of decision making	0.2285	0.0711	0.3618	0.3221	-0.1060	**0.8099**	0.1364	-0.2080
Making rationale/informed decisions	0.1403	0.1290	0.3067	0.2249	0.1453	**0.7818**	0.2210	0.0212
Customer loyalty	-0.1736	0.0294	-0.2169	-0.3481	0.2243	-0.0305	**0.6053**	0.1063
Market share	-0.2129	0.1892	-0.2327	-0.4102	0.1054	-0.0199	**0.6094**	0.4983
Profitability	-0.2822	0.1747	-0.1539	-0.4411	0.3443	0.1801	**0.8278**	0.3272
Quality management	-0.0050	0.3503	0.1670	-0.0759	0.2999	0.3909	**0.7272**	0.1865
Revenue growth	-0.2196	0.2206	-0.1074	-0.3308	0.0082	0.1105	**0.8106**	0.3793
ROA	-0.1803	-0.0301	-0.0063	-0.2552	0.0265	-0.0902	0.4447	**1.0000**

Table 4 reports the measurement indicators' means and standard deviations along with other standard measurement model quality indicators, as well as the bootstrapped error terms, t-statistics and significance levels.

All *composite reliability* measures (0.84 to 0.97) comfortably exceed the recommended threshold of 0.70 (Fornell and Larcker 1981, Chin 1998). Cronbach's Alphas (α) are slightly lower, but still greater or very close to 0.70 (Nunnally 1978, Chin 1998), indicating strong reliability of the measurement model. All average variances extracted (AVE) are higher than 0.50 (Fornell and Larcker, 1981), ranging from 0.52 to 0.89. Hence, there is no concern with *convergent validity* either.

Table 4: Measurement Model – Descriptive Statistics and Quality Indicators

Constructs and Indicators:	Mean	Std. dev.	Loadings	Composite reliability rc	Cronbach's Alpha α	AVE	Bootstrapping	
							SE	t-statistic
A. BI Management				**0.92**	**0.88**	**0.74**		
BI development standardization	*3.03*	*1.287*	*0.86****				*0.05*	*15.66*
BI projects on time	*2.94*	*1.298*	*0.87****				*0.04*	*22.10*
BI resources	*3.00*	*1.000*	*0.80****				*0.10*	*8.03*
BI scalability	*3.36*	*1.168*	*0.92****				*0.03*	*27.92*
B. Scope of BI				**0.90**	**0.77**	**0.81**		
BI tools available	*3.82*	*1.911*	*0.91****				*0.03*	*36.00*
BI functional scope	*4.91*	*2.708*	*0.89****				*0.09*	*10.18*
C. Data Quality				**0.94**	**0.92**	**0.81**		
Data volume adequacy	*3.42*	*0.936*	*0.91****				*0.04*	*22.71*
Data relevance	*3.42*	*0.867*	*0.89****				*0.05*	*19.13*
Data transparency	*3.39*	*0.966*	*0.89****				*0.06*	*14.66*
Data trusted	*3.36*	*0.929*	*0.90****				*0.04*	*22.21*
D. User Satisfaction				**0.97**	**0.96**	**0.89**		
Effectiveness & efficiency of BI system	*3.27*	*1.008*	*0.95****				*0.02*	*45.98*
Suitability/task relevance of BI info.	*3.64*	*0.859*	*0.93****				*0.03*	*35.92*
BI system meeting user requirements	*3.33*	*1.051*	*0.94****				*0.03*	*31.22*
General end-user satisfaction with BI system	*3.21*	*0.927*	*0.95****				*0.02*	*52.28*
E. BI Use				**0.86**	**0.68**	**0.76**		
Scope of passive use	*2.88*	*2.147*	*0.86****				*0.16*	*5.50*
Scope of ad-hoc reporting	*2.36*	*1.765*	*0.88****				*0.05*	*18.16*
F. Decision Quality				**0.88**	**0.82**	**0.64**		
Decision effectiveness	*3.70*	*0.684*	*0.84****				*0.13*	*6.67*
Accuracy/correctness of decision making	*3.53*	*0.671*	*0.77****				*0.14*	*5.67*
Timeliness/speed of decision making	*3.67*	*0.777*	*0.81****				*0.15*	*5.31*
Making rationale/informed decisions	*3.52*	*0.667*	*0.78****				*0.19*	*4.09*
G1. Performance (indicators)				**0.84**	**0.77**	**0.52**		
Customer loyalty	*3.73*	*0.839*	*0.61****				*0.19*	*3.11*
Market share	*3.48*	*0.972*	*0.61***				*0.24*	*2.52*
Profitability	*3.79*	*0.893*	*0.83****				*0.12*	*6.67*
Quality management	*3.76*	*1.062*	*0.73****				*0.21*	*3.48*
Revenue growth	*3.79*	*0.857*	*0.81****				*0.11*	*7.43*
G2. Performance (ROA)				**1.00**	**1.00**	**1.00**		
ROA	*0.051*	*0.0458*	*1.00*				-	-

*** significant at $p < 0.01$; ** significant at $p < 0.05$ (two-tailed)

Table 4 also reports on the bootstrapping results (SE, t-statistic and p-values) for the indicator variables. With the exception of performance indicator 'market share', which is significant at $p < 0.05$, all other indicator loadings are highly significant at $p < 0.01$.

As for the assessing of *discriminant validity*, Chin (1998) outlined two procedures for: (1) cross-loadings (see Table 3 above) and (2) the AVE-PHI matrix. The diagonal elements in the Table 5 show the square roots of the AVE of each construct, whereas the off-diagonal elements show the PHI matrix of latent variable (LV) correlations. The cross-loading test requirements are fully met: No indicator has a higher correlation on a LV other than the one it is intended to measure, and each block of indicators does not load higher on its respective LV than indicators for other LVs (Fornell and Larcker, 1981; Chin, 1998)[12].

Table 5: Measurement Model: Discriminant Validity

	A	B	C	D	E	F	G1	G2
A. BI Management	**0.861**							
B. Scope of BI	0.359	**0.903**						
C. Data Quality	0.776	0.193	**0.899**					
D. User Satisfaction	0.675	0.027	0.691	**0.941**				
E. BI Use	0.065	0.637	0.022	-0.178	**0.870**			
F. Decision Quality	0.325	0.237	0.512	0.360	0.078	**0.802**		
G1.Performance (indic.)	-0.249	0.291	-0.135	-0.443	0.281	0.201	**0.722**	
G2.Performance (ROA)	-0.180	-0.030	-0.006	-0.255	0.027	-0.090	0.445	**1.000**

An interesting detail shown in Table 5 is the negative correlations, in particular between the performance constructs and BI management, data quality and user satisfaction. This observation will be further explored below.

Evaluation of the Structural Model

The results of the structural model are summarised in Table 6 and Figure 2.

The model provides strong support for hypotheses 1, 6, 7 and 8, and some (week) support for hypotheses 4, 9a and 9b. Hypotheses 2, 3 and 5 were rejected, and most notably, the relationship between user satisfaction and BI use was negative *and* significant. Possible explanations and implications are discussed below.

The amount of variance in the endogenous constructs explained by the model (R^2) is indicative of the predictive power of the exogenous latent variables. The explained variance of most of the variables was substantial to moderate (Chin, 1998). As expected, BI related variables can only explain a small percentage of (firm) performance.

[12] The reporting of the PLS modeling results follows Chin's (2010) guidelines.

Table 6: Structural Model Results

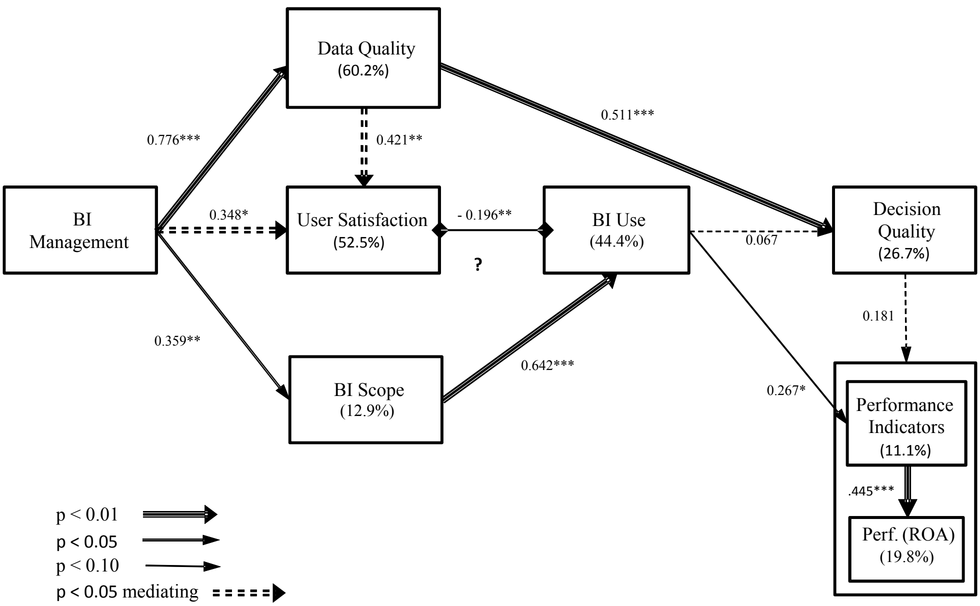
Hypothesis/Path Analysis:				**Coefficient**	**Bootstrap t-statistic**
H1:	***Data Quality***	→	***Decision Quality***	***0.511****	***3.054***
H2:	*Decision Quality*	→	*Performance (indicators)*	*0.181*	*0.753*
H3:	*BI Use*	→	*Decision Quality*	*0.067*	*0.456*
H4:	***BI Use***	→	***Performance (indicators)***	***0.267****	***1.433***
H5:	*User Satisfaction*	→	*BI Use*	*-0.196** (!)*	*1.845*
H6:	***Scope of BI***	→	***BI Use***	***0.642*****	***6.431***
H7:	***BI Management***	→	***Data Quality***	***0.776*****	***9.961***
H8:	***BI Management***	→	***Scope of BI***	***0.359*****	***2.134***
H9a:	***BI Management***	→	***User Satisfaction***	***0.348****	***1.483***
H9b:	***BI Management***	→	***Data Quality → User Satisf.***	***0.327*****	*(Table 7)*
Other paths:					
	Data Quality	→	User Satisfaction	0.421**	1.868
	Performance ind.	→	Performance (ROA)	0.445***	2.728

R-squares:

• *Scope of BI*	*12.9%*	• *Decision Quality*	*26.7%*
• *Data Quality*	*60.2%*	• *Performance (indicators)*	*11.1%*
• *User Satisfaction*	*52.5%*	• *Performance (ROA)*	*19.8%*
• *BI Use*	*44.4%*		

*** significant at $p < 0.01$; ** significant at $p < 0.05$; * significant at $p < 0.10$ (one-tailed)

Figure 2: Structural Model Test Results



Analysis of Mediation and Moderation

To test for mediating effects of data quality on the relationship of BI management and user satisfaction, we used the Hertel et al. (2008) multivariate adaptation of the Bollen and Stine (1990) bootstrap percentiles approach. Shrout and Bolger (2002) demonstrate and prove the superiority of Bollen and Stine's (1990) bootstrapping approach over the conventional mediation test statistics, and Hertel et al. (2008) adapted it innovatively to PLS. The essence of Bollen and Stine's bootstrapping approach is that the distribution of the *mediation scores* ($a \times b$) (Baron and Kenny 1986) is bootstrapped and that the resulting scores are examined to determine the $(\alpha/2) \times 100\%$ and $(1 - \alpha/2) \times 100\%$ percentiles of the distribution (α = confidence interval)[13]. If both percentile scores are either below or above zero, a significant deviation from the expected distribution within the confidence interval is confirmed.

Adapted to our model, we determine the product of the bootstrapping coefficients of the paths BI Management → Data Quality and Data Quality → User Satisfaction and determine the percentiles for $\alpha = 5\%$ and $\alpha = 10\%$. The results are shown in Table 7.

Table 7: Mediation of Effect of BI Management on User Satisfaction

Effect	Estimate	Bootstrap Percentile (one-tailed)			
		95%		90%	
		Upper	Lower	Upper	Lower
Effect on User Satisfaction					
Direct via BI Management	0.348	0.707	-0.046	*0.628*	*0.010*
Indirect via Data Quality ($a \times b$)	0.327	*-0.014*	*-0.265*	*-0.043*	*-0.248*

None of the other potential mediation paths in the model showed significant mediation.

We also tested for a potential moderating effect of BI use on decision quality, but found no such effect.

4. Discussion, Limitations and Outlook

Discussion

The *purpose of this research* was to integrate and extend the findings of previous DW/BI research by developing, testing and refining an information systems success model for the specific purpose, application, target group and technology of BI. Many of the predicted relationships in our model were confirmed. For others we could not find empirical support and contrary to established theory (DeLone and McLean, 1992; 2002;

[13] For one-tailed analysis, the formula is $(\alpha) \times 100\%$ and $(1 - \alpha) \times 100\%$.

2003), user satisfaction with BI systems was negatively associated with the scope of use of BI systems. The following sections discuss both the expected and unexpected findings.

Confirmed Predictions

Our results confirm the quality of managerial decision making is strongly influenced by the quality of data available in BI systems, and that the quality of managing BI within an organization is an important antecedent of data quality and therefore also decision making quality (total effect: 0.403). The findings substantiate the many calls for data quality management initiatives expressed in the practitioner literature (e.g. Swartz, 2007; Sandler, 2008).

We also confirmed the expected strong relationship between the scope of BI tools available and the actual use of BI, but most importantly, broader use of BI tools appears to be positively – although weekly – associated with performance. The strong total effect of BI scope on performance in the initial model (0.179) was confirmed in sensitivity analysis which revealed a significant direct relationship between BI scope and performance (0.272**). The strong relationship between the quality of BI management and BI scope reinforces the importance of properly managing BI to achieve tangible benefits.

Better BI management also leads to higher user satisfaction, both directly and mediated by data quality, but considering the controversial role of user satisfaction in the model, there is doubt about the implications of this relationship.

Unconfirmed Predictions

The expected positive relationship between managerial decision quality and performance remained unconfirmed. Possible explanations include a time lag between managerial decisions and performance, the dominance of other performance drivers not included in the model and limitations in the measurement of managerial decision quality.

Unexpected Findings

As an exogenous variable in the model, user satisfaction – and to a lesser extend BI system use – not only failed to meet the expectations (‘no findings’), but had a significant negative association with BI system use and a negative association with decision quality and firm performance, and ex-post modeling also revealed a significant direct negative association with both decision quality and performance.

While we acknowledge that the object of investigation in the Delone-McLean model (1992) is the individual rather than the firm, the results are still surprising, even more so as a large range of ex-post modeling and testing confirmed the relationships revealed in our initial analysis. Limitations in the measurement model of user satisfaction may have contributed to deviations from the expected findings, but could not fully explain this ‘user satisfaction paradox’.

We are not aware of any established theory capable of explaining this paradox directly. In search for our own explanation of the phenomenon, we arrived at the following potential explanation:

Frequent and advanced (business) users of IS are more likely to explore the 'boundaries' of systems, ask more challenging questions, are more likely to detect errors, and are therefore more likely to be dissatisfied with the system and challenging for the IT department than 'basic' users. BI systems are typically configured to provide relatively easy to use or fully automated standard reports, but in order to explore the real potential of these systems, ad-hoc reporting skills, advanced analytical skills and even configuration skills are required. Moving beyond the pre-configured standard functionality is likely to be associated with frustration about lack of user friendliness of the system, capabilities of the system and lack of knowledge about the system logic, functionality and the underlying models.

On the other hand, users who do not go beyond the base functionality of the system and who do not ask critical questions are more likely to be 'happy users'. But are 'happy' users 'good' users?

In the BI context, most likely they are not. More likely, they are evidence of lack of (adequate) system use or lack of BI 'mentality' of BI culture, and potentially a leading indicator of lack of performance.

Limitations and Outlook

Some of the limitations of our research have already been addressed above: The small sample size, simplified measurement of user satisfaction and managerial decision quality and reference to theory which evolved from individual user experiences with IS rather than organizational experiences.

However, many of our predictions were confirmed, and the unexpected findings provide a wide avenue for future research.

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Appendix: Measurement Details (Extract)

Scope of BI:

a) BI tools available:

'What types of BI products/tools are in use in your company? (Multiple answer option)'

OLAP Tools:

- Cognos (now IBM)
- Hyperion Solutions (now Oracle)
- Microsoft
- SAP Business Objects
- Microstrategy
- SAP BI
- Cartesis SA
- Applix
- Oracle (other than Hyperion)
- Infor
- Others (list here):

Querying and Frontend Reporting Tools

- List here:

Digital Dashboards

- List here:

Data Mining Tools

- SAS - Enterprise Miner
- SPSS - Clementine, AnswerTree, Neural Connect.
- IBM - Intelligent Miner
- Oracle - Darwin
- CSI - Advisor Toolkit
- Angoss Software - Knowledge Studio/Seeker
- Trajecta - dbProphet
- Partek
- Megaputer Intelligence - PolyAnalyst
- Silicon Graphics - MineSet
- Clopinet
- Unica
- Eudaptics Software - Viscovery
- HYPERparallel - Discovery
- Others (list here):

b) BI Functional Scope:

Which basic business functions or processes are directly supported by your BI solution? (Multiple answer option)

- Regular financial/tax reporting (external reporting)Suppliers
- Assurance and special compliance support (e.g. SOX)
- Group consolidation
- Cost analysis
- Operational planning and budgeting
- Other internal financial reporting
- Strategic planning
- Market/Sales planning/analysis
- Campaign management
- Production planning and control*)
- Supply-Chain analysis
- Supplier analysis
- HR analysis
- Other (list here)

*) excluded from analysis to avoid industry bias.

BI Use

What functional areas does the BI solution support, and how is the BI solution used in these areas?

Passive users are report receivers only.
Ad-hoc 'reporters' are producers of ad-hoc reports (rather than re-usable reports).
OLAP users are authors of re-usable reports, analysts or power users in general (but not analytic experts).
Analytic experts use 'business analytics methods', e.g. data mining techniques or artificial intelligence.

	Passive users	Ad-hoc 'reporters'	OLAP users	Analytics experts
• Executives/Directors	○	○		
• Accounting/Finance	○	○	○	○
• Purchasing	○	○	○	○
• Production/SCM*)	○	○	○	○
• Marketing/Sales	○	○	○	○
• Customer Support	○	○	○	○
• Human Resource Management	○	○	○	○
• IT/ORG	○	○	○	○
• Legal Department	○	○	○	○
• R&D (incl. Product Development) *)	○	○	○	○
• Other (please specify):	○	○	○	○

*) excluded from analysis to avoid industry bias.

Dynamic Approach of Capital Structure of European Shipping Companies

Stavros H. Arvanitis[1], Irakleia S. Tzigkounaki[2], Theodoros V. Stamatopoulos[3] and Eleftherios I. Thalassinos[4]

Abstract

The issue of capital structure of companies is one of the most debated problems of financial management. According to economic theory, capital structure determines the stock market value of firms and therefore their viability, while one of the most negative result of the crash of 2008 and the persisting crisis (excess supply in markets of labor and money) is their ongoing steep decline of lending by credit institutions and other sources. In this paper, considering the importance of the issue and motivated by the conflicting results of previous empirical studies, we attempt the analysis of capital structure of the European Maritime Enterprises (oceanic shipping). We focus on shipping companies, because of the large volume of funding that demands their main operation, due to the intensity of the assets held. The objectives of this research are firstly the identification of factors that affect the capital structure of European oceanic shipping and secondly to search for the existence of an ideal - target capital structure ratio. The determinants of capital structure are examined through static (fixed effect method and FGLS) and dynamic (GMM Methods) econometric models, using data from the financial statements of 32 listed European shipping companies for the period 2005-2010. The results suggest the prevalence of pecking order theory in our case, while a positive relationship arises between tangible assets and tax benefits (arising from sources other than borrowing) against leverage. Moreover, we observe a negative relationship between size or profitability and debt. Our findings contribute to a deeper understanding of the decisions taken by European shipping on their capital structure.

Keywords: Capital Structure, Trade-off Theory, Pecking Order Theory, Dynamic Panel Data, Shipping companies

JEL Classification: G32, C23, L91

[1] T.E.I. of Crete, S.M.E., Dept. of Accounting, MSc Accounting and Auditing. Estavromenos, 71500 Heraklion, Crete, tel. +30 2810-379674, starvan@staff.teicrete.gr

[2] Corresponding Author. T.E.I. of Crete, S.M.E., Dept. of Accounting, MSc Accounting and Auditing. Estavromenos, 71500 Heraklion, Crete. Plateia Analipseos square 3, 71306 Heraklion, Crete, Hellas, tel. +30 2810-283502, iratz@otenet.gr

[3] T.E.I. of Crete, S.M.E., Dept. of Accounting, MSc Accounting and Auditing. Estavromenos, 71500 Heraklion, Crete, tel. +30-2810-379601, and University of Piraeus, Hellas (Greece), and D.E.F.I., Mediterranean University-Aix-Marseille II, France, stamth@staff.teicrete.gr

[4] University of Piraeus, Dept. of Maritime Studies, and T.E.I. of Crete, S.M.E., Dept. of Accounting, MSc Accounting and Auditing. 21 str. Gr. Lambraki, 18534 Piraeus, Hellas, tel. +30-210-4142543, thalassi@unipi.gr

1. Introduction

The issue of capital structure of companies consist the core of modern financial management and one of the most important decisions to be taken by the administration of companies. In recent years, theories of capital structure have received attention from many researchers and economists. From the theorem of Modigliani and Miller (1958) until today, there have been various theories on maximizing the value of a stock company through the structural funds. The original theorem of Modigliani and Miller (1958), becomes even more complicated with the introduction of taxes of legal persons (Modigliani and Miller, 1963), taxation of individuals (Miller, 1997), the cost of bankruptcy (Stiglitz, 1969; Titman, 1984), agency theory (Jensen and Meckling, 1976; Myers, 1977) and the issue of information asymmetry (Myers, 1984). Considering these factors and based on the basic theories of trade off and pecking order theory, the researchers have different approaches to the subject, highlighting the main theories.

The first basic theory, the trade off theory, states that, every company oscillates between the advantages and disadvantages of borrowing, targeting a level of leverage capable to maximize benefits and minimize its disadvantages. In contrast, according to the pecking order theory, the company follows a series of sourcing capital. Following any of the above theories, entities try to increase their wealth, based on liabilities rather than assets, ignoring their real estate. The issue becomes even more crucial for shipping companies, where the largest part of their assets are tangibles (Apergis and Sorros, 2009) and it is very important the way of financing them. Furthermore, in recent years due to global economic crisis, or better global crash of 2008, financial institutions, make borrowing difficult for any company including shipping ones, forcing them to turn to other ways of borrowing, making harder the current situation.

The aim of the paper is to study the capital structure of European shipping companies, through panel data, taking advantage of the opportunity of the analysis in time and the entities, by using static (fixed effect method and GLS) and dynamic (GMM method and GMM system) econometric models. This approach aims at finding the formula used by shipping companies, for their capital structure. Essentially, by focusing our attention in a sample of 32 European shipping companies, traded for the period 2005 to 2010, inquiring if the main financial theories, can explain the financing decisions of the funds of shipping companies. Through panel dataset, will be attempted to determine the factors that affect the capital structure, while the dynamic approach used, aims at finding the ideal-target in shipping capital structure and their speed of adjustment. The use of static econometric models will be an indispensable asset for the subsequent comparison of results obtained from the use of dynamic models.

The remainder of the paper is organized as follows: Section 2 presents the research questions based upon the key prior literature and provides some basic information about European Maritime companies. Section 3 displays the methodology and the data while the empirical results and the discussion of them, are reported in section 4. Section 5 summarizes the conclusion of the study, the limitations and presents suggestions for further research.

2. Previous Research and Research Questions

2.1 Empirical studies using static econometric models

To date, most empirical studies have focused on determinants of the firms' capital structure in specific countries (for instant, Rajan and Zingales, 1995; Booth et al., 2001; Ozkan, 2001; Deesomsak et al., 2004; Bevan and Danbolt, 2004; Eriotis et al., 2007; Deari and Deari, 2009; Omran and Pointon, 2009; Psilaki and Daskalakis, 2009; Khalid, 2011; Chakraborty, 2010; Noulas and Genimakis, 2011). Their results, most often are conflicting, suggesting the absence of a specific formula for shaping the capital structure of enterprises and the specific characteristics of economic and social environment in which they undertake, (Rajan and Zingales, 1995; Omran and Pointon, 2009; Degryse et al., 2010; Noulas and Genimakis, 2011). On the other hand, several empirical studies examine the application of the trade off theory and pecking order theory, resulting in this case to conflicting conclusions, mainly because of the different approach of the two theories, (Shyam-Sunder et al., 1999; Fama and French, 2002; Frank and Goyal, 2009; Flannery and Rangan, 2006).

The first set of empirical studies, using static models[1], conducted by Taggart (1977), Marsh (1982), Jalilvand and Harris (1984) and Titman ans Wessels (1988), contributing significantly to identify the factors that affect the capital structure._Titman and Wessels (1988) who studied companies operating in the U.S., identify a negative relationship between enterprise size, uniqueness, profitability and the ratio of short-term leverage. The growth, the industry and tax advantages are considered non-statistical significant variables. Unlike the transaction costs is an important determinant of capital structure.

In 1995 we find one of the largest surveys conducted, concerning the capital structure of firms. The Rajan and Zingales (1995), dealt with the G7 member countries and resulted in a positive relationship between size, assets and debt, excluding Germany. In contrast, negative relationship was shown between profitability and leverage ratio for all countries - members, a result that agrees with that of Titman and Wessels (1988). In conclusion, they analyzed the important role of social and economic environment in which each company operates. The results of Rajan and Zingales (1995) are confirmed by Wald (1999), who was influenced by Rajan and Zingales (1995). Its study leads to the diversity of the capital structure of companies, because of different fiscal framework that exists in each country, agency costs and asymmetric information.

Sample from different countries, outside the research of Rajan and Zingales (1995), includes the study of Deesomsak et al. (2004). The survey results, showed the positive relationship between growth, size and the leverage ratio. A negative relationship was found between the tax advantages, liquidity, and debt. Furthermore, the authors stressed the

[1] The econometric methods that can be applied are either static or dynamic. Depending on this choice, it is determined then, the model to be estimated. The most common static models are the Pooled Models, Fixed-Effects Models and Random Effects Models. The most common dynamic models are the Two Stage Least Squares of Anderson and Hsiao (1982) and the Generalized Methods of Moments (GMM) of Arellano and Bond (1991).

importance of the legal framework, of corporate governance and industry characteristics which are surrounding businesses, (Rajan and Zingales, 1995; Wald, 1999). In the same year with Deesomsak et al. (2004), using the same methodology, Bevan and Danbolt (2004), reach the opposite conclusion for the profitability factor. In their research, they found a negative relationship between profitability and debt, while according to their conclusions, the size is positively related with the capital structure. Not statistically significant, appears the variable of growth. Preposterous, the same researchers (Bevan and Danbolt, 2002), through a static model, analyzed the capital structure of English quoted companies of England. The main feature of the investigation is the continuing comparison with the study of Rajan and Zingales (1995). The results for the variable of size are the same as those of Rajan and Zingales (1995) and contrary to the variables of the profitability and structure of assets.

Continuing our review, during the last years we see recent surveys, such as Eriotis et al. (2007), who examine 129 Hellenic (Greek) companies listed in Athens Stock Exchange. The factors studied and the results obtained do not differ from previous surveys. Specifically, the leverage ratio was found to correlate positively with the size of the examined companies. Instead, liquidity and growth shows a negative correlation with the leverage of companies, which is consistent with the theories of capital structure. Psilaki and Daskalakis in 2009, dealt with 320 Italian small and medium companies, 52 Portuguese, 1,252 Hellenic and 2,006 companies active in France. The conclusions focus on the positive relationship between size and borrowing, appropriating the results of Eriotis et al. (2007), and on a negative relationship between profitability, risk and leverage by appropriating the results of Deari and Deari (2009). However, the capital structure of firms varies, due to the particular characteristics of each company and not by particular characteristics of each country or each industry. The latter contrasts with the study of Rajan and Zingales (1995), Deesomsak et al. (2004), Omran and Pointon (2009), Degryse et al. (2010), which focus on the characteristics of countries and sectors and not the characteristics of companies. Quoted Athens Hellenic companies, excluding financial institutions were the subject of research of Noulas and Genimakis (2011). According to them, the capital structure of firms varies according to sector of their function while the ownership does not affect their leverage. The pecking order theory seems to dominate the financing decisions of investment entities.

2.2 Empirical studies using dynamic models

At this point we must stress, that the above studies do not take into account the dynamism which contains the decisions on the capital structure of firms. First Fisher et al. (1989), raised the issue of dynamic management behavior on business capital. The results of their research showed that companies do not aim at an ideal leverage ratio but, this indicator can be moved in certain contexts, verifying the pecking order theory in the short term, because of the disadvantages of adaption to a perfect capital structure indicator. The dynamics of capital structure of 104 Swiss firms, examined by Gaud et al. (2005). Specifically, the size and significance of the tangible assets, is positively correlated with the debt ratio while growth and profitability are negatively related. Simultaneously, the cost that comes from not balancing advantages and disadvantages of borrowing are minimal, thus, the Swiss companies are moving slowly to achieve their goal. The authors validate the trade and pecking order theory.

Preposterous, Miguel and Pindado (2001), trying to determine the characteristics of firms that affects their capital structure. Their data consist of, 133 Spanish companies. As in the study of Gaud et al. (2005), the pecking order theory prevails and firms take into account transaction costs in cases of search of funding, turning their interest to internal borrowing sources. In this way, the entities eliminate the problems of asymmetric information. The same research objective with Miguel and Pindado (2001), examined by Heshmati (2001) for 2,261 Swedish SMEs. Its findings highlighted the negative relationship between size, expected growth and leverage. Meanwhile, business decisions are an important factor influencing the capital structure. As for the speed of adjustment to an ideal ratio, it appears to be quite slow for small businesses, while it is faster for large companies.

More recent studies, such as the one of Serrasqueiro and Nunes in 2009, analyze the factors influencing the capital structure. This study are examined, 237 Portuguese companies listed in Portugal. The Portuguese companies, target to an ideal capital structure ratio, verifying by this way the trade off theory. Apart from the trade off theory, there is strong evidence that companies follow the pecking order theory. In contrast, no evidence seems to approach the market timing theory. The adjustment to a perfect indicator of capital structure is not fast, if we compare the results of Serrasqueiro and Nunes (2009), with others concerning U.S., Germany, Spain and the United Kingdom. This fact is explained by transaction costs.

One of the most recent studies, following the methodology of dynamic capital structure model, is that of Khalid (2011). He showed that the leverage ratio depends on the cost of adjustment, which is needed to achieve an optimal capital structure. The adjustment process of capital structure, as in the study of Serrasqueiro and Nunes (2009), appears slow here too, compared with other developing countries. Earlier, the adjustment process in ideal ratio target leverage, was empirically verified by Flannery and Rangan (2006). Specifically, they verify the conclusions of Heshmati (2001), Gaud et al. (2005), by supporting the existence of specific operational characteristics, responsible for the target ratio of capital structure. In contrast to the results of Khalid (2011) and Serrasqueiro and Nunes (2009), the adjustment to a perfect target ratio takes place fairly quickly, a finding consistent with research findings of Huang and Ritter (2009), which was implemented in companies active in the U.S., during 1963-2001.

Dang (2011) is consistent with the rapid adjustment to an ideal target ratio of capital structure of companies operating in Germany, France and the United Kingdom. In his empirical study, he proved the existence of an ideal target ratio of capital structure and the acceptance of trade off theory, from the majority of the companies. Therefore, it was found that firms react strongly in a case of derogation from their target, leading to return quickly to him, but do not react as strongly, to past deviations from the target ratio.

In conclusion, the studies which are focused on factors influencing the capital structure of enterprises, using static or dynamic models are numerous. For this reason, the following table presents some empirical studies and the factors which are identified as responsible for the capital business structure.

Table 1: Capital Structure Determinants

Factors	**Authors**
Tax	Kim and Sorensen (1986); Titman and Wessels (1988); Fisher et al. (1989); Mackie-Mason (1990); Chanplinsky and Niehaus (1993); Wald (1999); Booth et al. (2001); Ozkan (2001); Miguel and Pindado (2001); Heshmati (2001); Huang and Song (2006); Delcoure (2007); Omran and Pointon (2009); Deari and Deari (2009); Chang et al. (2009); Serrasqueiro (2011)
Size	Warner (1977); Ang (1976); Kim and Sorensen (1986); Kester (1986); Titman and Wessels (1988); Friend and Lang (1988); Fisher et al. (1989); Rajan and Zingales (1995); Michaelas et al. (1999); Booth et al. (2001); Ozkan (2001); Heshmati (2001); Voulgari et al. (2002); Fama et French (2002); Bevan and Danbolt (2002); Chen (2004); Bevan and Danbolt (2004); Keshar (2004); Hall et al. (2004); Gaud et al. (2005); Maghyereh (2005); Abor (2005); Huang and Song (2006); Eriotis et al. (2007); Delcoure (2007); Serrasqueiro and Rogao (2009); Omran and Pointon (2009); Psilaki and Daskalaki (2009); Deari and Deari (2009); Chakraborty (2010); Degryse et al. (2010); Khalid (2011); Noulas and Genimakis (2011); Serrasqueiro (2011)
Profitability	Kim and Sorensen (1986); Kester (1986); Titman and Wessels (1988); Friend and Lang (1988); Rajan and Zingales (1995); Michaelas et al. (1999); Wald (1999); Booth et al. (2001); Ozkan (2001); Heshmati (2001); Voulgari et al. (2002); Bevan and Danbolt (2002); Chen (2004); Bevan and Danbolt (2004); Keshar (2004); Gaud et al. (2005); Maghyereh (2005); Delcoure (2007); Serrasqueiro and Nunes (2009); Psilaki and Daskalaki (2009); Deari and Deari (2009); Chang et al. (2009); Chakraborty (2010); Degryse et al. (2010); Khalid (2011); Noulas and Genimakis (2011); Serrasquieiro (2011)
Tangible Assets	Marsh, (1982); Rajan and Zingales (1995); Booth et al. (2001); Heshmati (2001); Voulgari et al. (2002); Gaud et al. (2005); Maghyereh (2005); Delcoure (2007); Serrasqueiro and Rogao (2009); Omran and Pointon (2009); Deari and Deari (2009); Chang et al. (2009); Sabiwlsky (2010); Degryse et al. (2010); Khalid (2011); Noulas and Genimakis (2011); Serrasqueiro (2011)
Industry	Kim and Sorensen (1986); Titman and Wessels (1988); Miguel and Pindado (2001); Omran and Pointon (2009); Chang et al. (2009); Khalid (2011); Noulas and Genimakis (2011)

Liquidity	Taggart (1977); Jalivand and Harris (1984); Ozkan (2001); Eriotis et al. (2007); Omran and Pointon (2009); Ramalho and Silva (2009)
Earnings Volatility	Titman and Wessels (1988); Chang et al. (2009); Sabiwlsky (2010); Degryse et al. (2010); Khalid (2011); Noulas and Genimakis (2011)
Risk	Keshar (2004); Delcoure (2007); Serrasqueiro (2011)
Factors	**Authors**
Growth	Kim and Sorensen (1986); Kester (1986); Titman and Wessels (1988); Michaelas et al. (1999); Booth et al. (2001); Graham and Harvey (2001); Ozkan (2001); Heshmati (2001); Voulgari et al. (2002); Fama and French (2002); Chen (2004); Keshar (2004); Gaud et al. (2005); Maghyereh (2005); Abor (2005); Sogord-Mira (2005); Eriotis et al. (2007); Omran and Pointon (2009); Psilaki and Daskalaki (2009); Deari and Deari (2009); Chang et al. (2009); Chakraborty (2010); Degryse et al. (2010); Khalid (2011); Noulas and Genimakis (2011)
Age	Heshmati (2001); Ramalho and Silva (2009); Noulas and Genimakis (2011); Serrasquieiro (2011)

2.3 European Shipping Industry

The post-World War II global economic growth and the consequently growing consumer demand for manufactured goods contributed to the increase of international trade and therefore respective need for transportation. The Bretton Woods agreement on stable but adjustable exchange rate system in 1944 contributed in this perspective, by playing a key role in the commercial sector of mercantile trade. One of the most lucrative ways of transport is the transportation by sea. The reasons why the sea transportations appear more advantages than other modes vary. For example, we suggest the liberalization of markets, the achievement of large loads transportation quickly and cheaply and the transportation of perishable goods through appropriate ship (Lekarakou and Papaspirou, 2001). Result in demand for maritime transport, is the increase of shipping, with a view to meeting the needs of consumers (Alizadeh and Nomikos, 2009; Sjoqvist and Sorocka, 2011). Despite the increasing needs for transportation and recovery of trade in 2010, there was strong concern about the evolution of the industry both in 2011 and 2012 (PwC, 2012).

The economic growth is directly related to industrial development, trade and maritime transport. The oil crisis directly affected the shipping industry and the growth of several countries. If we draw our attention to the economic development of the European Union from 1991 up today, we see an upward trend, except for the years 2008 and 2009 (Conference on Trade and Development -UNCTAD- 2011), 'where the world entered into the deepest recession experienced since the Second World War' (Blanchard et al. 2010).

The onset of the crisis was marked in the United States of America but was soon expanded to Europe. According to data of UNCTAD (2011), the same rate of European economic growth, was followed by trade in the European Union. It was observed a decline on both exports and imports from 2008 to 2009, while international shipping follow the same path, (UNCTAD, 2011). These appear in the tables below.

Table 2: Economic Development in the European Union (annual % change)

Area	**1991 – 2004** (Average)	**2007**	**2008**	**2009**	**2010**	**2011**
European Union	2.3	3.0	0.5	-4.2	1.8	1.9

Source: UNCTAD (2011)

Table 3: Development of trade in the European Union (annual % change)

Export			**Area**	**Import**		
2008	**2009**	**2010**		**2008**	**2009**	**2010**
2.9	-14.7	18.2	European Union	1.4	-14.8	14.1

Source: UNCTAD (2011)

The element that concerns us directly is the financing of the listed companies, as their main feature is the increased capital resulting from the intensity of their assets. Particularly in 2011, the banks of the euro zone financed shipping very difficult, mainly because of the ongoing crisis (uncertain economic conditions; Lloyds, 2011). Therefore, the loan agreements contained stringent clauses within as usual banking. Apart from the lending by financial institutions and other funding sources, such as bond issues or capital increase, appear limited, mainly because the profits of shipping companies increasingly decrease (PWC, 2009). The conditions expected to prevail during 2012, as the main banks that finance the global maritime industry are located in Europe (Lloyds, 2011). The result consists to the trend in shipping companies, for securing their property from the bankruptcy as well, the ship prices and their profits are reduced continuously (Lloyds, 2011). For example, in the first half of 2011, lending to shipping companies reached 28.3 million USD from 95 negotiations; in contrast, the first half of 2010, this was 48.6 million USD, (Lloyds, 2011), i.e., almost 42% decline. Against this background, we understand that the issue of capital structure of the shipping business is timelier than ever.

2.4 Determinants of capital structure

Size

One of the most discussed features of the companies responsible for developing their capital structure is the size. According to trade off theory, size is positively correlated with the leverage because larger companies have less chance of bankruptcy, less variation in their profits or losses and appear stronger in situations of financial hardship, due to their spreading of investments. Several empirical studies have shown the positive relationship between size and debt (e.g., Warner, 1977; Ang, 1976; Friend and Lang, 1988; Rajan and Zingales, 1995; Michaelas et al., 1999; Ozkan, 2001; Booth et al., 2001; Fama and French, 2002; Bevan and Danbolt, 2002; Hall et al., 2004; Gaud et al., 2005; Maghyeren, 2005; Huang and Song, 2006; Eriotis et al., 2007; Deari and Deari, 2009; Omran and Pointon, 2009; Psilaki and Daskalakis, 2009). On the other hand, large firms have lower information asymmetry problems, leading to elect to issue shares as optimal borrowing and not resorting to bonds. This relationship applauds many studies (for instance, Kester, 1986; Kim and Sorensen, 1986; Titman and Wessels, 1988; Heshmati, 2001; Bevan and Danbolt, 2004; Chen et al., 2004; Khalid, 2011). Based on trade off theory and defining the variable of size as the natural logarithm of sales as they did many authors like, Titman and Wessels, 1988; Rajan and Zingales, 1995; Ozkan, 2001; Heshmati, 2001; Bevan and Danbolt, 2002; Bauer, 2004; Keshar, 2004; Abor, 2005; Gaud et al., 2005; Eriotis et al., 2007; Deari and Deari, 2009; Psilaki and Daskalakis, 2009; Ahmed et al., 2009; Ramalho and Silva, 2009; Serrasqueiro and Rogao, 2009; Chakraborty, 2010; Noulas and Genimakis, 2011, we assume that:

H1: The firm's size is positively correlated with debt

Assets structure

The structure of assets is the second factor that should concern us. Tangible assets, according to the trade off and pecking order theory, are positively related to borrowing and are offered as collateral to take loan, reducing the cost of representation, the cost of asymmetric information, the risk of bankruptcy and credit risk. The positive relationship between debt and tangible assets has been identified by several researchers (for instance see, Titman and Wessels, 1988; Rajan and Zingales, 1995; Booth et al., 2001; Chen, 2004; Gaud et al., 2005; Maghyeren, 2005; Noulas and Genimakis, 2011; Khalid, 2011). In conclusion, following the studies of, Titman et Wessels (1988), Gaud et al. (2005), Delcoure (2007), Chang et al. (2009) and Ramalho and Silva (2009), we define the asset structure as the ratio between tangible assets plus inventories to total assets and based on trade off and pecking order theories we formulate the following hypothesis:

H2: Tangible assets are positively related to borrowing.

Profitability

According to pecking order theory, firms due to the problems of asymmetric information, they prefer to finance their activities first from retained earnings, then by issuing loans, and finally by the issue of capital (Myers, 1984; Myers and Majluf, 1984). Therefore, profitable business, take care to make loans to their investment decisions from retained earnings, confirming the negative relationship between profitability and leverage ratio. This relationship have been confirmed several times by empirical studies (Kester, 1986; Friend and Lang, 1988; Titman and Wessels, 1988; Rajan and Zingales, 1995;

Michaelas et al., 1999; Wald, 1999; Booth et al., 2001; Ozkan, 2001; Chen, 2004, Bevan and Danbolt, 2004; Gaud et al., 2005; Maghyeren, 2005; Deari and Deari, 2009; Psilaki and Daskalakis, 2009; Degryse et al., 2010; Khalid, 2011). In contrast, from the side of the trade off theory, profitable firms in the name of the tax advantages of borrowing, resort to it by ensuring a positive relationship between debt ratio and profitability. In addition, profitable firms can cope with situations of economic recession; therefore, creditors express their preference by lending them more. Finally, according to Jensen and Meckling (1976), lending business operates as a discipline for managers and ensures increased efficiency of the shareholders. The positive relationship between debt and profitability demonstrate many empirical studies (Bevan and Danbolt, 2002; Abor, 2005; Keshar, 2004). Based on the trade off theory and defining the profitability as the ratio between earnings before interest, taxes, depreciation and repayments (EBITDA) to total assets as they did for instance Ozkan, 2001; Miguel and Pindado, 2001; Bevan and Danbolt, 2002; Bauer, 2004; Gaud et al., 2005; Deesomsak et al., 2004; Delcoure, 2007; Ramalho and Silva, 2009; Serrasqueiro and Rogao, 2009; Degryse et al., 2010; Chakraborty, 2010, we suggest that:

H3: Profitability is positively correlated with leverage ratio

Tax benefits from other sources except borrowing

Borrowing is not the only factor that generates tax benefits to companies. According to De Angelo and Masulis (1980), the tax benefits from other sources such as depreciations, operating as substitutes for the tax shield of debt and reveal a negative relationship between leverage ratio and tax benefits from other sources. Consequently, companies that enjoy tax advantages from other items of their balance sheet, refrain from issuing bonds because they do not need additional tax relief. The reported relationship is empirically verified by Kim and Sorensen (1986), Titman and Wessels (1988), Mackie-Mason (1990), Chanplinsky and Niehaus (1993), Wald (1999), Miguel and Pindado, 2001; Huang and Song (2006). The above evidence navigate us to assume:

H4: The tax advantages that come from sources other than lending, are negatively related to leverage ratio

Based on the empirical studies of Titman and Wessels (1988), Rajan and Zingales (1995), Heshmati (2001), Ozkan (2001), Bauer (2004), Deesomsak et al. (2004), Huang and Song (2006), Delcoure (2007), Deari and Deari (2009), Chang et al. (2009), Ahmed et al. (2009), Ramalho and Silva (2009), Degrysee et al. (2010), Chakraborty (2010), Serrasqueiro (2011), we determine the tax benefits of other sources as the ratio between depreciation to total assets.

Growth

According to pecking order theory, a growing business is apt to exhaust all resources to raise capital and eventually leads to a large debt burden. Instead, the trade off theory provides the negative relationship between debt and growth because the growing businesses face greater risk of bankruptcy, in times of financial distress. Furthermore, according to the agency theory, firms with growth trends often show exaggerated optimism, thus jeopardizing the interests of creditors (Myers, 1977; Jensen, 1986), verifying once again the current negative relationship between growth rate and leverage, confirmed by several empirical studies (Kim and Sorensen, 1986; Titman and Wessels, 1988; Rajan and Zingales, 1995; Heshmati, 2001; Ozkan, 2001; Graham and Harvey, 2001; Fama and French, 2002; Gaud et al., 2005; Maghyeren, 2005; Khalid, 2011). On the other hand, the application of pecking order theory, come to verify the findings of Kester (1986), Michaelas et al. (1999), Booth et al. (2001), Huang and Song (2002), Chen (2004), Sogord-Mira (2005), Omran and Pointon (2009), Deari and Deari, 2009, Degryse et al. (2010), Noulas and Genimakis, 2011. Considering the above, we arrive at the following hypothesis:

H5: The growth is negatively related to debt.

Influenced by the studies of Titman and Wessels (1988), Heshmati (2001), Voulgari et al. (2002), Keshar (2004), Ramalho and Silva (2009), Chang et al. (2009), Deari and Deari (2009), Degryse et al. (2010), Chakraborty (2010), Noulas and Genimakis (2011), we interpret the variable growth as the percentage change in total assets of European shipping companies.

Liquidity

In recent years, as factors influencing the optimal target-debt ratio, make their appearance the liquidity variables and the age of business. Specifically, firms that are highly liquid, can more easily meet their obligations therefore creditors make borrowing easier. On the other hand, Myers and Majluf (1984), based on pecking order theory, consider that liquidity helps businesses to concentrate on retained earnings and financing their capitals from them. The negative relationship between liquidity and debt proved through empirical studies Ozkan (2001), Ramalho and Silva (2009), Deesomsak et al. (2004) and Eriotis et al. (2007). Defining liquidity as the ratio between current assets excluding inventories to current liabilities, (Ozkan, 2004; Deesomsak et al., 2004; Eriotis et al., 2007) and based on trade off theory, we obtain the following hypothesis:

H6: The liquidity is positively correlated with debt.

Age

According to the pecking order theory, the oldest entities have built up large reserves of profits, resulting in the finance of their investments from retained earnings, which indicate the negative relationship between borrowing and age (Petersen and Rajan, 1994; Ramalho and Silva, 2009). Conversely, if the older businesses have managed to successfully repay their bank loans, this reduces the cost of borrowing and increases the preference to finance their operations by borrowing abroad (Diamond, 1989; Kimki, 1997). Setting the variable age of business, as its years of operation (Heshmati 2001; Ramalho and Silva, 2009; Serrasqueiro, 2011; Noulas and Genimakis, 2011) we assume that:

H7: Age is positively associated with the debt

In conclusion, the existence of specific factors has been identified by the majority of investigations, as culpable for the choice of capital structure of firms. Thus, the leverage ratio of each company has not to be taken as constant because it depends on certain factors and characteristics in time. A crucial question, which concerns the leverage ratio, is the values used to calculate it. Specifically, in the literature we find two approaches, thus we are given two choices. The first option concerns the calculation of debt ratio in book value while the second option, concerns the calculation by value of equity that emerges in the market. If we look in the literature, the prevailing view suggests the use of book values, as the market value of equity, is easily influenced by factors not controlled directly by the companies (Fama and French, 2000; Rajan and Zingales, 1995). On the other hand, the book values reflect better the management options. In the present investigation, based on the dynamic trade off theory and empirical results of studies (Lev and Pekelman, 1975; Ang, 1976; Taggart, 1977; Jalilvand and Harris, 1984; Moh 'd et al., 1998; Goldstein and Leland, 2001; Shyam-Sunder and Myers, 1999; Miguel and Pindado, 2001; Ozkan, 2001; Gaud et al., 2005; Serrasqueiro and Nunes, 2009) we assume that:

H8: Companies shape their lending aiming at achieving an ideal long-term debt ratio

The leverage ratio is calculated based on book values, defining it as the total debt to total assets (Degryse et al., 2004; Delcoure, 2007; Eriotis et al., 2007; Bevan and Danbolt, 2002; Heshmati, 2001; Keshar, 2004; Gaud et al., 2005; Ramalho and Silva, 2009; Serrasqueiro, 2011). The question that arises is: *what's the ideal capital structure ratio and if it exists, companies adapt to this*? To conclude the literature review, we give the role table summarizing the above factors, within the main theories of capital structure, i.e., trade off theory and pecking order theory.

Table 4: Correlation of factors determining the capital structure of firms

Factors	Trade off theory	Pecking order theory
Tax benefit arising from sources other than borrowing	-	
Size	+	-
Profitability	+	-
Tangible Assets	+	+
Growth	-	+
Age	+	-
Liquidity	+	-

Note: +/- positive/negative respectively.

3. Methodology

3.1 Data and definitions of variables

3.1.1 Data

To conduct the survey we used annual secondary data, resulting in the selection of an adequate number of companies. Our sample consists of listed European shipping companies excluding coasters and logistics because. The data were drawn from the Reuters/ Thomson One database and specifically from the Worldscope, (selected firms with SIC: 4412), to ensure the homogeneity of the sample. This database harmonizes accounting data from different countries, aiming for the smooth processing of user. Based on the above criteria, we examine 32 European oceanic shipping companies for the period 2005-2010. Specifically, the following table presents the distribution of the sample by country.

Table 5: Composition of the sample

Countries of origin for European Oceanic Shipping Companies	Number of firms	Sample's structure (%)
Norway	11	34.40
Denmark	6	18.75
Hellas (Greece)	6	18.75
England	2	6.25
Sweden	2	6.25
Lithuania	1	3.12
Latvia	1	3.12
Belgium	1	3.12
Finland	1	3.12
Italy	1	3.12
Sum	**32**	**100,00**

The sample listed companies are operating at the stock exchange of London, Copenhagen, Lithuania, Oslo, New York, Stockholm, Brussels, Helsinki, and Italy, while the majority of Hellenic shipping companies are meeting the index NASDAQ. Secondary panel data we used were drawn from published financial statements of companies, so our sample is limited to 192 observations. This kind of dataset allows us to look at, a certain number of units over time, mainly through fixed or random effects models and dynamic econometric models. Specifically, according to relevant econometric literature (e.g.. Hsiao, 1985; Hsiao, 1986; Ozkan, 2001; Gaud et al., 2005; Wooldridge, 2006; Colin and Trivedi, 2005; Baltagi, 1995) in order to achieve sufficient estimates within this short run sample period (2005-2010), it is necessary to use panel dataset.

3.1.2 Variables

As mentioned before, empirical studies confirm that the leverage ratio is not constant but depends on specific factors. For the study of the factors during the empirical survey we used ratios, as they are the most accurate measure for accent the characteristics of business. The latter is common practice by most researchers. The definition of the variables used in the study is shown below.

Table 6: Measurement of variables

Variables	Denomination	Measurement
Dependent variables		
Leverage	($Lev_{i,t}$)	Ratio between total debt to total assets.
Independent variables		
Size	($size_{i,t}$)	Natural logarithm of sales.
Growth	($grow_{i,t}$)	Percentage change in total assets.
Age	($lnage_{i,t}$)	Logarithm of the years of operation.
Tangible assets	($Tang_{i,t}$)	Ratio between tangible assets plus inventories to total assets.
Profitability	($Prof_{i,t}$)	Ratio between earnings before interest, taxes, depreciation and repayments (EBITDA) to total assets.
Tax benefits	($ntax_{i,t}$)	Ratio between depreciation to total assets.
Liquidity	($Liq_{i,t}$)	Ratio between current assets excluding inventories to current liabilities.

3.2 Econometric Method

Having discussed the variables that determine the optimal capital structure and variable that is used as measure of leverage in the previous section, we will now specify panel data models used in our study. We suppose that leverage can be explained as the follow structural form:

Leverage = f(size, growth, age, tangibility, profitability, tax benefits, liquidity)

As was said, we use both static and dynamic panel data methods. For the static relationship, we consider the following linear specification:

$$y_{it} = \gamma_t + \beta' x_{it} + \mu_{it} \;; \quad i = 1,...,N \text{ and } t = 1,...,T \qquad (1)$$

where y_{it} the leverage of firm i in year t, x_{it} a time-varying regressors (Size, Grow, Lnage, Tang, Prof, Ntax, Liq) assumed to be strictly uncorrelated with past, present and future realization of μ_{it}, β' a 7x1 vector of constants, γ_t are the individual effects or an unobserved heterogeneity and μ_{it}, the error term independently and identically distributed with zero mean and variance σ^2_{μ}.

In the case where observations on y_{it} and x_{it} are available, an aggregate time series regression would treat γ_t as part of the constant and thus unidentified, whilst a cross-section regression will yield a biased estimator of β' if γ_t is correlated with x_{it}. For these purpose, we must identify whether the unobserved individual effects γ_t are random or fixed, that is, if these effects are orthogonal or not to the explanatory variables considered in the model.

There are two basic frameworks used in this model. The fixed effects (1) approach takes γ_t to be a group specific constant term in the regression model. In the case of the presence of fixed effects, β and γ_t can be estimated consistently and efficiently by the Within Groups estimators which can be obtained by OLS after the data are transformed by subtracting group means from each observation (Hsiao, 1985). In contrast, the random effects approach

$$y_{it} = \beta' x_{it} + \nu_{it} \; ; \quad \nu_{it} = \gamma_t + \mu_{it}, \; i = 1,...,N \text{ and } t = 1,...,T \qquad (2)$$

specifies that γ_t is a group specific disturbance, similar to μ_{it} except that for each group, there is a single draw that enters the regression identically in each period. The appropriate GLS estimator of β shows that the random effects estimator is consistent.

A set of tests were undertaken on our models to verify the degree of consistency and robustness of the results obtained. To deal with the problem of heteroskedasticity and serial correlation, we select an appropriate model by testing Random versus Fixed Effects models. To perform this comparison, the character of the individual effects is tested through the Hausman's specification test. This procedure indicates that the individual effects are supposed to be fixed (chi2(7) = 22.52; Prob>chi2 = 0.0021). Thus the Within Groups estimators (Fixed effects model) are more efficient relative to the GLS estimators (Random effects model). To examine if time fixed effects are needed, we test for time-fixed effects (F(5,148) = 0.36; Prob > F = 0.8745). We conclude that we failed to reject the null that all yearly coefficients are joint equal to zero therefore no time fixed-effects are needed.

The diagnostics tests (Table 9) of the fixed effect model chosen, show: a) Absence of cross-sectional dependence/contemporaneous correlation (Pesaran's test = -0.616; Pr = 0.5381), b) Presence of heteroskedasticity (Modified Wald test: chi2 (32) = 14541.91; Prob>chi2 = 0.0000) and c) Serial correlation in panel data (Wooldridge test: F(1,31) = 20.26; Prob > F = 0.0001). Namely, this means that data have first-order autocorrelation. Because of this problems, we re-estimate our model applying FGLS estimator which assumes that, the panels are heteroskedastic and within panels, there is AR(1) autocorrelation and that the coefficient of the AR(1) process is common to all the panels.

In order to evaluate the robustness of the results, we also use dynamic panel data estimators. The primary motivation for analyzing panel data is to control for unobservable firm heterogeneity. In finance literature the endogeneity problem is either largely ignored or corrected for only using fixed effects or control variables approach. We control for this important problem by employing Generalized Method of Moments (GMM) technique to avoid significant bias in estimates.

Leverage decisions are dynamic by nature and could be modeled as such. Panel data analysis allows us to study the dynamic nature of the payout decisions at the firm level. Dynamic panel-data models can be estimated by the Generalized Method of Moments developed by Hansen and Singleton (1982), Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991) and Arellano and Bover (1995) to estimate the structural model of Leverage. GMM is used when the regression is dynamic and include lagged dependent variables. However the lagged dependent variables can create a bias on estimates obtained through classical regression analysis because the error term by definition is correlated with the lagged dependent variable. Due to such a correlation the OLS assumptions will be violated as regards the assumption of non-spherical error term.

To deal with variables that may be correlated with the error term, Instrumental Variables (IV) can be used. Application of GMM to econometric models can be considered as an extension of IV estimation method. IV estimation is widely used for models with random regressors (*e.g.* lagged dependent variable) which exhibit the correlation with model errors. Using IV has the additional advantage of solving problems encountered in static models, mainly the simultaneity bias between the leverage measure and the explanatory variables, and the measurement error issue. The prime advantage of GMM is that the model need not to be homoscedastic and serially independent. These GMM estimators allow controlling for unobserved individual effects which is present in the static model, endogeneity and simultaneity of explanatory variables and the use of lagged dependent variables, Hansen (1982).

Thus, if capital structure is dynamic and the firm *i* (given its leverage at time $t-1$ or earlier) chooses a capital structure $\mathbf{X}_{it}$ to achieve a level of expected leverage $E(y_{it})$ at time *t*, then the dynamic model for the effect of capital structure on leverage have to be given by the following specification :

$$E(y_{it} / y_{it-1}, y_{it-1} ... y_{it-p}, \mathbf{X}_{it,} \eta_i) = a + \sum_s \kappa_s y_{it-s} + \beta_i \mathbf{X}_{it} + \eta_i ;\;\; s = 1,...,p \qquad (3)$$

where $\mathbf{X}$ and y represent capital structure and leverage, respectively, η represents an unobserved firm effect and β_i measures the effect of capital structure on firm leverage given the firm's historical leverage. Including the lagged dependent variables accounts for the fact that the explanatory variables are themselves related to past leverage.

Equation (3) allows for the possibility that the effect of board structure on performance (β_i) may differ across individual firms, which is what is suggested by existing theory and empirical research. A key aspect of equation (3) is that it does not rule out the possibility that firms strategically use capital structure to change their leverage. However, cross-sectional estimation of (3) will mean estimating the following model:

$$y_{it} = a + \sum_s \kappa_s y_{it-s} + \beta_i \mathbf{X}_{it} + \eta_i + \varepsilon_{it} ;\;\; s = 1,...,p \qquad (4)$$

where ε_{it} is a random error term and β_i is the average effect of capital structure on leverage, $\beta = E(b_i)$. The key economic question here concerns the inference drawn from the estimated $\hat{\beta}$ in equation (4). The model in (3) allows b_i differing across firms. It is of course possible that $b_i < 0$ for some firms and $b_i > 0$ for other firms. Thus, while capital structure may be important in determining firm leverage, if capital structure is completely endogenously determined, then $\hat{\beta} = E(b_i) = 0$.

For the selection of suitable dynamic capital structure model, we followed the procedure:

First, we examined empirically how many lags of leverage we need to capture all information from the past. This is important for at least two reasons: a) failure to capture all influences of the past on the present could still mean that equation (3) is misspecified (i.e., there might be an omitted variable bias) and b) perhaps more importantly, we argue that all older lags are exogenous with respect to the residuals of the present; thus, they can be used as instruments. This is important for consistent estimation using the dynamic panel GMM estimator. Glen, Lee, and Singh (2001) and Gschwandtner (2005) suggest that two lags are sufficient to capture the persistence of leverage. To see if two lags are sufficient to ensure dynamic completeness, we estimate a regression of current leverage on *five* lags of past leverage, controlling for other firm-specific variables. Results suggest that including two lags it is sufficient to capture the dynamic endogeneity of the capital structure/leverage relation. Particularly, the first two lags are statistically significant while older lags are insignificant. Then, we drop the older lags and include only the recent ones. In these specifications, the older lags are statistically significant. Thus, while the older lags include relevant information, that information is subsumed by the more recent lags. Second, we examined empirically how strong the present with the past correlation is. Our test, involve OLS regression of current levels of firm specific variables. We find that, size, lnage and liquidity are significantly related to past leverage. The latter also shows that the variables are dynamically endogenous.

As we discussed earlier, we include two lags of leverage in the dynamic model. This makes historical leverage and historical firm characteristics, lagged three periods or more, available for use as instruments. We use variables lagged three periods as instruments for all the endogenous variables in the GMM estimates. Our assumption in the GMM regression is that all the regressors except growth, tangibility, profitability and tax benefits are endogenous.

Finally, we estimate the following model:

$$\begin{aligned} Lev_{it} = a_1 + \kappa_1 Lev_{it-1} + \kappa_2 Lev_{it-2} + \beta_1 Size_{it} + \beta_2 Grow_{it} + \beta_3 \ln Age_{it} + \beta_4 Tang_{it} \\ + \beta_5 Prof_{it} + \beta_6 Ntax_{it} + \beta_7 Liq_{it} + \eta_i + \varepsilon_{it} \end{aligned} \tag{5}$$

To estimate the above dynamic basic model, two versions of the GMM technique are used; First, the GMM in-difference and secondly, the linear GMM estimator in form of GMM in-system (see Table 10). In GMM in-difference technique, the model is estimated in first-differences using level regressors as instruments to control for unobservable firm heterogeneity. The GMM in-system model is estimated in both levels and first-differences, *i.e.,* level-equations are simultaneously regressed using differenced lagged regressors as instruments. As the autocorrelation of order 1 in the dependent variable is high and the number of time-series observation is small (6), the GMM in-system estimator is the most appropriated in comparison with the GMM differenced estimator.

The consistency of the coefficient estimates obtained with the panel GMM estimator depends, to a significant extent, on the validity of the instruments (exogeneity of instruments) that we use. Arellano and Bond (1991) suggest two tests for that reason. The first test is a serial correlation test. The biggest concern is whether or not we have included enough lags to control for dynamic endogeneity. For our GMM in-system estimates, if the assumptions of our specification are valid, by construction the residuals in first differences (AR(1)) should be correlated, but there should be no serial correlation in second differences (AR(2)). The results of these tests confirm that this is the case: the AR(1) test yields a *p*-value of 0.334 and the AR(2*)* test yields a *p*-value of 0.249 (see Table 10). The second test is a Hansen (or Sargan) test of over-identification. The dynamic panel GMM in-system estimator uses multiple lags as instruments. This means that our system is over-identified and provides us with an opportunity to carry out the test of over-identification. Hansen and Sargan tests (*p*-value of 0.235 and *p*-value of 0.0380, respectively) show that our instruments are valid. Finally, to test the exogeneity of the subset of our instruments, use the difference-in-Hansen test. The results show that the additional subset of instruments used in the system GMM estimates is indeed exogenous.

4. Results and Discussion

4.1 Descriptive statistics and correlation

Summary statistics for the set of variables in this study is presented in the following table:

Table 7: Descriptive statistics

Variables	CV	Mean	Std. Dev.	Min	Max
Leverage	0.3735	0.4354	0.1626	0.0065	0.8608
Size	0.3433	5.1662	1.7737	1.1241	10.6531
Growth	12.9713	1.4610	18.9510	-3.3481	262.6288
Lnage	0.2857	3.6837	1.0526	0.6931	5.0173
Tangible Assets	0.2136	0.7790	0.1664	0.1028	1.1886
Profitability	0.9320	0.1143	0.1065	-0.3598	0.5425
Tax benefits	0.7955	0.1988	0.1581	0.0036	1.0352
Liquidity	1.0750	1.2760	1.3716	0.0068	10.7838

The volatility of variables lies within the expected range except for the variable of growth which seems to be dominated by outliers[2]. Furthermore, we note from the leverage

[2] We didn't abstract them because we have not the necessary interpretation.

ratio on average 43.54% of the assets of the shipping companies are financed by borrowing, during the sample period 2005-2010. Simultaneously, the tangible assets consist of 77.90% of total assets of the companies, emphasizing the importance of long term funding for maritime businesses. Although the volume of assets, only 19.88% is subject to depreciation. This percentage is quite small when considering that most of the assets are ships, which have a large life for depreciation. This can be explained by the constant buying and selling ships, conducted by maritime shipping companies, (Apergis and Sorros, 2009). Finally, liquidity has mean 1.27 indicating that companies can handle well their obligations.

At the next table it is shown the matrix of correlation coefficients between leverage and the independent variables. From the table it seems that we have no problem of multicollineartiy (Mean VIF=1.47 <10).

Table 8: Correlation matrix

Variables	$Lev_{i,t}$	$Size_{i,t}$	$Grow_{i,t}$	$Lnage_{i,t}$	$Tang_{i,t}$	$Prof_{i,t}$	$Ntax_{i,t}$	$Liq_{i,t}$
$Lev_{i,t}$	1							
$Size_{i,t}$	-0.1586*	1						
$Grow_{i,t}$	-0.088	0.0083	1					
$Lnage_{i,t}$	-0.0575	0.5649*	0.066	1				
$Tang_{i,t}$	0.2005*	-0.2226*	0.0554	-0.3573*	1			
$Prof_{i,t}$	-0.3546*	0.3530*	0.0069	0.2014*	-0.1413	1		
$Ntax_{i,t}$	0.118	0.1451*	-0.0372	0.1866*	0.088	-0.0624	1	
$Liq_{i,t}$	-0.3679*	0.0838	0.5052*	0.2685*	-0.2468*	0.2774*	-0.1415	1

Note: * $p < 0.05$

4.2 Comparison of the results of static panel models

The estimations from the fixed effect model and FGLS estimator are shown at Table 9. In Fixed - effect model, the only statistically significant variable is the structure of assets, showing a positive relationship with the leverage ratio. In the FGLS estimator except of the structure of assets, significant variables are shown the size and profitability, indicating a negative relationship with the leverage ratio. The specific variables show a negative relationship in fixed effects model but they are non-statistically significant. The variable of age appears non-significant in both models, emphasizing the positive dependence on borrowing. While, there is negative relationship between tax advantages resulting from depreciation and borrowing, this is not statistically significant in both models. The variables of growth and liquidity are also not statistically significant. So, observing the results of Table 9, we can conclude that the estimations of the fixed effects model are a little bit different from those of the FGLS one.

Table 9: Static panel models' estimations

Dependent variable $Lev_{i,t}$	Fixed-effect	FGLS
size	-0.0107	-0.0111[a]
	(-0.68)	(-1.87)
grow	0.0002	-0.0001
	(0.75)	(-0.17)
lnage	0.0250	0.0222
	(0.20)	(1.60)
tang	0.3960**	0.2920***
	(3.30)	(4.79)
prof	-0.1950	-0.3770***
	(-0.96)	(-4.98)
ntax	-0.0847	-0.0260
	(-0.99)	(-0.55)
liq	0.0079	-0.0101
	(0.76)	(-1.12)
_cons	0.1190	0.2500**
	(0.26)	(3.10)
N	192	192
R-sq	0.185	0.168
F & Wald statistics	F(7,31)= 509.25	chi2(7)=86.86
Mean VIF	1.47	
Ramsey Reset test	F(3, 181) = 2.10; Prob > F = 0.1018	
Hausman test	Chi2(7)=22.52; Prob>Chi2= 0.0021	
Pesarans test	-0.616; Pr = 0.5381	
Modified Wald test	chi2(32)=14541.91; Prob>chi2 = 0.000	
Wooldridge test	F(1,31) = 20.260; Prob > F = 0.0001	

Notes: The Null Hypotheses for the used tests are as follows: 1. Ramsey Reset test ‘the functional form is correct’, 2. Wald tests ‘non-significance of the explanatory variables as a whole’, 3. F-test ‘non-significance of the set of estimated variables’, 4. Hausman test ‘the explanatory variables and the individuals’ effects are uncorrelated’, 5. Pesaran test ‘cross-sectional dependence of panel data’, 6. Modified Wald test ‘group-wise heteroskedasticity’, 7. Wooldridge test ‘no-first order autocorellation of panel data variables’. t-statistics are in parentheses. [a] $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.3 Comparison of the results of dynamic panel models

At Table 10 we present the results of Generalized Method of Moments (GMM) and GMM in-system model.

Table 10: Dynamic panel models' estimations

Dependent variable $Lev_{i,t}$	One-step diff. GMM	Two-step system GMM
size	-0.0396	-0.0078
	(-0.58)	(-0.41)
grow	-0.0003*	-0.0001
	(-2.07)	(-0.49)
Lnage	-0.2890	0.0243
	(-1.16)	(1.12)
Tang	0.4680**	0.1710
	(3.04)	(1.25)
Prof	-0.1870	-0.3650[a]
	(-0.73)	(-1.72)
Ntax	0.1330*	0.09970[a]
	(2.11)	(1.89)
Liq	0.03920[a]	-0.0027
	(1.94)	(-0.17)
lev (t-1)	0.0431	0.2210
	(0.23)	(0.93)
lev(t-2)	0.2630	0.4910
	(0.84)	(1.50)
_cons		-0.0301
		(-0.25)
N	96	128
F statistics	F(9,32) =11.57	F(9,31) = 27.47
Arellano-Bond test for AR(1) (p-value)	(0.166)	(0.334)
Arellano-Bond test for AR(2) (p-value)	(0.522)	(0.249)
Sargan test of over-identification (p-value)	(0.609)	(0.380)
Hansen test of over-identification (p-value)	(0.683)	(0.235)
Difference-in-Hansen tests of exogeneity (p-value)	(0.683)	(0.554)

Notes: 1. F-test 'non-significance of the set of estimated variables'. 2. Sargan and Hansen test 'the over-identifying validity of restrictions'. 3. Arellano-Bond test ''autocorrelation AR(1) and AR(2). t-statistics are in parentheses. [a] $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

At the GMM and GMM system dynamic estimators we observe a negative and not statistically significant relationship between size and debt. On the other hand, growth appears statistical significant with a negative relationship with debt, at GMM model, while at GMM system dynamic estimator is not statistical significant. The variable of age is not statistical significant for both models, although we observe a negative relationship between debt and age, at GMM dynamic estimator and a positive relationship at GMM system dynamic estimator. The structure of assets affects positively debt and it is statistical significant at GMM model. In drawing our attention to the variable of profitability, we see the negative relationship with debt and statistical significant, at GMM system. The tax benefit, resulting from the depreciation, reported statistically significant in both models, indicating a positive relationship with the leverage ratio. The statistically significant variable of liquidity displays a positive relationship with the dependent variable of leverage in GMM model, in contrast to the GMM system where it is shown a non-significant negative dependence on the leverage ratio. At the end, the impact of dept in the previous periods is not statistically significant in both models.

4.4 Discussion

Size

The variable of size is negatively related to the leverage ratio for all models and displayed statistically significant in the FGLS estimator. Therefore, the hypothesis H1 for positive correlation of size and leverage ratio didn't verify by our dataset of European oceanic shipping companies. By this way, the Pecking order theory is confirmed as well larger firms face less information asymmetry problems by selecting the issuance of shares as the best way to finance capital. This is supported in the shipping sector because we are faced with large companies that operate globally by their nature and continuously disclose their financial information, while the most of them are controlled by external and internal auditors. We should also not forget that the period of economic crisis has created a bleak and volatile economic environment, leading financial institutions, firstly on banking solvency crisis making borrowing difficult enough. Although, the sample period comprises the crash of 2008 and the ongoing crisis, which we should take in to account, the negative relationship between size and leverage ratio has been verified by Kester, 1986; Kim and Sorensen, 1986; Titman and Wessels, 1988; Heshmati, 2001; Bevan and Danbolt, 2004; Chen et al., 2004; Khalid, 2011.

Growth

The variable of growth is negatively related to the leverage ratio in all estimated models, except in fixed effect model where we find a positive relationship, but statistically insignificant. So, we accept the hypothesis H5 for negative relationship between growth and leverage ratio. This result serves to confirm the trade off theory, as well developing businesses particularly this crisis period, yield risk for creditors while occupied by over-optimism. Result of reported events is the reduction of loans from credit institutions given the aforementioned banking crisis. The negative relationship between debt ratio and growth come to confirm studies of: Kim and Sorensen, 1986; Titman and Wessels, 1988; Rajan and Zingales, 1995; Heshmati, 2001; Ozkan, 2001; Graham and Harvey, 2001; Fama and French, 2002; Gaud et al., 2005; Maghyeren, 2005; Khalid, 2011.

Age

The variable of age, statistically insignificant, shows a positive relationship with the leverage ratio for the estimated models, except the GMM where it is reported as a negative one. This could verify both the pecking order theory and the trade off theory. Our dataset support the thesis that the age of shipping companies does not affect their capital structure.

Asset Structure (Tangible Assets)

Structure of assets is appeared as a positive determinant of the leverage ratio as it proved statistically significant (with the exception of the GMM system), verifying the hypothesis H2. Tangible assets, offered as collateral to credit institutions, reducing the cost of asymmetric information and bankruptcy costs. This finding supports both the trade off theory and the pecking order theory and is confirmed empirically by the following researchers: Titman and Wessels, 1988; Rajan and Zingales, 1995; Booth et al., 2001; Chen, 2004; Gaud et al., 2005; Maghyeren, 2005; Noulas and Genimakis, 2011; Khalid, 2011.

Profitability

The variable of profitability is negatively related to the leverage ratio and appears statistically significant in the FGLS estimator and the GMM system model. Our data for European shipping reject the H3 hypothesis. So, we confirm the pecking order theory. Profitable firms are able to retain profits to fund their activities from them, rather than external borrowing. This result verified empirically by: Kester, 1986; Friend and Lang, 1988; Titman and Wessels, 1988; Rajan and Zingales, 1995; Michaelas et al., 1999; Wald, 1999; Booth et al., 2001; Ozkan, 2001 ; Chen, 2004, Bevan and Danbolt, 2004; Gaud et al., 2005; Maghyeren, 2005; Deari and Deari, 2009; Psilaki and Daskalakis, 2009; Degryse et al., 2010; Khalid, 2011.

Tax benefits from other sources except borrowing

The variable of tax benefits from sources other than borrowing appears statistically significant and shows a positive relationship with the leverage ratio (Table 10), which is the opposite case of the static econometric estimations presented in Table 9. This evidence depicted by the dynamic modeling of the GMM, might be explained by the specific tax regulation for/and the nature of the shipping companies, which have a large volume of fixed assets and engage in continuous buying and selling it. As a result, appears the delayed depreciation of capital equipment and essentially exempting income from the cost of depreciation, during the first years of the new asset. This positive relation may have as underlying reason the age of ships, i.e., the greater the tax benefits, the aging ship have to be replaced, ceteris paribus, by new borrowing which give rise to the leverage ratio. The income generated from the years that follow the sale of the asset, is without costs of depreciation, so the companies are turning to loans to obtain tax benefits resulting from it. The specificity of the shipping companies with very high relative variability of tax benefits, appears in the table of descriptive statistics quoted above (Table 7).

Liquidity

The variable of liquidity shows statistically significant in the dynamic model GMM. Furthermore, there is a positive relationship between liquidity and leverage ratio. This fact verifies the trade off theory. Specifically, firms with excess liquidity cope with their obligations, thus predisposing the credit institutions to facilitate loans. If we observe Table 7 which shows the descriptive statistics, we see that on average the shipping companies have good liquidity, but always under the constraint of business cycles in shipping which may be revealed by its high relative variance.

Adjustment to a target ratio

The size of coefficients of lagged leverage are not so high and also is not statistical significant. Specifically, although the rate of adjustment, at the model GMM, for a time lag is 0.957 and 0.737 for two lags, indicating a rapid adaptation of the European shipping companies in an ideal target indicator, we cannot take this into account due to non-statistically significant variable. The same goes for the GMM system model. This finding verifies the pecking order theory, which does not require companies to adapt to an ideal target ratio. So, the H8 hypothesis is not accepted, or our data advocates with a no-leverage target ratio

The following table shows the expected and observed results of our research.

Table 11: Expected and observed signs

Factors	Trade off theory	Pecking order theory	Statistically significant estimated signs			
			Fixed-effect	GLS	One-step diff. GMM	Two-step sys. GMM
Tax benefit arising from sources other than borrowing	-				+	+
Size	+	-		-		
Profitability	+	-		-		-
Tangible Assets	+	+	+	+	+	
Growth	-	+			-	
Age	+	-				
Liquidity	+	-			+	

Above, we analyzed the determinants of capital structure of enterprises through static and dynamic econometric models. If we observe the results, we will identify the differences arising depending on the model used, without excluding the commonalities among the models. Essentially, static models give us the variables of growth, age, liquidity and tax advantages of depreciation, non-statistically significant. While easily end up in a negative relationship between size, profitability and debt and a positive relationship between physical assets and the leverage ratio. These lead us to conclude to the adoption of pecking order theory of the shipping companies.

The static models, due to unobserved effects result in somewhat unreliable results. In that conclusion reached Gow et al. (2007) in their empirical study, by opposing 121 studies, published in prestigious journals such as 'The Accounting Review', 'Journal of Accounting and Economics' and 'Journal of Accounting Research', resulted in the finding of error specification of the statistical results of the investigations, because of the violation of the assumption of independence of the disturbing term with the independent variables. Specifically, many studies employed models which assume either independence or cross section or time series, but not time series and cross section, resulting in a cross sectional or time series correlation, as appropriate. Simultaneously, basic assumptions which must be observed, often violated leading to erroneous conclusions, (Gow et al., 2007). For these reasons, we proceeded to implement dynamic econometric models. The GMM model, suggest us the application of both the trade off theory and the pecking order theory for our dataset of European shipping companies. The variables of size, profitability and age appear not statistically significant. At the same time it is displayed a positive relationship between liquidity, tangible assets, tax benefits from other sources than borrowing, and leverage ratio. On the other hand growth depends negatively on debt. Unlike, the GMM system model gives clearer results. Negative relationship occurs between profitability and debt while a positive relationship occurs between tax benefits arising from the depreciation and the debt ratio. To export our final conclusions, we will take into account the GMM system model which essentially gives us more strong results than the GMM model. Therefore, based on the above, we conclude the implementation of the pecking order theory of the European shipping companies.

5. Conclusion

This research, for the first time as far as we know, examines the capital structure of European shipping companies during the turbulent period 2005-2010, including the crash of 2008 and the ensuing global economic crisis. It was conducted over static (Fixed effects and FGLS estimator) and dynamic (GMM and GMM system methods) models using panel data. The objective of the research has been two-fold: a) to reveal the determinants of the capital structure of European shipping enterprises based on the dominant relative theory and b) to search for the existence of an ideal - target capital structure ratio.

If you consider the issue through econometric static models, easily end up in a negative relationship between size and profitability against lending and a positive relationship between tangible assets and the leverage ratio. The variables of growth, age, liquidity and tax advantages of depreciation showed up as not statistically significant. These lead us to conclude that our dataset (shipping companies) is in favor of the pecking order theory. Based on the GMM system model, due to the statistically robust estimations obtained, we reached at the negative relationship between profitability and debt and a positive relationship between tax benefits from depreciation, which might underlie the aging factor of the ships, and the debt ratio. Furthermore, the variable of adjustment in an ideal capital structure ratio appears as not statistically significant, suggesting that European shipping companies verify pecking order theory.

This research is limited on European shipping companies, which constraint the global inference of the estimations yield. Moreover, interpreting the leverage ratio we used only book values, while we have not distinguished in the long or short term borrowing. A special limitation, is that we analyzed this issue based only on micro-data during a global crisis period (2005-2010), without macro-elements in our identified models. However, our research may be the trigger for a global one in the maritime sector, taking into account the socio-economic conditions that surround the enterprises and other determinants. Simultaneously, in future studies would be useful to consider the debt leverage of enterprises through market values, or to distinguish in the long and short term borrowing.

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Price Discovery and Asymmetric Volatility Spillovers in Indian Spot-Futures Gold Markets

P. Srinivasan[1] and P. Ibrahim[2]

Abstract

This study attempts to examine the price discovery process and volatility spillovers in Gold futures and spot markets of National Commodity Derivatives Exchange (NCDEX) by employing Johansen's Vector Error Correction Model (VECM) and the Bivariate ECM-EGARCH(1,1) model. The empirical result confirms that the spot market of Gold plays a dominant role and serves as effective price discovery vehicle. Besides the study results show that the spillovers of certain information take place from spot market to futures market and the spot market of gold have the capability to expose the all new information through the channel of its new innovation.

Keywords: Price Discovery, Asymmetric Volatility Spillover, Cointegration, VECM, EGARCH Model

JEL Classification: G13, G14, C51

1. Introduction

India is the largest consumer of Gold in the world accounting for nearly 25% of the total gold consumption in the world. Most of India's gold consumption is in the form of jewellery and as investment demand. Indian gold demand is supported by cultural and religious traditions which are not directly linked to global economic trends as a result of which demand remains steady even during high prices. The steadily rising prices of Gold reinforce the inherent value of gold jewellery, an intrinsic part of its desirability and also as a means of investment. The growth in investment demand has sparked numerous innovations in gold investment.

Gold Futures contract started trading on National Commodity Derivatives Exchange (NCDEX) from 2004 onwards. The introduction of gold futures trading allows integration of demand and supply of market participants, i.e., gold and jewellery manufacturers, exporters and importers, and investors, in organized markets. Using futures contract, the importers

[1] Assistant Professor, Department of Economics, Christ University, Hosur Road, Bangalore 560029, Karnataka, India. Tel: +91-9611273853, E-mail: srinivasan.palamalai@christuniversity.in

[2] Professor, Department of Economics, Pondicherry University, Kalapet, Pondicherry, India. E-mail: ecoibrahim@yahoo.co.in

and domestic buyers can minimize their price risk from the adverse price movements of underlying spot markets. Wide range of market participants ensure good price discovery. With ever increasing import demand, importers can insure themselves against price risk. The essence of spot and futures market in price discovery functions hinges on whether new information is first reflected in futures market or in spot markets. It has been argued, that the lead-lag relationship between spot and futures prices series can be attributed to one or more market imperfection like differences in transaction cost, liquidity differences between two market, short selling restriction, non-stochastic interest rate, different taxation regimes and differences in margin requirements.

The purpose of the present study is to examine the price discovery process and volatility spillover between the commodity spot and futures markets of gold in India. The present study possesses significance in the sense that it enables to determine which market is more efficient in processing and reflecting of new information. The study will throw light on the possibility of acting spot or future prices as an efficient price discovery vehicle, and this will be immensely useful for the traders to hedge their market risk. Besides, the study provides useful insights to the arbitrageurs, who are formulating their trading strategies based on market imperfections. Further, the present study is immensely helpful for the investors and portfolio managers to develop effective trading and hedging strategies in the Indian gold market.

2. Review of Literature

Attempts to investigate the futures-spot price relationships and volatility spillover have received considerable attention in the futures market literature. Earlier study by Gardbade and Silber (1983) used daily spot and futures prices for four storable agricultural commodities (wheat, corn, oats and orange juice) to understand the price discovery process in storable agricultural commodities. For wheat, corn and orange juice, they found that the futures markets dominate the spot markets, but for oats the results were not clear enough. Oellermann et al. (1989) and Schroeder and Goodwin (1991) studied the price discovery for livestock contracts and found that the futures markets capture the information first and then transfer it to the spot markets. Brockman and Tse (1995) investigated the price discovery mechanism of four agricultural commodities futures market in Canada using cointegration, vector error correction model and the Hasbrouck (1995) information model. They found that the futures market leads the spot market for all four commodities and hence the price discovery was mainly driven by the futures market. Fortenberry and Zapata (1997) examined the lead-lag relationship between futures and spot markets in the US for cheddar cheese, diammonium phosphate and anhydrous ammonia by using cointegration techniques. They found the evidence that futures and spot prices of diammonium phosphate and anhydrous ammonia markets are cointegrated but not that of cheddar cheese. Koutmos and Tucker (1996) examined the temporal relationships and dynamic interactions between S&P 500 spot index and stock index futures through VECM and ECM-EGARCH(1,1) model. He reported that volatility in both markets is an asymmetric function of past innovations. Further, empirical analysis revealed that volatility spillover effects between the two markets are bidirectional.

Yang et al. (2001) examined the price discovery performance of the futures markets for storable (corn, oats, soybean, wheat, cotton, and pork bellies) and non-storable (hogs, live cattle, feeder cattle) commodities. They used cointegration procedures and vector error correction models (VECM) and found that futures markets lead the spot markets in the case of both storable and non-storable commodities. Moosa (2002) examined whether the crude oil futures market perform the function of price discovery and risk transfer. The study used the daily data of spot and one-month future prices of WTI crude oil covering from January 1985 to July 1996. He found that sixty percent of the price discovery function is performed in futures market.

Mattos and Garcia (2004) analyzed the lead-lag relationship between spot and futures prices in the Brazilian agricultural markets. They used daily data on Brazilian futures and spot prices of coffee (arabica), corn, cotton, live cattle, soybeans, and sugar and found mixed results. It was found that the futures and the spot prices were cointegrated in the case of live cattle and the coffee markets. Besides, the analysis revealed that there was no cointegrating relationship in the thinly traded markets (i.e., corn, cotton, soybeans). Tse and Xiang (2005) found that NYNEX E-mini futures contracts on gas and crude contribute more than thirty per cent of price discovery even though they account for less than one per cent of the volume of standard contracts.

Zapata et al. (2005) examined the relationship between eleven futures prices traded in New York and the world cash prices for exported sugar by considering the observation from January 1990 to January 1995. They found that the futures market of sugar leads the cash market in price discovery mechanism. Azizan et al. (2007) investigated the return and volatility spillovers in the Malaysian crude palm oil futures market using bivariate ARMA(p,q)-EGARCH(p,q) model specifications. They used daily price data of crude palm oil futures and spot markets and found bidirectional information transmission between futures and spot markets for both returns and volatility. Ge et al. (2008) examined the interactivity of Chinese cotton markets with the US market and found that futures prices of cotton in China and the US are cointegrated. Besides, the empirical analysis revealed that these two markets efficiently share price transmissions.

As regards to the research concerning India, Thomas and Karande (2001) studied the price discovery process in the castor seed futures market traded on Ahmedabad and Mumbai regional exchanges. They found that Ahmedabad and Mumbai markets react differently to information in the price discovery of castor seed. In the Bombay market, futures prices dominated the spot prices. However, no lead-lag between spot and futures prices was found in the Ahmedabad market. Kumar and Sunil (2004) investigated the price discovery of five Indian agricultural commodities futures market by employing the Johansen cointegration technique. They found inability on part of the futures market to fully incorporate information and confirmed inefficiency of Indian agricultural commodities futures markets.

Karande (2006) investigated the linkages between Indian castor seeds futures and spot market employing co-integration test. The study showed that the Indian futures markets of Mumbai and Ahmedabad are cointegrated, indicating the existence of unidirectional causality from futures to spot market. Praveen and Sudhakar (2006) analyzed price discovery between stock market and the commodity futures market. They considered Nifty futures traded on National Stock Exchange (NSE) and gold futures on Multi Commodity Exchange of India (MCX). The result empirically showed that the Nifty futures had no influence on the spot Nifty. Besides, the casual relationship test in the commodity market showed that gold futures price influenced the spot gold price, but the opposite was not true.

Roy and Kumar (2007) investigated the lead-lag relationship between spot and futures prices of wheat spot markets in India using the Johansen cointegration test. It was found that the cointegration across spot markets had increased after the introduction of the futures market. Roy (2008) examined the price discovery process of thirty-two wheat futures contracts in India. He found that the Indian wheat futures markets are well cointegrated with their spot markets. The bidirectional causality observed in the majority of the wheat futures contracts.

Iyer and Pillai (2010) had examined whether futures markets play a dominant role in the price discovery process. They used two-regime threshold vector autoregression (TVAR) and a two-regime threshold autoregression for six commodities. They found that commodity futures market prices play the vital role in the price discovery process. For copper, gold and silver, the rate of convergence is almost instantaneous during the expiration week of the futures contract affirming the utility of futures contracts as an effective hedging tool. In the case of chickpeas, nickel and rubber, the convergence worsens during the expiration week indicating the non-usability of futures contract for hedging. Shihabudheen and Padhi (2010) examined the price discovery mechanism and volatility spillovers effect for six Indian commodity markets, viz., Gold, Silver, Crude oil, Castor seed, Jeera and Sugar. The study result supported that futures price acts as an efficient price discovery vehicle in the case of Gold, Silver, Crude oil, Castor seed, Jeera. They found that the volatility spillover exists from futures to spot market in all cases except sugar.

Pavabutr and Chaihetphon (2010) examined the price discovery process of the nascent gold futures contracts in the Multi Commodity Exchange of India (MCX) over the period 2003 to 2007. The study employed vector error correction model (VECM) to show that futures prices of both standard and mini contracts lead spot price. They found that standard and mini futures contracts exhibit a stronger influence over spot prices both in the short-run and long-run. Moreover, Srinivasan (2012) examined the price discovery process and volatility spillovers in Indian spot-futures commodity markets through Johansen cointegration, Vector Error Correction Model (VECM) and the bivariate EGARCH model. He found that the commodity spot markets of MCXCOMDEX, MCXAGRI, MCXENERGY and MCXMETAL serve as effective price discovery vehicle. Besides the volatility spillovers from spot to the futures market are dominant in case of all MCX commodity markets.

From the existing literature, it appears that even though spot and futures markets react to the same information, the major question is which market reacts first and from which market volatility spillover to other markets. The empirical research on the price discovery role of Indian commodity futures markets is relatively sparse. Especially, the studies pertaining to price discovery role and volatility spillover in Indian gold futures market was found to be meager. The existing studies such as Praveen and Sudhakar (2006), Iyer and Pillai (2010), Shihabudheen and Padhi (2010) and Pavabutr and Chaihetphon (2010) regarding Indian gold futures market mainly focused on Multi Commodity Exchange of India Ltd (MCX). This is due to the fact that MCX accounts for over half of gold futures trading in India. The activity on MCX revolves around precious metals and crude oil. However, activity on NCDEX is largely driven by regional domestic crops. Since the past few years, the spurt in the gold prices and concerned over the falling volume in agri-commodities exhibited maturity on all parameters of gold in NCDEX viz. traded volumes, open interest and member participation. According to data on NCDEX website, the trading volume of gold has increased from Rs. 202 crore in November 2010 to Rs. 13,971 crore in January 2011. Besides, the entities perceived to be fronting for a rival exchange have drawn the market regulator's attention to the dramatic surge in trading volumes of gold at NCDEX. With the Indian gold commodity market assuming more and more importance in recent years, the debate on price discovery and volatility spillover becomes important among financial analysts, arbitrageurs, speculators and market regulators. The present paper attempts to examine the price discovery process and volatility spillovers in gold futures and spot markets of National Commodity Derivatives Exchange (NCDEX) by employing Johansen's Vector Error Correction Model (VECM) and the Bivariate ECM-EGARCH(1,1) model.

The remainder of the article is organised as follows: Section-3 describes the methodology and data used for empirical analysis. Section-4 offers empirical results and discussion of the study. Concluding remarks are presented in section-5.

3. Methodology

Johansen's (1988) cointegration approach and Vector Error Correction Model (VECM) have been employed to investigate the price discovery process in spot and futures market of gold in India. Before doing cointegration analysis, it is necessary to test the stationary of the series. The Augmented Dickey-Fuller (1979) test was employed to infer the stationary of the series. If the series are non-stationary in levels and stationary in differences, then there is a chance of cointegration relationship between them which reveals the long-run relationship between the series. Johansen's cointegration test has been employed to investigate the long-run relationship between two variables. Besides, the causal relationship between spot and futures prices investigated by estimating the following Vector Error Correction Model (VECM) (Johansen, 1988):

$$\Delta X_t = \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-1} + \varepsilon_t \quad ; \quad \varepsilon_t \mid \Omega_{t-1} \sim distr(0, H_t) \tag{1}$$

where X_t is the 2x1 vector $(S_t, F_t)'$ of log-Spot price and log-Futures price, respectively, Δ denotes the first difference operator, ε_t is a 2x1 vector of residuals $(\varepsilon_{S,t}, \varepsilon_{F,t})'$ that follow an as-yet-unspecified conditional distribution with mean zero and time-varying covariance matrix, H_t. The VECM specification contains information on both the short- and long-run adjustment to changes in X_t, via the estimated parameters Γ_i and Π, respectively.

There are two likelihood ratio tests that can be employed to identify the co-integration between the two series. The variables are cointegrated if and only if a single cointegrating equation exists. The first statistic λ_{trace} tests the number of cointegrating vectors is zero or one, and the other λ_{max} tests whether a single cointegrating equation is sufficient or if two are required. In general, if r cointegrating vector is correct. The following test statistics can be constructed as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} 1n\left(1-\hat{\lambda}_i\right) \tag{2}$$

$$\lambda_{max}(r;\, r+1) = -T 1n\left(1-\hat{\lambda}_{r+i}\right) \tag{3}$$

where $\hat{\lambda}_i$ are the eigen values obtained from the estimate of the Π matrix and T is the number of usable observations. The λ_{trace} tests the null that there are at most r cointegrating vectors, against the alternative that the number of cointegrating vectors is greater than r and the λ_{max} tests the null that the number of cointegrating vectors is r, against the alternative of r + 1. Critical values for the λ_{trace} and λ_{max} statistics are provided by Osterwald-Lenum (1992).

Johansen and Juselius (1990) showed that the coefficient matrix Π contains the essential information about the relationship between S_t and F_t. Specifically, if rank(Π) = 0, then Π is 2x2 zero matrix implying that there is no cointegration relationship between S_t and $F_{t,t-n}$. In this case the VECM reduces to a VAR model in first differences. If Π has a full rank, that is rank(Π) = 2, then all variables in X_t are $I(0)$ and the appropriate modelling strategy is to estimate a VAR model in levels. If Π has a reduced rank, that is rank(Π) = 1, then there is a single cointegrating relationship between S_t and F_t, which is given by any row of matrix Π and the expression ΠX_{t-1} is the error correction term. In this case, Π can be factored into two separate matrices α and β, both of dimensions 2x1, where 1 represents the rank of Π, such as $\Pi = \alpha\beta'$, where β' represents the vector of cointegrating parameters and α is the vector of error-correction coefficients measuring the speed of convergence to the long-run steady state.

If spot and futures prices are cointegrated then causality must exist in at least one direction (Granger, 1988). Granger causality can identify whether two variables move one after the other or contemporaneously. When they move contemporaneously, one provides no information for characterising the other. If 'X causes Y', then changes in X should precede changes in Y. Consider the VECM specification of Equation (1), which can be written as follows:

$$\Delta S_t = \sum_{i=1}^{p-1} a_{S,i}\Delta S_{t-i} + \sum_{i=1}^{p-1} b_{S,i}\Delta F_{t-i} + a_S z_{t-1} + \varepsilon_{S,t} \tag{4}$$

$$\varepsilon_{i,t} \mid \Omega_{t-1} \sim distr(0, H_t)$$

$$\Delta F_t = \sum_{i=1}^{p-1} a_{F,i}\Delta S_{t-i} + \sum_{i=1}^{p-1} b_{F,i}\Delta F_{t-i} + a_F z_{t-1} + \varepsilon_{F,t} \tag{5}$$

where $a_{S,i}$, $b_{S,i}$, $a_{F,i}$, $b_{F,i}$ are the short-run coefficients, $z_{t-1} = \beta' X_{t-1}$ is the error- correction term which measures how the dependent variable adjusts to the previous period's deviation from long-run equilibrium from equation (1), and $\varepsilon_{S,t}$ and $\varepsilon_{F,t}$ are residuals.

In the above equations of Vector Error Correction Model, the unidirectional causality from Futures-to-Spot price (F_t Granger causes S_t) requires: (i) that some of the $b_{s,i}$ coefficients, i = 1, 2, …, p-1, are non zero and/or (ii) a_S, the error-correction coefficient in Equation (4), is significant at conventional levels. Similarly, unidirectional causality from Spot-to-Futures price (S_t Granger causes F_t) requires: (i) that some of the $a_{F,i}$ coefficients, i = 1, 2, …, p-1, are non zero and/or (ii) a_F is significant at conventional levels. If both variables Granger cause each other, then it is said that there is a two-way feedback relationship between S_t and F_t (Granger, 1988). These hypotheses can be tested by applying Wald tests on the joint significance of the lagged estimated coefficients of ΔS_{t-i} and ΔF_{t-i}. When the residuals of the error-correction equations exhibit heteroskedasticity, the *t*-statistics are adjusted by White (1980) heteroskedasticity correction.

As we are interested in knowing how volatility responds to good and bad news, we apply EGARCH specification popularized by Nelson (1991). Following the methodology of Koutmos and Tucker (1996) and Lin et al. (2002), we use a bivariate ECM-EGARCH(1,1) model in order to examine volatility spillovers. The model is described by the following system of equations:

$$[e_t \mid \Omega_{t-1}] = \begin{pmatrix} es,t \\ ef,t \end{pmatrix} \mid \Omega t-1 \Big) \sim N[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, H_t] \tag{6}$$

$$H_t = \begin{bmatrix} Var(es,t \mid \Omega t-1) & Cov(es,t\ ef,t \mid \Omega t-1) \\ Cov(es,t\ ef,t \mid \Omega t-1) & Var(ef,t \mid \Omega t-1) \end{bmatrix} = \begin{bmatrix} hs,t & hsf,t \\ hsf,t & hf,t \end{bmatrix}$$

$$\hat{\imath}_{i,t} = \frac{ei,t}{\sqrt{hi,t}} \sim N(0,1),\ i = s,f$$

$$\ln h_{s,t} = a_{s,0} + b_{s,s}\, G_s(\xi_{s,t-1}) + b_{s,f}\, G_f(\xi_{f,t-1}) + \gamma_s \ln(h_{s,t-1}) \tag{7}$$

$$\ln h_{f,t} = a_{f,0} + b_{f,f}\, G_f(\xi_{f,t-1}) + b_{f,s}\, G_s(\xi_{s,t-1}) + \gamma_f \ln(h_{f,t-1}) \tag{8}$$

$$G_s(\xi_{s,t-1}) = (\,|\xi_{s,t-1}| - E|\xi_{s,t-1}|\,) + \lambda_s \xi_{s,t-1} \tag{9}$$

$$G_f(\xi_{f,t-1}) = (\,|\xi_{f,t-1}| - E|\xi_{f,t-1}|\,) + \lambda_f \xi_{f,t-1} \tag{10}$$

$$h_{sf,t} = \rho \sqrt{h_{s,t}\, h_{f,t}} \tag{11}$$

where $e_{s,t}$ and $e_{f,t}$ are the error terms which are obtained from the VECM; $h_{i,t} = \sigma^2_{i,t} = Var(e_{i,t} \mid \Omega_{t-1})$ is the conditional variance and Ω_{t-1} is the information set available time t-1; $\xi_{i,t} = e_{i,t} / \sigma_{i,t}$ is the standardized innovation; $h_{sf,t}$ is the conditional covariance and ρ represents conditional correlation which is assumed to be constant as this assumption simplifies the estimation.

According to Tse (1999), the estimation of the model can be achieved by a two-step approach. First, we apply the VECM and then we save its residuals for use in the bivariate EGARCH(1,1) model. Because, the least squares estimator used in VECM is still consistent and unbiased even though the errors do not have a constant variance (heteroscedasticity), this approach is asymptotically equivalent to a joint estimation of the VECM and EGARCH models.

The log-likelihood for our model, assuming that the conditional joint distribution of $R_{s,t}$ and $R_{f,t}$ is normal, is:

$$L(\theta) = -T \log(2\Pi) - 1/2 \sum_{t-1}^{T} (log(\left| H_t(\theta) \right|) + e_t(\theta)' H^{-1}_t(\theta)\, e_t(\theta)) \qquad (12)$$

where T is the number of observations; et = ($e_{s,t}$ $e_{f,t}$) is the 1x2 vector of innovations at time t, and θ is the parameter vector to be estimated. The log-likelihood function is highly nonlinear in θ and the algorithm of Berndt et al. (1974) is used in order to maximize $L(\theta)$. In addition, the test of significance of the parameters is computed with the robust standard errors of Bollerslev and Wooldrigde (1992). The LB test statistics are computed on standardized residuals and standardized squared residuals of every market to check in there is any linear or nonlinear dependence in residuals.

The conditional variance in spot (7) and futures (8) is an exponential function of past own and cross-market standardized innovations. The coefficients $b_{s,f}$ and $b_{f,s}$ indicate the volatility spillover from futures to spot and from spot to futures, respectively. The coefficients $b_{s,s}$ and $b_{f,f}$ represent the volatility clustering or else volatility pooling, which is the tendency for volatility in financial markets to appear in bunches. The coefficients γ_s and γ_f measure the degree of volatility persistence. The *Gi(•)* is an asymmetric function of past standardized innovations given in (9) and (10), which influence the conditional variances asymmetrically. $\left|\xi_{i,t-1}\right| - E\left|\xi_{i,t-1}\right|$ measures the magnitude effect, and the term $\lambda_i\xi_{i,t-1}$ measures the sign effect.

Depending on the sign of coefficients $b_{i,t}$, λ_i and in terms of cross-market volatility spillovers, a negative innovation , ($\xi_{it} < 0$) will be followed by higher volatility than a positive innovation, ($\xi_{it} > 0$) if, $b_{i,t} > 0$ and $-1 < \lambda_i < 0$. Thus, when $\lambda_i < -1$, a positive surprise will decrease volatility. Obviously, when $\lambda_i = 0$ the asymmetry disappears. Lin et al. (2002) state that if, $\xi_{it} < 0$, then the coefficients of ξ_{it} in (9) and (10) will be $-1+\lambda_i$. If $\xi_{it} > 0$, then the coefficients of ξ_{it} will be $1+\lambda_i$. Therefore, if λ_i is significant, the asymmetric effect of standardized innovations to the conditional variances is observed.

The data for the study consists of daily closing price of gold futures and its corresponding underlying spot market price. Since the past few years, the spurt in the gold prices and concerned over the falling volume in agri-commodities exhibited maturity on all parameters of gold in NCDEX viz. traded volumes, open interest and member participation. Besides, the entities perceived to be fronting for a rival exchange have drawn the market regulator's attention to the dramatic surge in trading volumes of gold at NCDEX in recent years. Moreover, the volatility of spot and futures markets is subject towards stochastic or time-varying in nature. Therefore, it has become necessary from time to time to conduct empirical studies to investigate the price discovery role of spot and futures markets of gold in developing commodity markets like India. For these reasons, the present employed recent past years daily dataset on spot and futures market of gold traded at NCDEX. The data span for the study has been considered from 23, April 2009 to 31, May 2011. All the required data information for the study has been retrieved from the website of National Commodity Derivatives Exchange (NCDEX), Mumbai. Throughout this paper, spot and futures market returns are defined as continuously compounded or log returns (hereafter returns) at time t, Rt, calculated as follows:

$$R_t = \log (P_t / P_{t-1}) = \log P_t - \log P_{t-1} \qquad (13)$$

where P_t and P_{t-1} are the daily closing prices of the gold futures contract and its corresponding underlying spot market at days, t and t−1, respectively.

Descriptive statistics are reported in Table 1. The sample means of spot and futures market returns are positive and the standard deviation ranges from 0.0081 (spot) to 0.0085 (futures). The values of skewness and excess kurtosis indicate that the distributions of spot and futures market returns are negatively skewed and leptokurtic relative to the normal distribution. The Jarque-Bera test statistic rejects normality at one per cent level of statistical significance in both cases. The Ljung-Box statistic for 16 lags applied on returns (denoted by LB(16)) and squared returns (denoted by $LB^2(16)$) indicate that significant linear and nonlinear dependencies exist. Linear dependencies may be due to some form of market inefficiency (Koutmos and Booth, 1995).

Table 1: Descriptive Statistics of Return Series

Statistics	**Spot**	**Futures**
Mean	0.000768	0.000761
Standard Deviation	0.00815	0.00858
Skewness	-0.0818	-0.2772
Kurtosis	4.5131	5.5050
LB(16)	17.61*	11.69*
$LB^2(16)$	46.96*	22.32*
JB	46.13*	131.10*
ARCH-LM(12)	11.65*	4.16**

Notes: LB(16) and $LB^2(16)$ are the Ljung-Box statistics applied on returns and squared returns, respectively. JB is the Jarque-Bera statistic to test for normality. ARCH-LM(12) is a Lagrange multiplier test for ARCH effects up to order 12 in the residuals (Engle, 1982). * and ** -denote the significance at the one and five per cent level, respectively.

Furthermore, the Engle (1982) ARCH-LM test statistics was conducted in order to test the null hypothesis of no ARCH effects. The test statistics are statistically significant at one per cent level, implying that there exist significant ARCH effects on the data at all frequencies. Nonlinear dependencies can satisfactorily be captured by autoregressive conditional heteroscedasticity (ARCH) models.

4. Empirical Results and Discussions

4.1 Price Discovery Process

Augmented Dickey-Fuller test was employed to test the stationarity of the spot and futures price series of gold market and the results are presented in Table 2. The results reveal that both the price series of gold market are found to be stationary at the first order level, and they are integrated in the order of I(1), respectively. This finding is in line with many studies on time series properties of price series.

Table 2: Augmented Dickey-Fuller Test Results

Variables	Intercept	Intercept & trend
I. Levels		
S	0.866	-2.983
F	-0.802	-2.715
II. First Difference		
ΔS	-10.11*	-10.10*
ΔF	-11.88*	-11.86*

Notes: * – indicates significance at one per cent level. Optimal lag length is determined by the Schwarz Information Criterion (SIC), F and S are the Futures and Spot market prices, respectively

Given that spot and futures prices are integrated of the same order, (1), co-integration techniques may be used to determine the existence of a stable long-run relationship between the prices. The results of Johansen's cointegration test are reported in Table 3.

Table 3: Johansen's Cointegration Test Results

Null Hypothesis (H_0)	Alternative Hypothesis (H_1)	Eigen Value	Likelihood Ratio Tests	95 % Critical Value	99 % Critical Value
			Trace test Statistics		
r = 0	r ≥ 1	0.044991	22.34958*	15.41	20.04
r ≤ 1	r ≥ 2	0.000918	0.437188	3.76	6.65
			Maximal Eigen value		
r = 0	r = 1	0.044991	21.91239*	14.07	18.63
r = 1	r = 2	0.000918	0.437188	3.76	6.65

Notes: r is the number of cointegrating vectors under the null hypothesis. * - denote the significance at one per cent level.

Maximum Eigen value and Trace test statistics indicate the presence of one cointegrating vector between the spot and futures market prices at the five per cent level. This shows that spot and futures prices of gold market are co-integrated and there exists atmost one co-integrating relationship between spot and futures prices. In other words, spot and futures prices share common long-run information. Overall, Johansen's test results support that the spot and futures prices of gold market lead in the long run.

According to Granger representation theorem, if two variables X and Y are co-integrated, then the relationship between the two can be expressed as ECM (Gujarati, 2005). Therefore, the Vector Error Correction Model (VECM) was employed to examine the price discovery process in spot and futures markets of gold. The VECM estimates obtained from equations (4) and (5) are presented in Table 4. The coefficients (a_s and a_f) of the error correction term provide some insight into the adjustment process of spot and futures prices towards equilibrium in all types of contracts. That is, the error correction term represents a mean-reverting price process. The table result shows that coefficient of the error correction term (a_s) in the spot equation (4) is statistically significant and negative, implying that the futures price makes the greater adjustment in order to reestablish the equilibrium. In the futures equation (5), the coefficients of lagged spot prices are statistically significant at one per cent level. Besides, the Wald-F statistics for the futures equation, $\sum_{i=1}^{k} b_s$(Wald-F),

Table 4: Result of Vector Error Correction Estimates

Independent Variables	Equation(4) ΔS	Equation(5) ΔF
Z_{t-1}	-0.5391	1.2818
	(-2.092)**	(4.864)*
ΔS_{t-1}	-0.4241	-0.6969
	(-2.143)**	(-3.444)*
ΔS_{t-2}	-0.2487	-0.3099
	(-2.234)**	(-2.722)*
ΔF_{t-1}	-0.2272	0.0461
	(-1.183)	(0.235)
ΔF_{t-2}	-0.1330	-0.0971
	(-1.246)	(-0.889)
c	1.88E-05	1.34E-05
	(0.043)	(0.030)
Wald F-stat.	1.879	6.391*

Notes: Optimal lag length is determined by the Schwarz Information Criterion (SIC), F_t and S_t are the Futures and Spot market prices respectively, * and ** denote the significance at the one and five per cent level, respectively. Parenthesis shows t-statistics.

is found to be statistically significant at one per cent level, suggesting that there was a significant causality running from spot to futures prices.

Overall, the VECM result confirms the unidirectional relationship runs from the spot market to futures market of Gold in India. In other words, spot price leads the futures price. This implies that the spot market of Gold plays a dominant role and serves as effective price discovery vehicle. This confirms that the spillovers of certain information take place from spot market to futures market and the spot market of gold have the capability to expose the all new information through the channel of its new innovation.

4.2 Volatility Spillover

Following the methodology of Koutmos and Tucker (1996) and Lin et al. (2002), the Bivariate ECM-EGARCH(1,1) model was employed to investigate, how news from one market affects the volatility behaviour of another market. The results of the Bivariate ECM-EGARCH(1,1) model are presented in Table 5. The coefficients bs,f and bf,s, shows that

Table 5: Result of Bivariate ECM-EGARCH (1,1) model

Parameters	Spot Return	Futures Return
α_i	-0.3574	4.0488
	(-0.219)	(1.212)
$b_{i,s}$	0.5481	0.6127
	(3.704)*	(2.712)*
$b_{i,f}$	2.4813	0.1961
	(6.932)*	(3.399)**
λ_i	0.5096	0.7566
	(4.151)*	(11.52)*
γ_i	0.7391	0.1961
	(5.448)*	(3.399)**
ρ	0.8349*	
Diagnostics on standardized and squared standardized residuals		
LB(16)	9.3384	5.8065
$LB^2(16)$	15.495	7.2816
ARCH-LM(12)	2.0827	1.0415

Notes: * and ** denote the significance at the one and five per cent level, respectively. Parenthesis shows z-statistics. LB(16) and $LB^2(16)$ are the Ljung-Box statistics applied on returns and squared returns, respectively. ARCH-LM(12) is a Lagrange multiplier test for ARCH effects up to order 12 in the residuals (Engle, 1982).

significant spillovers exist across the spot and futures markets. However, the absolute value of bs,f (2.4813) is greater than bf,s (0.6127), implying that the spillovers from spot to futures are more significant than the reverse direction, which means that the information flow from spot to futures is stronger. Furthermore, the coefficients γs (0.7391) and γf (0.1961), which represent the degree of volatility persistence, are both highly significant. This indicates the high persistence of shocks to volatility. The contemporaneous relationship measured by the conditional correlation ρ is 0.8349. Lin et al. (2002) point out that, if the capital market is efficient enough or the cost-of-carry model holds the value of the conditional correlation should be close to unity.

Finally, the estimated Ljung-Box statistics for the standardized and squared standardized residuals indicate that the Bivariate ECM-EGARCH(1,1) model is correctly specified. Besides, the ARCH-LM tests indicate that no serial dependence persists left in squared residuals. Hence, the results suggest that the Bivariate ECM-EGARCH(1,1) model was reasonably well specified and most appropriate model to capture the ARCH (time-varying volatility) effects in the time series analysed.

5. Conclusion

The primary objective of Indian commodity market is to build value for the traders by providing a mechanism to protect their business from adverse price change. Traders or exporters can hedge their price risk and improve their competitiveness by making use of futures market through price discovery mechanism. Price discovery is the process by which markets attempt to reach equilibrium price. Price discovery is a major function of commodity futures market. The essence of the price discovery function hinges on whether new information is reflected first in changes of future prices or changes of spot prices. The present study assumes significance in the sense that it enables to determine which market is more efficient in processing and reflecting of new information. Besides, the study of volatility interdependence provides useful insights into how information is transmitted and disseminated between futures and spot market. In arbitrage free economy, volatility of prices is directly related to the flow of information. If futures market increase the flow of information, volatility in the underlying spot market will rise. This study attempts to examine the price discovery process and volatility spillovers in Gold futures and spot markets of National Commodity Derivatives Exchange (NCDEX) by employing Johansen's Vector Error Correction Model (VECM) and the Bivariate ECM-EGARCH(1,1) model. The empirical result confirms that the spot market of Gold plays a dominant role and serves as effective price discovery vehicle. Besides the study results show that the spillovers of certain information take place from spot market to futures market and the spot market of gold have the capability to expose the all new information through the channel of its new innovation. Moreover, the study validates that the gold futures market of NCDEX found very intricate to incorporate the information in its prices. This clearly reveals that the futures market of gold is not yet matured and efficient when information gets disseminated.

To conclude, the gold spot market is more informationally efficient than the futures market. The study results have practical implications for investors and market participants who wish to hedge their risk against the adverse price movements. Investors may use the spot market price, which tends to discover new information more rapidly than futures prices, to adopt more effective hedging strategies. Moreover, a better understanding of the interdependence of these markets would be useful for those policy makers who coordinate the stability of financial markets.

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Distances and Small Business Credit Constraints: The French case

Salima Djedidi Kooli

Abstract

Deregulation and progress in information and communication technologies have increased the geographical expansion of banking structures and instruments. This makes banks operationally close to the borrowers. At the same time, banking industry consolidation have induced a geographical concentration of banking decision centers and strategic functions, leading to an increase of the functional distance that separates the decision center of a bank from its operational branches. The aim of this paper is to evaluate the impact of these two trends on small and medium-sized enterprise (SME) lending. Our findings on French data suggest that (i) increased functional distance induces an increase of the investment cash flow sensitivity considered as a measure of financing constraints and that (ii) the relationship between operational proximity and financing constraints is non linear with an investment-cash flow relationship supposed to be increasing for low levels of operational proximity below a certain threshold and decreasing for high levels of it. The adverse effect of functional distance on financing constraints is particularly acute for small firms.

Keywords: SME lending, functional distance, operational proximity, financing constraints, investment-cash flow sensitivity

JEL Classification: G21, G34, R51

1. Introduction

Over the last two decades in France, all credit institutions categories have known a substantial decrease of their establishments' number (see Appendix A, Figure A.1.). This decrease was about 22% for commercial banks over the period 1997 to 2008. It was about 36% for mutual and cooperative banks over the same period (see Appendix A, Figure A.2.).

This fall of the bank's number have been following a longstanding trend. Thus, since the law bank of January 24, 1984, the French banking sector have been engaged in an intense movement of restructuring, which resulted in a steady decrease of the number of credit institutions. This decline was about 64% for credit institutions established in France (excluding Monaco) during the period 1984 to 2008.

[1] LEDA – SDFi, Université Paris-Dauphine, Place du Maréchal de Lattre de Tassigny, 75775 Paris CEDEX 16, France, e-mail: salima.djedidi@dauphine.fr; djedidi.salima@voila.fr

The dynamic movement of reorganization and renovation of banking structures has been accompanied by a strengthening, since the early 2000s, of the banking system's supply (see Appendix A, Figure A.3.). In fact, the number of branches, which was maintained during fifteen years in a range of 25500 to 26000, is in progress since 2000 (27893 at the end of 2008 excluding branches of the postal bank). Also, the number of Automated Teller Machines (ATMs), which exceeds that of branches since 1997, almost doubled over the last ten years. Finally, the information and communication technology progress favored the expansion of impersonal methods to conduct businesses, such as Internet-banking, home-banking, or phone-banking. These changes reflect a research of productivity gains among French credit institutions, a strong dynamism and also a deep technological change in distribution channels.

Both of these phenomena have a spatial dimension. The geographical diffusion of banking structures and instruments contributed to the ease of access to banking services by savers and borrowers established locally. It refers to the so called '*operational distance*' considered in the banking literature. It largely depends on the physical distance that separates banks from their clientele. With respect to organizational structure, the wave of mergers and acquisitions that have reduced the number of banks and have created large national and multinational bank holding companies, have induced a geographical concentration of banking decision centers and strategic functions, leading to an increase in the '*functional distance*'[1] that separates the decision center of a bank from its operational branches.

In this paper, we focus on the French banking industry in order to assess the effects of these contrasting trends of spatial diffusion-concentration on financing constraints for local SMEs.

A large literature is devoted to assessing the impact of banking consolidation on local development. The vast majority of these studies follow a bank-based approach where they compare the lending behavior of small banks, theoretically considered as best suited to deliver relationship lending and therefore considered 'close' to the need of local small and medium-sized enterprises (SMEs), with the lending behavior of large banks, considered as more 'distant'. They find differences in relationship lending with larger institutions tending to lend to older and larger SMEs with stronger financial statements (Haynes and Berney, 1999; Cole et al., 2004; Scott, 2004; Berger et al., 2005). There is also evidence that as lending decisions are taken at higher layers of the organizational structure, there is less emphasis on soft information penalizing small opaque firms (Liberti and Mian, 2009).

A few other studies follow a market based approach, where the analysis is carried out at the local market level (Avery and Samolyk, 2000; Berger et al., 2007; Bonaccorsi di Patti and Gobbi, 2001; Collender and Shaffer, 2003). This approach has the advantage of directly assessing the net impact of banking industry structure on local borrowers.

In this paper, we follow the same market-based approach adopted by Alessandrini et al. (2009) and try to evaluate the impact of the two trends of diffusion-concentration of the banking system on SME financing. Following Alessandrini et al. (2009), we have

[1] This terminology was introduced by Alessandrini, Croci and Zazzaro (2005) and subsequently used in several studies.

tried to overcome the oversimplification of the morphological structure's measure of the local banking industry provided in the literature by introducing a more accurate measure of the functional distance of local banking systems from local economies. Using a pooled sample of 2174 French SMEs, we find that both operational and functional distances play a significant role in explaining financing constraints of local firms.

The remainder of the paper is organized as follows. The next section presents the main theoretical and empirical works related to our subject. Section 3 describes the data and the distance variables. Section 4 displays the dynamic investment econometric model performed and the different results obtained. The last section concludes.

2. Related Literature

2.1 Distance and lending decisions: theory and evidence

Economic theory recognize physical distance as causing potentially relevant economic costs for both the bank granting a credit and the firm seeking financing. These costs are not only pecuniary such as transportation costs, but also may be informational costs induced by the extra efforts required from the bank to access the creditworthiness of potential borrowers or to monitor firm's investments.

In theoretical models founded on information asymmetries, credit rationing may be the bank's optimal response to the deterioration of the quality of information on distantly located firms. Petersen and Rajan (2002) argue that as the severity of the asymmetric information problem intensifies with distance, local lenders can collect soft information on small firms over time and can strategically use their informational advantage to create a threat of adverse selection for more remote competitors who might not enjoy the same degree of access to local information. Hauswald and Marquez (2006) make this notion more precise by developing a model where the quality of a bank's proprietary information is negatively related to the physical distance between bank and borrower to capture the varying degrees of informational expertise present in modern banking. Because banks receive more precise signals about close borrowers, competing banks face increasing adverse selection problems when approaching these locally captured firms. As the distance between the borrower and the informed bank[2] increases, this bank's information advantage decreases, and the uninformed bank[3] is able to bid more frequently so that, in equilibrium, the likelihood of a competing loan offer increases in bank-borrower distance. Hence, the spatial pricing model based on informational asymmetries developed by Hauswald and Marquez (2006) show that geographical credit rationing by banks can occur in equilibrium, where the underlying rationale is an adverse selection mechanism à la Stiglitz and Weiss (1981). Type II errors in credit offers always increase on the bank borrower distance but the effect on type I errors is ambiguous and depends on the quality of information.

[2] The closest bank from the borrower.

[3] The closest competitor from the informed bank.

A simple theoretical model to rationalize the existence of geographical credit rationing developed by Carling and Lundberg (2005) leads to a similar prediction than in Hauswald and Marquez (2006). They also suggest that the creditworthiness signal's quality is decreasing in the borrower's distance to the bank and demonstrate that the bank's optimal strategy is to turn down credit applicants from some distantly located firms.

To summarize, we could suppose that the relationship between the distance and credit rationing is non linear. In fact, when the distance is low (the quality of the signal is high), the probability that the informed bank correctly identifies the borrower increases toward one, then the likelihood of doing type I and II errors is low as well as the probability of credit rationing equilibrium. As long as the distance increases but remains at a level that is below a certain threshold, the likelihood of doing type I and II errors increases as well as the probability of credit rationing equilibrium. For values of distance that are above this threshold, the quality of the signal is very bad for informed banks and the uninformed lender faces a less severe adverse selection threat and is therefore more likely to extend a loan offer.

Empirical findings on the effects of physical proximity of banks to borrowers are mixed. At the bank level, Petersen and Rajan (2002) find that remote applicants are more likely to be declined credits in the U.S. but this effect is strongly decreasing over time. In contrast, Agarwal and Hauswald (2010) find that credit availability decrease with the bank-borrower distance and increase with the borrower-competitor distance. However, the statistical significance of these relations disappears when they control for the bank's proprietary information (the bank's internal credit score) concluding that the geographical distance is a simple proxy for lender's informational advantage. However, Carling and Lundberg (2005), using data on corporate loans granted between 1994 and 2000 by a leading Swedish bank, find no evidence of geographical credit rationing. Uchida et al. (2008), using a unique Japanese data set and the same methodology as Berger et al. (2005) obtained no evidence of geographical credit rationing in Japan.

At the market level, Avery and Samolyk (2000), using U.S. data, find that the number of banks operating in a Metropolitan Statistical Area is positively but weakly related to the growth rate of SME's loans in the local market, whereas the number of offices has no impact at all on this growth rate. Using Italian data, Bonaccorsi di Patti and Gobbi (2001) find that the branch density (the ratio of branches to population) in a province is positively related to the volume of credit for small borrowers but it is negatively associated with the volume of bad loans. Benfratello et al. (2008), using a rich data set on innovation at the firm level for a large number of Italian firms over the 90's, find that the banking development (computed as the number of branches divided by population) affects positively the probability of process innovation, particularly for small firms and for firms in high(er) tech sectors and in sectors more dependent upon external finance. There is also some evidence that banking development reduces the cash flow sensitivity of fixed investment spending, particularly for small firms.

2.2 Why the geographical distribution of banks' decisional centers should affects small business lending? theory and evidence

The process of financial integration in the European and U.S. banking industry in the 1990s was accompanied by the debate about the benefits of strengthened competition in credit markets, greater efficiency and the geographical reach of banking groups through affiliated banks and branches. This would have assured an adequate response to the need of local economies. However, the growing body of research examining the effects of bank consolidation and organizational structure on lending policies raises the question, for a long time neglected, of the cost of the predictable geographical concentration of decisional centres and the increasing size and complexity of bank organisation induced by the spectacular wave of bank mergers and acquisitions. Put differently, this body of research highlights the fact that the organizational complexity of the institutions to which the loan office belongs is as much important as the operational proximity in the process of credit allocation to small businesses.

Academics assess the potential implications of induced changes in the banks organizational structure on small business lending by analyzing organizational theories. The general outcome of these theories is that small banks should be more inclined than large and complex banks to extend credits to small and opaque firms. The main argument supporting this claim is the existence of organizational diseconomies that limit the scope of large banks in their lending activities. The motivation of such organizational diseconomies has been widely debated by academics using several theories but it seems that they come from a common origin – the inherent difference between small business lending and transactions-based lending.

In small business lending, the bank bases its credit decisions largely on private or soft information about the firm and its owner that is collected through multiple interactions over time and across products (Boot, 2000; Berger and Udell, 2002). Soft information may confer the bank with a competitive informational advantage over banks that base their decision on public information and thus obtain a more precise signal of the creditworthiness of the firm. However, the collection method of this information needs to be personal, making soft information hardly verifiable and thus difficult to transmit to upper echelons of banking organization and to store (Stein, 2002). Therefore, the lack of adequate soft information transmission channels within a bank requires organizational adjustments, which is costly (Crémer et al., 2007).

The idea that a centralized bank (e.g. a large bank holding company) is less competent in relationship lending than a decentralized bank (e.g. a small community bank) has been theoretically demonstrated by Stein (2002) that shows that in hierarchically complex organizations, loan officers have less incentive to collect soft information since they are excluded from the decision making but have to report that information to their superiors. However, information research efforts by loan officers are well recognized by a decentralized organization that ensure to them access to funds necessary to capitalize on that expertise.

Berger and Udell (2002) suggest a different mechanism to motivate the existence of organizational diseconomies in large banks. It consists on internal agency problems between the loan officer – considered as a receptacle of soft information-and his superior and stem from the intangible nature of soft information and, in particular, from the difficulty in diffusing this information within a large and complex organisation. The necessary trade-off between delegation and control have been analyzed in the principal-agent theory In fact, Udell (1989) and Berger and Udell (2002) show that the specialization in relationship lending (e.g. small business lending) should go hand in hand with more investment in loan officers control. This endows small decentralized banks with another source of comparative advantage in small business lending.

A considerable research effort has been devoted to empirically test the relation between bank's organizational structure and credit availability to small firms. First, numerous studies show that bank organizational complexity implies a reduction in the availability of credit to small businesses (Berger et al., 1999). Small firms are, in fact, highly dependent on bank financing (Berger and Udell, 1998; Cole et al., 1996) and this is aggravated by the evidence that large banks allocate fewer resources to small business lending than do small banks because they have a real competitive disadvantage in evaluating their creditworthiness (Berger and Udell, 1996; Keeton, 1995; Peek and Rosengren, 1996; De Young et al., 1999; Alessandrini et al., 2008; Sapienza, 2002). Contradictory evidence are provided by Jayaratne and Wolken (1999) that find that the SME rationing probability is not significantly related to the presence of small banks in the market, suggesting the absence of a cost advantage of small banks in originating credit to small borrowers.

When focusing on the empirical literature analysing the impact of mergers and acquisitions (M&As) on credit supply to small firms, we notice the lack of consensus on this issue. On the one hand, Strahan and Weston (1996; 1998) show that small bank M&As have a positive effect on small business lending, however Berger et al. (1998) and Peek and Rosengren (1998) find that large bank M&As have the opposite effect.

At the market level, Bonaccorsi di Patti and Dell'Ariccia (2004) find that the creation of industrial firms in a giving province in Italy is positively associated with the share of deposits held by banks headquartered in the same province (one measure of functional distance). Collender and Shaffer (2003), studying the impact of functional distance on local economic growth, find that the impact of the number of bank offices operating locally on local economic growth differs significantly with the locus of their ownership.

2.3 Why SMEs may be financially constrained?

The availability of external finance for SMEs is a topic of significant research interest to academics and an issue of great importance to policy makers around the globe. Bank credit still remains the major source of external financing for SMEs. In fact, a conventional wisdom in the contemporary corporate finance literature argues that problems of information asymmetry, described by Jensen and Meckling (1976), Myers and Majluf (1984) and Stiglitz and Weiss (1981), are particularly acute for SMEs (Ang, 1991; Carpenter and Petersen, 2002), since beyond the shareholders' motivation of avoiding the dilution of ownership and their desire to keep control of the business, the prosperity of SMEs is affected by hidden information, the lack or low level of collateral and the lack of any history or reliable financial information and audited accounting records (Holmes and Kent, 1991; Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998). The lack of sufficient information to determine the quality of different investment projects in the SME as well as the quality of management for making investment decisions determines the level of risk that external creditor face. A high level of risk (a high level of opacity) is then reflected through the credit denial decision. It is important to note that the implication of asymmetric information is not that lending to SMEs is necessarily a risky job but that the assessment of this risk is challenging.

In this paper, we aim to evaluate the impact of the changing structure of the French banking system in terms of higher diffusion-concentration on local firms financing constraints. We particularly address the issues of endogeneity of functional distance and operational proximity, used as measures of this diffusion-concentration, as well as omitted variables by using system GMM estimations. Also, we take the same new measure of local banking structure adopted by Alessandrini et al. (2009) that takes into account the distance of local branches from their own headquarters. This measure of functional distance is challenging the view that it is a characteristic that banks either have or do not have, regardless of their location. Instead, we suggest that all banks are subject to organizational issues then we propose a continuous measure of local banking structure.

3. Data and variables

3.1 Dataset

To test the effects of spatial diffusion-concentration on SME lending, we build up a panel dataset containing information on firms, bank branches, head office locations, and macro variables in France at the departmental level. The time period considered ranges from 2001 – 2008. After cleaning, we have around 11 000 observations.

The dataset relies on four main sources. SME specific information is drawn from a well known database DIANE[4]. We consider French manufacturing enterprises with 1-500 employees from which we exclude those who are subsidiaries of groups because of their financial dependence of the group. We randomly selected and stratified firms by size (four classes of employees), technology-intensive industry (four classes according to the SESSI[5] classification) and geographical area (six mega regions).

In general, we eliminated observations in the extreme percentiles of the distribution of profit ratios. We did the same for observations showing an accumulation rate above 150%

[4] DIANE: DIsque pour l'ANalyse Economique, edited by the Bureau van Dijk.

[5] SESSI: Service of industry studies and statistics. Ministry of Economy, Finance and Industry (France).

and a tripling of sales in order to avoid retaining in the sample firms that have undergone major restructuring.

Data on geographical distribution at the departmental level of all bank branches are from the banks' location files of the Bank of France. Information on the composition of banking groups and the location of bank head offices is from banks annual reports. We obtain the geographical location of all head offices and their changes over time generated by intra group consolidations (especially for mutual and savings bank groups) by tracking the groups' annual reports. The number of workers employed by sector s in department d is from Unedic statistics and macroeconomic data on sectorial deflators of industry output and nominal investment and data on the population at the departmental level is from the National Institute of Statistics and Economic Studies (INSEE). Appendix B defines the variables employed in the empirical specifications and provides their mean, median, standard deviation and sources.

3.2 Distances

3.2.1 The banking system operational proximity

The notion of operational distance is the one usually examined in the banking literature. It is conceivable to assume that the number of bank branches in a giving geographical area (here the department) is typically positively related to the operational proximity (OP) of the banking system to this area. To measure this notion, we build up the most widely used index of bank presence in an area (Bonaccorsi di Patti and Gobbi, 2001; Bonaccorsi di Patti, 2003; Benfratello et al., 2008; Alessandrini et al., 2009), which allows us to easily compare our results with literature. It is a branch density index in terms of population:

$$OP\_POP_d = \frac{\sum_{b=1}^{b_d} Branch\,number_b}{Population_d} * 10000$$

where b_d is the total number of banks operating in the department $d(d = 1,\ldots,96)$

Of course, one can argue that this measure may be a better proxy for competition than for proximity. This is a problem as the literature indicated different outcomes for proximity and competition on credit availability. It is probably not the case because two departments having the same degree of competition may show different number of branches and thus different degree of proximity. For example, two departments with equal number of banks (equal degree of competition) may show very different operational proximity. In this respect, it is worth noting that OP_POP_d is only slightly correlated with the departmental Herfindahl-Hirschman concentration index HHI (see Table 1), suggesting that operational proximity and competition are two different elements.

Table 1: Pairwise Correlation Matrix

	I/K	*CF/K*	*FD_KM*	*FD_ECO*	*OP_POP*	Δy	*HHI*
I/K	1						
CF/K	0.2428***	1					
FD_KM	-0.0131*	-0.0904***	1				
FD_ECO	-0.0114	-0.0452***	0.5637***	1			
OP_POP	-0.0032	0.0232***	-0.1481***	-0.3930***	1		
Δy	0.1348***	0.1657***	0.0019	-0.0123	-0.0071	1	
HHI	0.0217***	-0.0934***	0.3616***	0.1665***	0.1301***	0.0006	1

***, **, * significant at the 1%, 5% and 10% levels respectively

3.2.2 The banking system functional distance

Functional proximity is usually measured as the proportion of local credit market (in terms of branches or deposits) controlled by banks that concentrate their activities in a delimited area. This measure implicitly assumes that functional distance is a dichotomous character that concerns only some, usually small, mutual and cooperative, banks and not the others. According to Alessandrini et al. (2009), functional distance is *'a character shared to some extent by all banks that, given the localism of their decisional centres and strategic functions, are necessarily close to some areas and far from others*'. To this respect, while a department with banking system formed by only local credit banks has the lowest value of functional distance indicators; it is also true that two departments with equally functionally distant banking systems may show very different proportion of local banks.

We adopt measures of functional distance at the departmental level advanced by Alessandrini et al. (2009). We compute the functional distance of the banking system from department *d* by weighting the proportion of each bank branches operating in the department *d* by the distance indicator that captures the severity of information asymmetries between the senior manager at the parent bank and the bank officer at the local branch. Organizational frictions induced by these information asymmetries are considered positively correlated to the distance between the bank's headquarter and the local lending office.

We build up two alternative functional distance indexes. The first one is:

$$FD\_KM_d = \sum_{b=1}^{bd}\left[\frac{Branch\,number_b}{\sum_{b=1}^{bd} Branch\,number_b} * Ln(1 + Physical\,distance_{dh})\right]$$

The physical distance is the kilometric orthodromic[6] distance between the local capital town (also called a prefecture) of the department *d* in which the branch is located

[6] Also called 'as the crow flies distance' or 'great-circle distance' and defined as the shortest distance between any two points of a sphere.

and the local capital town of the department h (h = 1,...,96) where the head office of the own (parent) bank is headquartered ($Physical\ distance_{dd} = 0$ when a bank branch and its head office are in the same department d).

The second indicator of function distance is:

$$FD\_ECO_d = \sum_{b=1}^{bd} \left[\frac{Branch\,number_b}{\sum_{b=1}^{bd} Branch\,number_b} * Ln(1 + Economic\,gap_{dh}) \right]$$

The economic gap (or distance) measured as $\sum_{s=1}^{m} \left| E_{sd} - E_{sh} \right|$ is an index of the economic structure difference between departments d and h computed using shares of workers E employed by m economic sectors. The idea behind the use of this indicator of functional distance is that as differences increase in the economic structure of the departments where the parent bank and local branch are located, so does the informational rent of local loan officers who can accumulate specific knowledge on the local economy.

Functional distance indexes are positively and significantly correlated with one another and uncorrelated with operational proximity indexes. This corroborates the idea that functional distance includes physical and economic distances.

3.3 Measuring credit constraints

It is difficult to directly measure financial constraints that prevent firms from investing as much as they wish. Problems of information asymmetry related to the quality of investment projects and the management competence of the business owner are mainly what may interfere with the functioning of financial markets (Stiglitz and Weiss, 1981; Myers and Majluf, 1984). These problems imply that in general, firms use primarily internal resources to finance their investments before turning to external financing sources and especially to traditional bank financing. This is the case for French SMEs (as shown by Appendix C).

The elusiveness of the notion of credit constraints makes it hard to measure. In fact, what we generally observe in the firms balance-sheets is the quantity of loan made, not the amount requested and the amount granted. Therefore, many proxy variables where proposed in the literature.

The proxy of financing constraints used in this paper is drawn from the large strand of literature which investigates the sensitivity of firm's investment to the cash flow[7] (Fazzari et al., 1988; Kaplan and Zingales, 1997). Fazzari et al. (1988) classify firms according to whether they were likely to be financially constrained on the basis of their size, dividend payouts and capital structure. These characteristics determine whether they are more sensitive to the supply of internal funds measured by cash flow. The highest sensitivities

[7] Other proxies for credit rationing are those of Kugler (1987) and King (1986) that attempt to estimate equilibrium credit rationing. Clearly (1999) uses multiple discriminant analysis to identify firms with financing constraints.

to cash flow are found for firms classified as financially constrained. Many further studies have followed the same methodology including Chirinko and Schaller (1995), Hubbard et al. (1995), Calomaris and Hubbard (1995), as summarized by Hubbard (1998).

3.4 Descriptive statistics

Figures 1 and 3 show a significant increase (on average) of both operational proximity (from 4.201 branches per 10 000 inhabitants in 2001 to 4.378 branches per 10 000 inhabitants in 2008) and functional distance (from around 27 km in 2001 to around 34 km in 2008) of the banking system to French departments. As a matter of fact, it is worth noting that functional distance has increased at higher pace than operational proximity showing that the trend toward the internal grouping of mutual networks is stronger than the recent process of banking supply system reinforcement. Table 2 shows that operational and functional distances measures have both a greater variability across departments (between variation) than over time (within variation). The regional distribution of distance indicators in 2008 shows that the banking system is operationally more proximate to the East, West, and Center than to the North and South (see Figures 2 and 4). It is functionally more distant to the East, Center, North, and South than to the West. However, it is interesting to mention that the 2001 – 2008 regional operational proximity growth rate is the highest in the North and in the South, and that the functional distance growth rate is the highest in the West, Center and East.

Table 2: Banking distance variables: summary statistics

Year	FD_KM		FD_ECO		OP_POP	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2001	3.320	1.133	0.230	0.094	4.210	0.891
2002	3.361	1.145	0.230	0.091	4.205	0.874
2003	3.402	1.121	0.230	0.089	4.197	0.786
2004	3.422	1.116	0.230	0.088	4.243	0.772
2005	3.438	1.115	0.229	0.088	4.308	0.769
2006	3.462	1.112	0.240	0.089	4.343	0.766
2007	3.496	1.156	0.232	0.099	4.347	0.752
2008	3.561	1.171	0.240	0.097	4.378	0.754

2001 – 2008 Growth rates			
France	7.26%	6.61%	4%
North	3.55%	3.64%	6.59%
West	12.27%	10.21%	-1.56%
Centre	12.08%	7.92%	0.28%
East	11.91%	6.45%	2.20%
South West	3.96%	1.65%	6.34%
South East	2.35%	-1.24%	7.01%
Overall, Between and Within variations (across departments)			
Overall	1.141	0.092	0.796
Between	1.118	0.090	0.777
Within	0.226	0.016	0.172

Note: The table reports the summary statistics for the banking distance variables (defined above). In the last part of the table, we report the overall, within and between variations of these variables across departments.

Figure 1: Evolution of the operational proximity by region, 2001 – 2008.

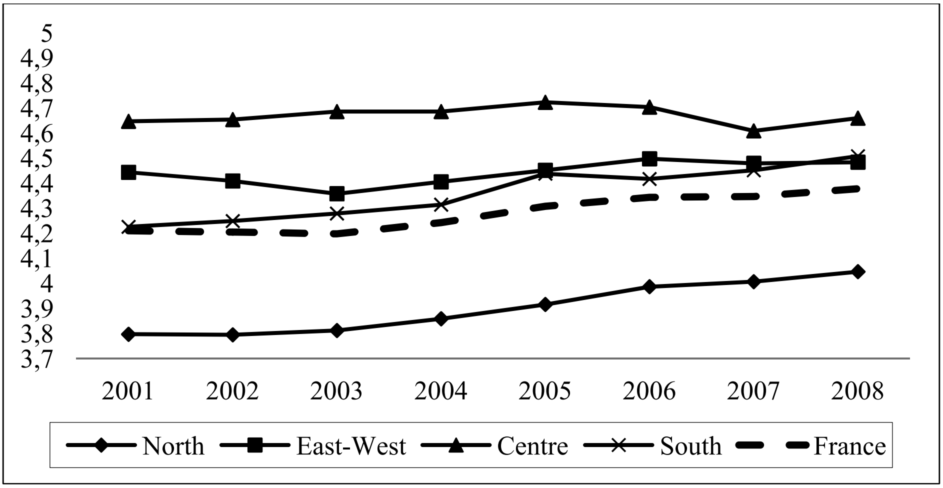


Figure 2: Operational proximity in the 96 French departments, 2008

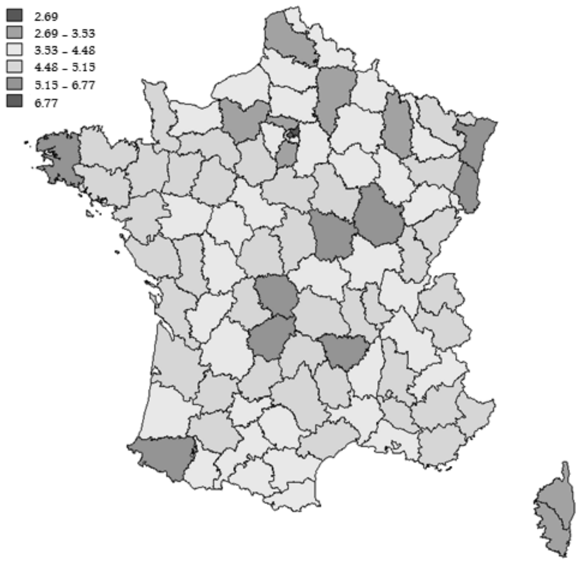


Figure 3: Evolution of the physical functional distance by region, 2001 – 2008

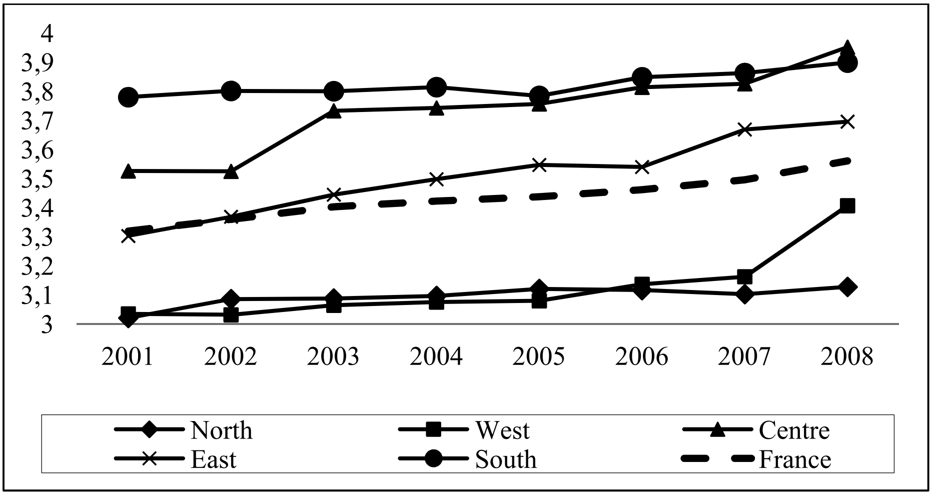
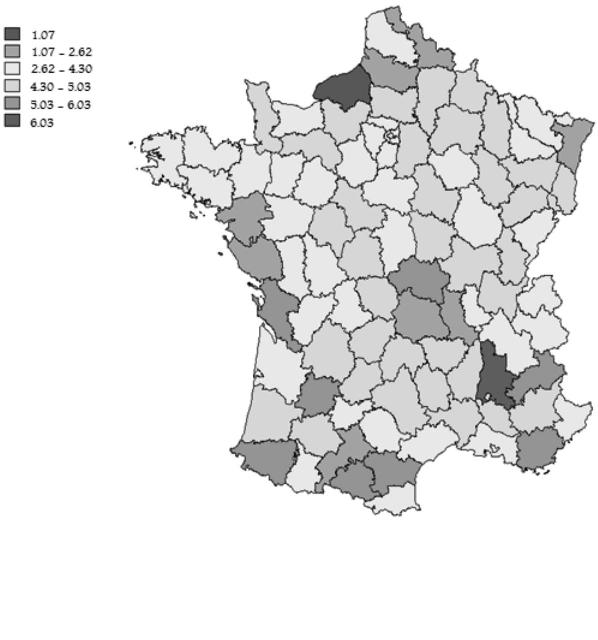


Figure 4: Physical functional distance in the 96 French departments, 2008



4. The empirical strategy

4.1 A profit-accelerator investment model

We first model the optimal firm demand of capital based on the neoclassical theory of investment as it was presented by Jorgenson (1963). The intertemporal maximization of the firm value leads to the optimal capital stock by equalizing its marginal productivity value with its user cost. Accordingly, under the assumption of a firm taking prices as given on a perfectly competitive market or facing a constant price elasticity function of good demand in a market of imperfect competition and assuming that the firm has a constant elasticity of substitution production function and no adjustment costs, the optimal capital stock is proportional to output,

$$k_{it} = \theta y_{it} + h_{it} \tag{1}$$

with k_{it} and y_{it} the log of optimal capital stock and the log of output. h_{it} is a function of the user cost. The introduction of adjustment costs results in a gradual adjustment of capital stock to its optimal value (Hall and Jorgenson, 1971). Modelling the adjustment process between k_{it} and y_{it} requires the incorporation of a long run relationship between capital and sales in an autoregressive distributed lag model (2,2) with two lags for the capital and two lags for sales. This specification seems sufficient flexible yet parsimonious because it introduces an autoregressive process on k_{it} to take into account the adjustment dynamic. In the estimates, the variation of h_{it}, that includes the user cost, the capital depreciation for each firm and the productivity term, is taken into account by the fixed effects specific to firms μ_i and a set for time dummies ϑ_t. Thus, we obtain the following linear regression:

$$k_{it} = \mu_i + \vartheta_t + \gamma_1 k_{it-1} + \gamma_2 k_{it-2} + \beta_0 y_{it} + \beta_1 y_{it-1} + \beta_2 y_{it-2} + \varepsilon_{it} \tag{2}$$

with ε_{it} the random error term of the regression. Instead of directly estimate this regression (4.2) (which could pose a problem because of strong collinearity between variables), we rewrite it in an error correction format adopted in several recent studies (Bond et al., 2003; Bond et al., 2005; Mairesse et al., 2001; Mizen and Vermeulen, 2005).

$$\begin{aligned}\Delta k_{it} = {} & \mu_i + \vartheta_t + (\gamma_1 - 1)\Delta k_{it-1} + \beta_0 \Delta y_{it} + (\beta_0 + \beta_1)\Delta y_{it-1} \\ & + (\gamma_1 + \gamma_2 - 1)(k_{it-2} - y_{it-2}) + (\beta_0 + \beta_1 + \beta_2 + \gamma_1 + \gamma_2 - 1) y_{it-2} + \varepsilon_{it}\end{aligned} \tag{3}$$

Thus, we obtain a relation linking current growth rates of capital stock and sales with those of the previous period and evolving the error correction term, i.e. the gap between the current capital stock and the optimal capital stock, and a scale factor.

The importance of financial constraints in this model can be ascertained by including the profit rate, measured as the cash flow scaled by capital, to the relation (3), as a measure of the supply of internal funds in the regression. Since the aim of the paper is to test the effects of operational proximity and functional distance on the sensitiveness of firm investment to cash flow, we interact cash flow with operational proximity, squared operational proximity and functional distance indicators. The idea behind these interaction terms is that we make the investment-cash flow sensitivity a non linear function of *OP* but linearly related to *FD*. In fact, this measure of the supply of internal funds becomes:

$$\frac{\partial\left(\frac{I}{K}\right)}{\partial\left(\frac{CF}{K}\right)} = \mu_0 + \mu_1 OP + \mu_2 OP^2 + \mu_3 FD \tag{4}$$

Then, by assuming that the change in the capital stock can be approximated by investment over previous capital stock less depreciation[8], $\Delta k_{it} \approx \frac{I_{i,t}}{K_{it-1}} - \delta$, we can rewrite the regression (3) in panel data format:

$$\left(\frac{I_t}{K_{t-1}}\right)_{id} = \mu_i + \vartheta_t + \eta_1\left(\frac{I_{t-1}}{K_{t-2}}\right)_{id} + \zeta_0 \Delta y_{idt} + \zeta_1 \Delta y_{idt-1} + \lambda\left(k_{it-2} - y_{it-2}\right) + \rho y_{it-2} + \mu_0\left(\frac{CF_t}{K_{t-1}}\right)_{id}$$
$$+\mu_1\left(\frac{CF_t}{K_{t-1}}\right)_{id} \times OP\_POP_{dt} + \mu_2\left(\frac{CF_t}{K_{t-1}}\right)_{id} \times OP\_POP_{dt}^2 + \mu_3\left(\frac{CF_t}{K_{t-1}}\right)_{id} \times FD_{dt} + \varepsilon_{it} \tag{5}$$

Geographic and technological intensity industry classification dummies are included in the basic specification of equation (5) to control for other unobserved local fixed effects.

In this specification, the parameter would be negative or near zero because we generally have negative autocorrelation between capital stock growth rates of two successive periods when using individual firm data. The long-run properties of this specification solely depend on the coefficient of the error correction $\lambda = \gamma_1 + \gamma_2 - 1$ and the scale factor $\rho = \beta_0 + \beta_1 + \beta_2 + \gamma_1 + \gamma_2 - 1$. It is expected that λ is negative because when the level of existing stock of capital is above the optimal stock (as determined by sales), there should be a reduction in the capital accumulation rate and conversely, if less, an increase. We also expect that $\mu_0 > 0$ which suppose that French SMEs are financially constrained.

Following Hauswald and Marquez (2006), we expect that

H1: the relationship between operational proximity and financing constraints is non monotone with an investment-cash flow sensitivity supposed to be increasing for low levels of OP below a certain threshold and decreasing for high levels of OP above the same threshold.

This implies a positive μ_1 and a negative μ_2.

Following the theoretical literature on the impact of functional distance on financing constraints described above, we expect that:

[8] We assume that the capital stock rate of depreciation is taken into account by the individual effects and time dummies μ_i and ϑ_t.

H2: the increase of the functional distance induces an increase of the investment cash flow sensitivity.

This implies a positive μ_3.

Giving that smaller firms are more likely to be rationed than greater ones, it is interesting to verify that:

H3: the investment-cash flow sensitivity is lower for large firms comparing to small firms which are supposed to be more financially constrained.

H4: the functional distances affect differently small and large firm's investment sensitivities to cash flows.

To do this, we run two other specifications by interacting firm size with $\left(\frac{CF_t}{K_{t-1}}\right) * FD$.

4.2 Estimation methodology

The dynamic structure of the model by the inclusion of a lagged dependent variable makes usual estimators of fixed effect panel data biased and inconsistent (Verbeek, 2012; Wooldridge, 2010). By construction, the correlation between the lagged dependent variable and the error component renders the OLS estimator biased and inconsistent even if the ε_{it} are not serially correlated (Sevestre and Trognon, 1985). For the fixed effects (FE) estimator, the Within transformation wipes out the fixed effects but the correlation still persists between the transformed lagged dependent variable and errors, even if the ε_{it} are not serially correlated (Nickell, 1981) . It is well known that only if $T \to \infty$ will the Within estimator of the autoregressive parameter be consistent for the dynamic error component model, which is not the case.

An alternative to the Within estimator consists on applying OLS to the model written in first differences. In this case, correlation between the predetermined explanatory variables and the reminder error is easier to handle. This solution is less satisfactory because unlike Within estimator, the first differences (FD) estimator is biased and inconsistent even when N and T both tend to infinity.

The instrumental variable (IV) estimation methods (Anderson and Hsiao, 1981) are known to have better performances than these usual methods. They lead to consistent but not necessarily efficient estimates of the parameters in the model because it suffers from a significant loss of degrees of freedom, and it does not take into account the differenced structure on the residual disturbances.

Arellano and Bond were the first in 1991 to propose an extension of the Generalized Method of Moments (GMM) in case of panel data. Their estimator were designed to avoid two causes of inefficiency of Anderson and Hsiao estimator namely the small number of instruments and the lack of consideration of the autocorrelation disturbance. From the model in first differences, Arellano and Bond (1991) note that the lagged dependent variable can be considered as an instrument when the ε_{it} are not serially correlated. In this case, orthogonality conditions are:

$$E\left(y_{it-j}\Delta\varepsilon_{it}\right)=0 \qquad for \quad t=2,\ldots,T \;\; and \quad j=2,\ldots,T$$

However, the Arellano and Bond (1991) estimator suffers from the loss of information associated with the first differences model which often leads to imprecise and erratic estimates.

For all these reasons, we decide to use the system-GMM (Blundell and Bond, 1998) that is known to be more efficient than the Arellano and Bond (1991) estimator. The Blundell and Bond (1998) GMM method is based on the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This method has the advantage of adding other orthogonality conditions $E\left(\Delta y_{it-j}\varepsilon_{it}\right)=0 \;\; for \quad t=2,\ldots,T \;\; and \;\; j=2,\ldots,T$ in order to obtain an estimator with greater accuracy. Indeed, Blundell and Bond (1998) show, using Monte-Carlo simulations, that the use of this double set of instruments improves the estimates' quality (Roodman, 2009).

4.3 Results

Table 3 displays the estimation results of the basic and augmented specifications. As expected, we find that the coefficient related to the first lagged accumulation ratio is negative and significant, which is consistent with the idea that there is less incentive to currently invest in fixed capital for a firm that invested last year. Another interesting finding is the negative and significant coefficient related to the error correction term, showing that the error correction is playing in the 'right way' by reducing the capital accumulation rate when the level of existing stock of capital is above the optimal stock and by increasing the accumulation rate when the opposite occurs. We also find positive and significant effects of current and lagged sales growth rates on the accumulation rate, highlighting the importance of the accelerator effect. In fact, rising sales growth rate implies that profit expectations and business confidence rise, encouraging businesses to build more factories and other buildings and to install more machinery.

On the whole and regarding the interest variables, the results on the sensitivity of investment to cash flow are consistent with those on credit constraints described in section 2. Investment of firms in departments with a functionally more distant banking system is more sensitive to cash flow, and this effect decreases with size. All specifications display a positive coefficient on the interaction term $\left(CF/K\right)*FD$ showing that the marginal effect of cash flows on investment is increasing with the physical distance and the economic gap between the branch and the parent bank departments. These findings confirm the idea that the severity of communication and incentive problems as well as their negative impact on lending policies and credit allocation grows with the distance between bank's hierarchical levels (Alessandrini et al., 2009).

We also consider a possible direct effect of functional distance on investment by introducing *FD* as an isolated term in eq. (5) (see Table 3, specifications (2), (4), (6) and (8)). Nevertheless, they appear to be statistically insignificant without affecting the other estimation coefficients[9]. This finding shows that the effect of functional distance on the capital accumulation behavior is *indirect*. In fact, *FD* impacts access conditions to external financing that, in turn, affects the amount invested. Thus, as Benfratello et al. (2008) and Alessandrini et al. (2009), we prefer to concentrate on the indirect effect of distance on firms' investment through its impact on financing constraints.

The results of the augmented specification (columns (6), (7), (8) and (9)) point out significant differences in the impact of functional distance on investment-cash flow sensitivity according to firm size. From column (6), we can see that the larger is the firm, the lower is the contribution of *FD_KM* to the marginal effect of cash flow on investment. This relation is significant for all firm size groups. In fact, the effect for the fourth size class (251 – 500 workers) is significantly lower than that of the benchmark case, constituted by the smallest group (01 – 09 workers). This trend is also confirmed for the other measure of functional distance in economic terms even if for this case the effect seems to be more pronounced. These findings are broadly consistent with the theoretical prediction stipulating that larger firms suffer less from the lack of banks' decisional centres in the department where they are located. The declining impact of functional distance on investment cash flow sensitivity according to the firm size group is reflected in the measure of elasticities of investment to cash flow according to size, as shown by the last part of Table 3. It is interesting to note that the capital accumulation behavior is very elastic to firm liquidity (internal financing) and this is even more important than the firm size is low. We can also note that the effect of size is the same for the third and the fourth size classes suggesting that for companies with more than 250 employees, the negative impact of functional distance is rather the same.

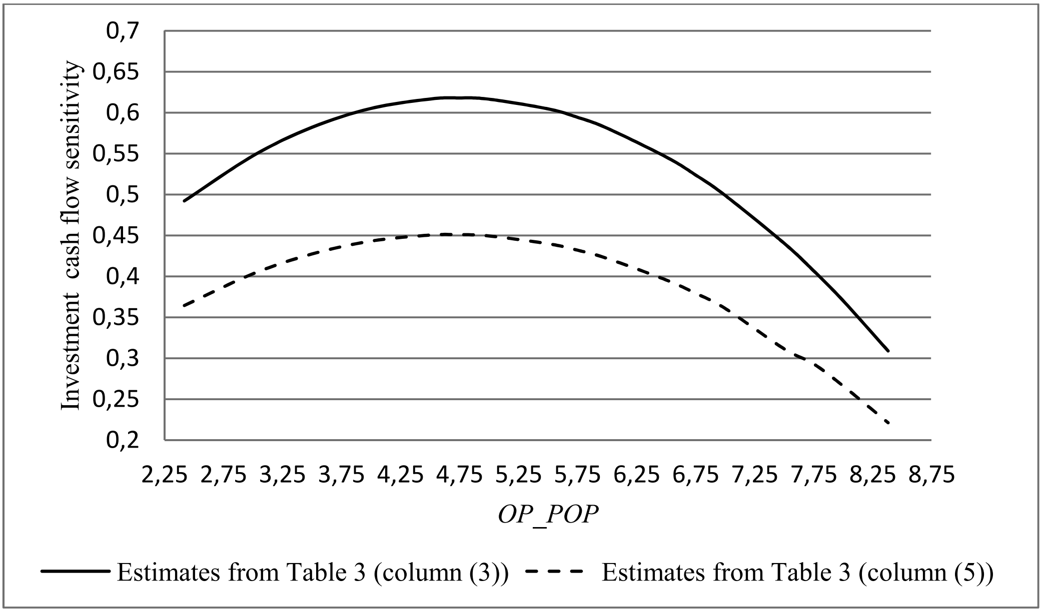
With regard to operational proximity, our findings are consistent with the theoretical prediction advanced by Hauswald and Marquez (2006). In fact, we find that the relationship between operational proximity and financing constraints is significantly non monotone with an investment cash flow sensitivity supposed to be increasing with operational proximity for low levels of *OP_POP* and decreasing for high levels of it. More explicitly, for values of operational proximity below the value of 4.74 or 4.68[10], corresponding approximately to the 75th percentile of the *OP_POP* distribution, the probability that the lending bank is located near the firm is low, the credit screen quality is relatively uninformative and thus adverse selection problems are high (see Figure 5). This intensification of adverse selection problems due to low operational proximity generates an aggravation of firm external financing conditions and thus an increase of the investment cash flow sensitivity. However, for values of operational proximity beyond this threshold, the probability that the lending bank is located near the firm is high, the credit screen quality is sufficiently high and thus adverse selection problems are low.

[9] see Table 3 and compare specifications (2) vs (3), (4) vs (5), (6) vs (7) and (8) vs (9).

[10] Respectively from specifications (3) and (5)

The consistencies of these results are confirmed by the validation of the instrument set at 5% and the reject of serial correlation in the original error, as desired (see Appendix D for more details). The dummies are generally not significant, except for dummies relatives to 2001 and 2002 years that shows positive and significant coefficients, except for industry dummies which shows significantly higher investment capabilities for low and medium technological sectors.

Figure 5: Illustration of the relationship between the investment cash flow sensitivity and the operational proximity



Note: Calculations are based on estimates from Table 3. The vertical blue lines demarcate the 5th and the 95th percentile of the *OP_POP* distribution of the SME sample over the study period 2001 – 2008.

Table 3: The effect of operational and functional distances on investment cash flow sensitivity

Dependent variable (*I/K*)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$(I/K)_{-1}$	-0.1077***	-0.0727***	-0.0940***	-0.0443**	-0.1054***	-0.0544***	-0.0664***	-0.0617***	-0.0850***
	(0.0498)	(0.0188)	(0.0237)	(0.0184)	(0.0228)	(0.0162)	(0.01831)	(0.0165)	(0.0192)
Δy	0.1264***	0.2472***	0.2420***	0.1417***	0.1940***	0.2077***	0.2077***	0.1653***	0.1603***
	(0.0448)	(0.0550)	(0.0684)	(0.0552)	(0.0673)	(0.0468)	(0.0527)	(0.0467)	(0.0543)
$(\Delta y)_{-1}$	0.0569***	0.0933***	0.1128***	0.0776***	0.1081***	0.1012***	0.1173***	0.0968***	0.1238***
	(0.0417)	(0.0273)	(0.0363)	(0.0552)	(0.0346)	(0.0218)	(0.0242)	(0.0233)	(0.0266)
$(k{-}y)_{-2}$	-0.1390**	-0.0616***	-0.0839***	-0.0478***	-0.1143***	-0.0499***	-0.0643***	-0.0708***	-0.0988***
	(0.0660)	(0.0212)	(0.0294)	(0.0205)	(0.0279)	(0.0171)	(0.0203)	(0.0179)	(0.0218)
y_{-2}	-0.0436***	-0.0115	-0.0171	-0.0047	-0.0410**	0.0131**	0.0150**	0.0039	-0.0000432
	(0.0405)	(0.0120)	(0.0167)	(0.0132)	(0.0193)	(0.0061)	(0.0069)	(0.0069)	(0.0086)
(*CF/K*)	0.464***	0.0525***	0.0523***	0.0431***	0.0451***	0.0453***	0.0430***	0.0409***	0.0396***
	(0.0303)	(0.0109)	(0.0127)	(0.0109)	(0.0128)	(0.0089)	(0.0104)	(0.0093)	(0.0101)
(*FD_KM*)		-0.0064				-0.0026			
		(0.0072)				(0.0067)			
FD_ECO				-0.1100				-0.1756	
				(0.1107)				(0.0982)	
OP_POP		-0.0111		-0.0292		-0.0126		-0.0309	
		(0.0119)		(0.0140)		(0.0104)		(0.0114)	
(*CF/K*) * *FD_KM*		0.0159**	0.0121**			0.0278***	0.0247***		
		(0.0097)	(0.0116)			(0.0089)	(0.0098)		
(*CF/K*) * *FD_ECO*				0.2014**	0.1572**			0.2851**	0.2861**
				(0.1413)	(0.1540)			(0.1311)	(0.1391)
(*CF/K*) * *OP_POP*		0.2463**	0.2210**	0.1689**	0.1575**	0.2197***	0.2114**	0.1828**	0.2179***
		(0.1103)	(0.1223)	(0.1053)	(0.1127)	(0.0907)	(0.1023)	(0.0861)	(0.0896)
(*CF/K*) * OP_POP^2		-0.0257**	-0.0233**	-0.0170**	-0.0168**	-0.0230**	-0.0226**	-0.0190**	-0.0238***
		(0.0114)	(0.0128)	(0.0104)	(0.0113)	(0.0094)	(0.0107)	(0.0086)	(0.0090)
(*CF/K*) * *FD_KM* * *SIZE2*						-0.0170***	-0.0200***		
						(0.0053)	(0.0057)		
(*CF/K*) * *FD_KM* * *SIZE3*						-0.0366***	-0.0409***		
						(0.0059)	(0.0065)		
(*CF/K*) * *FD_KM* * *SIZE4*						-0.0391***	-0.0398***		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
						(0.0069)	(0.0076)		
(CF/K) * FD_ECO * SIZE2								-0.2485***	-0.2542***
								(0.0813)	(0.0917)
(CF/K) * FD_ECO * SIZE3								-0.4025***	-0.3806***
								(0.0922)	(0.0979)
(CF/K) * FD_ECO * SIZE4								-0.4311***	-0.3469***
								(0.1024)	(0.1228)
Number of observations	11091	11056	11056	10401	10401	11056	11056	10401	10401
Number of firms	2174	2169	2169	2048	2048	2169	2169	2048	2048
OIR Sargan test	0.9729	0.2295	0.2138	0.2297	0.3915	0.2453	0.1689	0.3536	0.3639
AR(1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AR(2)	0.8723	0.7252	0.9129	0.5339	0.7704	0.5942	0.6621	0.5732	0.6632
AR(3)	0.7982	0.9105	0.9438	0.9050	0.9231	0.8621	0.8687	0.9390	0.9411
Wald-test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Elasticities of investment to cash flow according to size									
Average firm	1.230***		1.6263***		1.189***				
Size 1 firm							1.642***		1.599***
Size 2 firm							1.459***		1.442***
Size 3 firm							1.268***		1.363***
Size 4 firm							1.282***		1.384***

Note: This table shows the Two step System-GMM estimation of equations (3) and (5) using Stata 10.1 SE package. Regression coefficients and, in brackets, the associated standard errors are reported. Significance reported at 10% (*), 5% (**) and 1% (***) levels. Time, geographic and technological intensity industry classification dummies are included in all regressions, not shown for reasons of space. As instruments, we use lags of endogenous and pre-determined variables in level from t-2 to t-6 for differenced equation and differentiated endogenous and pre-determined variables for level equation. Geographic, industry and time dummies are taken as strictly exogenous regressors. The table also reports the p-value of the Wald-test used to test the significance of all variables in the model. A first specification test is the Arellano and Bond autocorrelation tests of first, second and third orders AR (1), AR (2) and AR (3) (the null hypothesis is no autocorrelation). A second specification test is the Sargan test of Over-Indentifying Restrictions (OIR Sargan test, the null is the validity of the instrument set). P-values are reported for all these tests. The last part of the table reports the estimated elasticity of investment to cash flow $\left(\frac{\frac{\partial(I/K)}{(I/K)}}{\frac{\partial(CF/K)}{(CF/K)}}\right)$. Columns (1), (3), (5) refer to the average firm elasticity, while the columns (7) and (9) report the elasticities according to the firm class of size measured at the mean values of (*I/K*), (*CF/K*), *FD_KM*, *FD_ECO* and *OP_POP*. The asterisks report the significance level of the t-test of nullity.

6. Conclusion

In this paper, we have tried to assess the impact of geographical diffusion of banking structures and instruments as well as geographical concentration of decisional and strategic centres of banking institutions over the period 2001 – 2008 on firms' financing constraints. Our econometric exercise consistently show that increased functional distance made financing constraints more binding, as indicated by the positive coefficient relying it with the investment cash-flow sensitivity. Interestingly, with regard to operational proximity, our findings are consistent with the theoretical prediction of non linearity of the operational proximity with financing constraints advanced by Hauswald and Marquez (2006). This finding confirms the informational capture that an operationally close banking system may exercise on local borrowers as well as adverse selection problems arising when approaching these locally captured firms.

There are two policy-oriented implications of our findings. First, the consolidation of the French banking industry, leading to an increase of the functional distance may aggravate financing problems of small local firms, especially in peripheral departments. As Alessandrini et al. (2009) and before Berger and Udell (2006) have pointed out, these negative externalities of market deregulation could be reduced by *'favoring a change in emphasis in bank organization from the search of economies of scale by standardized, arm's-length lending technologies, to economies of scope by making specialized credit instruments available to local firms*'. Second, our findings regarding operational proximity and its impact on SME financing suggest that the French banking system should be more operationally proximate to local firms to better fit their funding needs and to promote the entry and creation of new banks and non-bank competitors struggling to offer financing to local firms. Despite commendable efforts made by certain banking groups since the early 2000s to reinforce the French banking system's supply by opening new branches, much remains to be done in this field.

Finally, our results are particularly suggestive of the persistent importance of relationship lending for small opaque borrowers despite the technological progress that significantly expands the ability of banks to produce hard information and therefore substitute transactions-based lending for relationship lending and basel II recommendations that push banks to develop sophisticated credit scoring models, largely based on hard information, to assess the credit risk.

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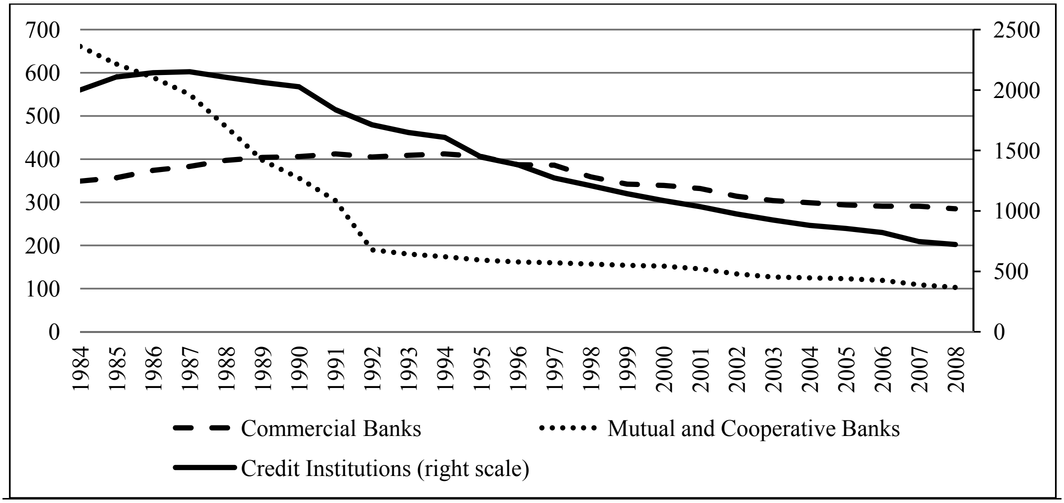
Appendix

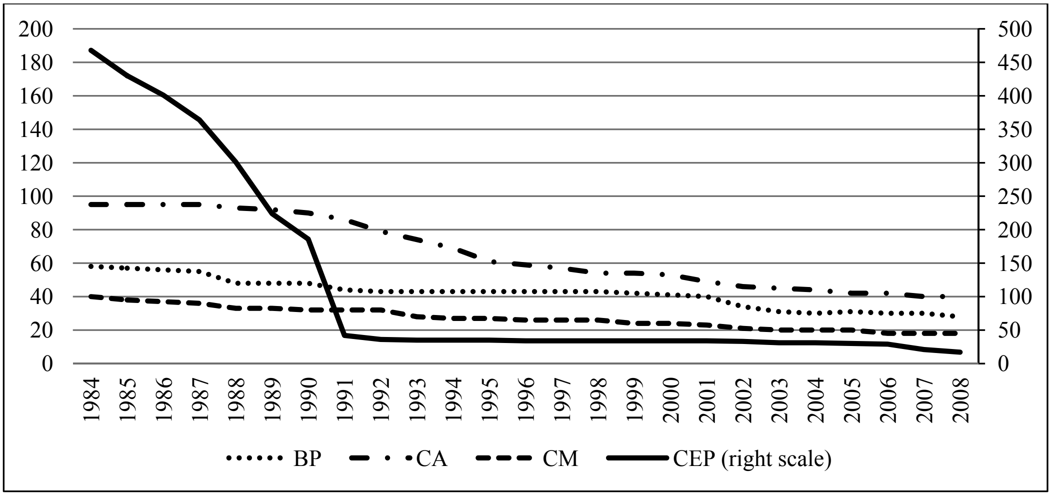
Appendix A: Recent changes in the French banking sector

A.1: The French banking sector consolidation



Source: CECEI annual reports and own elaboration.

A.2: The emblematic internal grouping of cooperative networks



Source: CECEI annual reports and own elaboration.

A.3: Branches, ATMs and employees evolution in the French banking system, 1999 – 2008

Source: CECEI annual reports and own elaboration

Appendix B: Data description

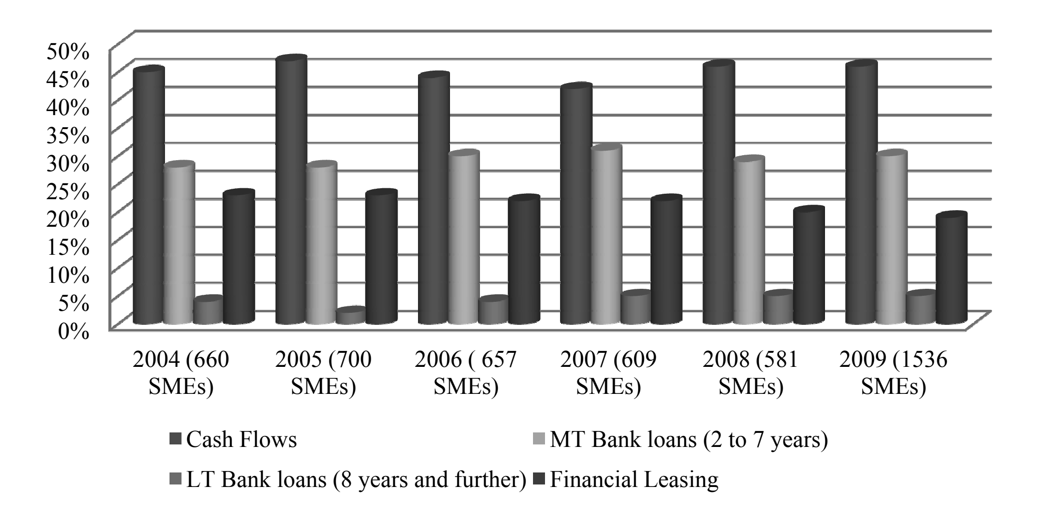
Variables	Definition	Mean	Median	Std. Dev.	Min	Max	Source
Dependent variable							
(*I/K*)	The firm-level accumulation ratio.	20.22%	12.12%	23.83%	0	149.46%	Author's calculation on Balance Sheet data in DIANE
Explanatory variables							
(*CF/K*)	The firm-level ratio of profit rate. *CF* is computed as net profit plus depreciation allowances.	53.63%	37.78%	52.74%	-34.09%	295.26%	
Δy	The firm's annual growth rate of total sales.	2.46%	2.52%	17.93%	-69.79%	286.67%	Author's calculation on Balance Sheet data in DIANE
(*k–y*)	Error correction term. It is the gap between the current capital stock and the optimal capital stock.	-1.90	-1.88	0.85	-5,47	8.52	
FD_KM	The first measure of the organizational structure of the local banking system. It is the physical functional distance, computed as the ratio of bank *b* branches to total branches in department *d* weighted by the logarithm of 1 plus the orthodromic distance between the department of the branch and the department where the parent bank is headquartered.	3.4473	3.2833	1.1409	0.647	6.031	Author's calculation on Bank of France data and Banks annual reports
FD_ECO	The second measure of the organizational structure of the local banking system. It is the economic functional distance, computed as the ratio of bank *b* branches to total branches in department *d* weighted by the logarithm of 1 plus the index of the economic structure difference between the department of the branch and the department where the parent bank is headquartered in terms of shares of workers employed by *m* economic sectors.	0.2337	0.214	0.0919	0.0561	0.5119	Author's calculation on Unedic statistics (UNISTATIS)

OP_POP	The first departmental indicator of the local banking system operational proximity to a department *d*. It is a measure of the branch density in this department, computed as the number of bank branches in department *d* per 10 000 inhabitants.	4.2901	4.2384	0.7959	2.4187	8.3849	Author's calculation on Bank of France and INSEE data
HHI	Herfindahl-Hirschman concentration index is computed on the number of bank branches in a deparment.	0.146	0.148	0.045	0.014	0.014	Author's calculation on Bank of France data.
*Size*1	is 1 if [01 - 09] employees	29.31%					Firm data in DIANE
*Size*2	is 1 if [10 - 49] employees	42.24%					
*Size*3	is 1 if [50 - 250] employees	24.56%					
*Size*4	is 1 if [251 - 500] employees	3.89%					
*Tech*1	is 1 if the firm is affiliated to a low technology manufacturing sector (NAF rév2 code = 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18 - 24 - 31)	34.71%					Firm data in DIANE and SESSI Classification
*Tech*2	is 1 if the firm is affiliated to a medium-low technology manufacturing sector (NAF rév2 code = 22 - 23 - 25 - 28 - 30.1 - 30.2 - 30.9 - 32 - 33)	50.99%					
*Tech*3	is 1 if the firm is affiliated to a medium-high technology manufacturing sector (NAF rév2 code = 20 - 26.5 - 26.6 - 26.7 - 26.8 - 27.1 - 27.2 - 27.3 - 27.4 - 27.9 - 29.1 - 29.2 - 29.3)	10.73%					
*Tech*4	is 1 if the firm is affiliated to a high technology manufacturing sector (NAF rév2 code = 21 - 26.1 - 26.2 - 26.3 - 26.4 - 30.3 - 30.4)	3.07%					

North	is 1 if the firm is located in the North of France (Insee region codes: 11 - 21 - 22 - 31)	30.3%	
West	is 1 if the firm is located in the West (Insee region codes: 23 - 25 - 52 - 53)	12.5%	
Center	is 1 if the firm is located in the Center (Insee region codes: 24 - 74 - 83 and Insee department codes: 86 - 79)	8.9%	Firm data in DIANE
East	is 1 if the firm is located in the East (Insee region codes: 26 - 41 - 42 - 43 - 82)	23.85%	
South West	is 1 if the firm is located in the South West (Insee region codes: 72 – 73 and Insee department codes: 16-17)	14.3%	
South East	is 1 if the firm s located in the South East (Insee region codes: 91 - 93)	10.15%	

Note: *I*: Investment is measured as the variation between t and t-1 of the firm's capital stock (defined as tangible assets, gross of depreciation allowances). Investment $I_{it} = K_{it} - K_{it-1} + \delta K_{it-1}$ is deflated by the sectorial deflator of nominal investment (at 2000 prices). K_{it} is the net capital stock at the end of period *t*. *y*: Logarithm of sales at 2000 prices.

Appendix C: French SMEs Investments' financing plan, 2004 – 2009



Source: the OSEO biannual surveys on SMEs and own elaboration.

Appendix D: Specification tests

- **The Arellano and Bond test of autocorrelation disturbance**

For consistent estimation, the system-GMM estimators require that the error $\varepsilon_{i,t}$ be serially uncorrelated.

Specifically, if $\varepsilon_{i,t}$ are serially uncorrelated, then $\Delta\varepsilon_{i,t}$ are correlated with $\Delta\varepsilon_{i,t-1}$, because $Cov\left(\Delta\varepsilon_{i,t},\Delta\varepsilon_{i,t-1}\right) = Cov\left(\varepsilon_{i,t}-\varepsilon_{i,t-1},\varepsilon_{i,t-1}-\varepsilon_{i,t-2}\right) = -Cov(\varepsilon_{i,t-1},\varepsilon_{i,t-1}) \neq 0$. But $\Delta\varepsilon_{i,t}$ will not be correlated with $\Delta\varepsilon_{i,t-k}$ for $k \geq 2$. A test of whether $\Delta\varepsilon_{i,t}$ are correlated with $\Delta\varepsilon_{i,t-k}$ for $k \geq 2$ can be calculated based on the correlation of the residuals $\Delta\hat{\varepsilon}_{i,t}$. The null hypothesis that $Cov\left(\Delta\varepsilon_{i,t},\Delta\varepsilon_{i,t-k}\right) = 0$ for $k = 1,2,3$ is rejected at a level of 0,05 if $p < 0{,}05$. As explained, if $\varepsilon_{i,t}$ are serially uncorrelated, we expect to reject at order 1 but not at higher orders. This is indeed the case.

- **The overidentifying restrictions (OIR) test**

The validity of an instrument must be tested. This test cannot be performed in a just-identified model (a model in which the parameters' number is equal to instruments' number). But it is possible to test the validity of overidentifying instruments in an overidentified model provided that the parameters of the model are estimated using optimal GMM.

The starting point is the fitted value of the criterion function after optimal GMM, i.e., $Q\left(\hat{\beta}\right) = \left\{\left(\frac{1}{N}\right)(y - X\hat{\beta})'Z\right\}\hat{S}^{-1}\left\{\left(\frac{1}{N}\right)Z'(y - X\hat{\beta})\right\}$ with Z is the instruments matrix and $\hat{S}^{-1} = W$ with $W = (Z'Z)^{-1}$ is a positive definite symmetric-weighting matrix. If the population moment conditions $E\left\{Z'(y - X\hat{\beta})\right\} = 0$ are correct, then $Z'(y - X\hat{\beta}) \approx 0$, so $Q\left(\hat{\beta}\right)$ should be clause to zero (for more details, see Roodman, 2009 and Verbeek, 2012). Under the null hypothesis that all instruments are valid, it can be shown that $Q\left(\hat{\beta}\right)$ has an asymptotic chi-squared distribution with degrees of freedom equal to the number of overidentifying restrictions. Large values of $Q\left(\hat{\beta}\right)$ lead to rejection of $H_0 : E\left\{Z'(y - X\hat{\beta}\right\} = 0$. Rejection is interpreted as indicating that at least one of the instruments is not valid. Here, for all specifications, all instruments are valid because $p > 0,05$.

The Interrelationship between Money Supply, Prices and Government Expenditures and Economic Growth: A Causality Analysis for the Case of Cyprus

Andreas G. Georgantopoulos[1] **and Anastasios D. Tsamis**[2]

Abstract

This paper investigates the short run as well the long run relationships between money supply, inflation, government expenditure and economic growth by employing the Error Correction Mechanism (ECM) and Johansen co-integration test respectively for the case of Cyprus using annual data from 1980 to 2009. Collectively, empirical results imply that public spending promotes economic development in Cyprus. However, deficit financing by the government causes more liquidity effects but also inflationary pressure in the economy. Results show that inflation negatively effects economic growth probably due to adverse supply shock. Money supply should be allowed to grow according to the real output of the economy but excess growth of money causes inflationary pressure in case of Cyprus. Therefore, this paper suggests that the government should control its current expenditure that stimulates aggregate demand and to focus more on development expenditure which stimulates aggregate supply and increases real output level.

Keywords: Economic development, Co-integration, Granger causality, Deficit financing

JEL Classification: C32, E60, O11

1. Introduction

1.1 Theoretical Background

During the last decades, the macroeconomic literature has provided a vast number of instruments of fiscal and monetary policies regarding almost every country in order to achieve macroeconomic goals such as development, growth, redistribution of income, financial stabilization, job opportunities etc. However, economists still argue on the basic dilemma, whether more government expenditure can finally boost economic growth, or appropriate contractionary policy measures are the key for long-term economic development

[1] PhD, Department of Public Administration, Panteion University of Political and Social Sciences, 136, Sygrou Ave. 176 71,Athens, Greece, e-mail: ageorgantos@yahoo.com

[2] Professor, Department of Public Administration, Panteion University of Political and Social Sciences, 136, Sygrou Ave. 176 71, Athens, Greece, e-mail: atsamis@panteion.gr

and financial stability. In this aspect, policy makers are usually interested in demanding management policy and supplying side policies. Change in money supply will affect the liquidity position in financial institutes and private spending of the economy, while the public expenditures affect public spending of the economy.

The theory of Money is based on two core elements for policy purpose; the quantity theory of money and the natural rate of unemployment. Monetarism derives from the quantity theory of money and states that variation in the money supply has major influences on national output in the short run and the price level over longer periods and that objectives of monetary policy are best met by targeting the growth rate of the money supply. Assuming that the velocity of money is constant and the output is not influenced by money supply, increases in the money supply proportionally raise inflation level. The long run evidence behind monetarism is compelling but the short run support is weak.

According to the monetarism, money supply is changed by monetary authority. As money supply increases, prices also rise proportionally (with all other things remain constant). So, inflation rises as monetary authority increases money supply. On the other hand, the hypothesis of natural rate of unemployment suggests that this rate is determined by the central institution of the national economy. Any increase in money supply that causes output level above natural level in the short run will cause a proportionally increase in prices (i.e. inflation) in the long run. It is also suggested that instead of following up full employment objective, macroeconomic policy should be concentrated on achieving the constant rate of monetary growth. However, monetarists ruled out the possibility that demand management can impact either on real economic growth or employment in the long run. It was argued that the above analyzed policies did not generate employment; on the contrary, they created only inflation in the economy. This methodology of demand management critically spoiled the free market mechanism where price stability is a necessary base.

A second feature of the monetarists' approach to the monetary policy was to focus on supply side economy. They ruled out any discussion for demand management policies but they agreed upon that government can take a severe initiative to enhance economic efficiency by macroeconomics instruments and policies in order to influence households and industries from the supply side. One example of this approach is the policy of reducing marginal tax rates for those who have high incomes. This was initiated under the assumption that entrepreneurs will lead the way to long term economic growth. On the other hand, for those who have low incomes, the corresponding incentives were to be obtained by the reduction of unemployment and earnings-related payments (i.e. wages).

Nevertheless, during the last decade central banks did not predict the increasingly important role of investment banks and hedge funds in the global financial system, which was extended with participation of funds outside the regulatory framework of traditional commercial banks. The global financial crisis that followed the shortness of liquidity in the banking system of the United States necessitated government intervention to direct provision of funds, bringing the monetarist model in second place, and fears of destabilization of the economy and inflation emerged. Fears judged to be minor compared to the effort of governments, central banks and other policy makers to address the prolonged downturn in the global economy that began in 2008 and continues until present.

Taking into consideration the above analysis, this paper investigates the behavior of money supply, inflation, government expenditures and economic growth for a developed European Union member country, Cyprus.

1.2 A Brief Review of the Economic Outlook of Cyprus

Cyprus was included by the International Monetary Fund in its list of advanced economies in 2001. Erratic growth rates in the 1990s reflected the economy's vulnerability to swings in tourist arrivals, caused by political instability on the island and fluctuations in economic conditions in Western Europe. On 1 January 2008, the country entered the Eurozone replacing the Cypriot pound with the euro. Since gaining independence from the United Kingdom in 1960, Cyprus has had a record of successful economic performance, reflected in strong growth, full employment conditions and relative stability. The underdeveloped economy inherited from colonial rule has been transformed into a modern economy, with dynamic services, industrial and agricultural sectors and an advanced physical and social infrastructure.

According to World Economic Outlook Database (2011), Cyprus is one of the most prosperous countries in the Mediterranean region, with GDP per capita reaching $30,000. Their standard of living is reflected in the country's high Human Development Index and Cyprus is ranked 23rd in the world in terms of the quality-of-life index, as data from the Economist Intelligence Units (2005) rankings imply.

In the past 30 years, the economy has shifted from agriculture to light manufacturing and services. The services sector, including tourism, contributes almost 80 percent to GDP and employs more than 70 percent of the labor force. Industry and construction account for approximately one-fifth of GDP and labor, while agriculture is responsible for 2.1 percent of GDP and 8.5 percent of the labor force.

After robust growth rates in the 1980s (i.e. average annual growth was 6.1%), economic performance in the 1990s was mixed with real GDP growth ranging from 1.7% to 9.7%. This pattern underlined the economy's vulnerability to swings in tourist arrivals and the need to diversify the economy. Declining competitiveness in tourism and especially in manufacturing is expected to act as a drag on growth until structural changes are effected. Overvaluation of the Cypriot pound prior to the adoption of the euro in 2008 had kept inflation in check.

Trade is vital to the Cypriot economy (the island is not self-sufficient in food and has few natural resources) and the trade deficit continues to grow. Cyprus must import fuels, most raw materials, heavy machinery, and transportation equipment. More than 50 percent of its trade is with the rest of the European Union, especially Greece and the United Kingdom, while the Middle East receives 20 percent of exports. In 1991, Cyprus introduced a Value Added Tax (VAT), which is currently 15% in line with the EU minimum. Cyprus ratified the new world trade agreement (General Agreement on Tariffs and Trade, GATT) in

1995 and began implementing it fully on 1 January 1996. Cyprus also has the fourth-largest ship registry in the world, with 2,758 ships and 25.5 million gross registered tons (GRTs). It is an open registry and includes ships from more than 43 countries, including Greece, Germany, and Russia.

EU accession negotiations started on 31 March 1998, and concluded when Cyprus joined the organization as a full member in 2004. However, after more than three decades of unbroken growth, the economy of Cyprus entered recession in 2009. This reflected the exposure of Cyprus to the European sovereign debt crisis. In recent times, concerns have been raised about the state of public finances and spiraling borrowing costs.

In the above spirit, this paper attempts to estimate the behavior of money supply, government expenditure, growth and prices and their simultaneous impacts on inflationary expectations. This work has a particular research interest, taking into consideration that Cyprus recently entered the global financial crisis and experienced since then difficulties in various macroeconomic aspects.

This study is motivated by a number of factors. First, there is a lack of published studies that investigate the presence of interdependence between money supply, government expenditures, prices and growth in one study for Cyprus. Second, it enriches the very few existing literature on the links between these macroeconomic variables. The above kind of nexus has been studied separately using methods of correlation, regression, or Granger's bivariate causality tests. Third, it covers a period which includes some of the most important macroeconomic and political transformations leading to a more open and therefore more globalized and developed economy for Cyprus.

Therefore, there are three central objectives of this research; First, to investigate the causal links between money supply (i.e. monetary policy), public expenditure (i.e. fiscal policy) and real GDP. Second, to find out the association between current governments spending and consumer price index. Third, to examine the impact of government expenditures on monetary base in case of budget deficit (deficit financing).

The rest of the paper is organized as follows. Section 2 briefly reviews the literature. Section 3, presents the data and methodology employed. Section 4 presents the empirical results, while concluding remarks with some policy implications are presented in Section 5.

2. Review of Recent Literature

In the recent literature there are several studies dealing with monetary and fiscal policy issues producing contradictory evidence regarding the behavior of the selected macroeconomic variables in each case.

Karpetis (2006) developed a simple dynamic New Keynesian type model using the multiplier – accelerator principle in order to examine the quantitative impact of changes in the level of government expenditures and the growth rate of nominal money supply on the level of several macroeconomic magnitudes. He concluded that long run value of inflation (expected and actual) is affected by size of government expenditure and nominal money supply.

Demeri, Duck and Musgrave (2004) used a data set from 1964 to 1981 in the case of West Germany. They found that for this country unanticipated money growth affects output and employment.

Choi and Devereux (2005) explored how fiscal policy (represented by increases in government spending) has asymmetric effects on economic activity across different levels of real interest rates. They suggested that the effect of fiscal policy depends on the level of real rates. Using threshold vector autoregression models on U.S. data, the paper provides evidence that expansionary government spending is more conducive to short-term growth when real rates are low.

Han and Mulligan (2008) argued that inflation is significantly positively related to the size of government, mainly when periods of war and peace are compared. They found a weak positive peacetime time series correlation between inflation and the size of government and a negative cross-country correlation of inflation with non-defense spending.

Jiranyakul (2007) used Thai-data from 1993 to 2004 in order to find out causal relationships between economic development and size of government. Empirical evidence showed that there was no bilateral link between government expenditures and economic growth. However, a unidirectional causality running from government expenditures to economic growth existed. Furthermore, estimation results from the ordinary least square (OLS) regression confirmed the strong positive impact of government spending on economic growth during the period of investigation.

Koeda and Kramarenko (2008) evaluated a fiscal scenario based on the assumption of a rapid scaling-up of expenditure to be followed by a rapid scaling-down in the context of Azerbaijan's current temporary oil production boom. They suggested that the evaluated fiscal scenario poses significant risks to growth sustainability.

Albatel (2000) used data from 1973 to 2004 in the case of Saudi Arabia, and employed granger causality test to examine the association between money supply, government expenditure and economic growth and his findings showed bilateral causality between the variables.

Nurudeen and Usman (2010) investigated the effect of government expenditure on economic growth, by employing a disaggregated analysis for Nigeria during the period 1970-2008. The results reveal that government total capital expenditure (TCAP), total recurrent expenditures (TREC) and government expenditure on education (EDU) have negative effect on economic growth. On the contrary, rising government expenditure on transport and communication (TRACO) and health (HEA) resulted to an increase in economic growth.

Hsieh and Lai (1994) conducted a multivariate time series analysis based on data for the Group-of-Seven (G-7) countries with particular attention paid to the causal pattern and the shape of the impulse-response function in the context of vector autoregressions. The empirical results suggest that the relationship between government spending and growth can vary significantly across time, as well as across the major industrialized countries that presumably belong to the same level of economic development.

Mehmood and Sadiq (2010) examined both the long run and the short run relationship between the fiscal deficits, which is the outcome of high government expenditure over the level of tax revenue collection and poverty. Their results reveal a negative relationship between government expenditure and poverty, based on time series data from 1976 to 2010 for Pakistan.

Lucas and Stokey (1983), Judd (1989) and others have argued that an optimal tax policy involves the use of 'state-contingent debt'. Citizens buy contingent claims on the government, which pay off extraordinarily well when government revenues (spending) are above (below) expectations and poorly when government revenues (spending) are below (above) expectations.

Judd (1989) argues that nominal government liabilities and nominal provisions in the tax code serve this state-contingent debt function, with monetary policy adjusting the price level appropriately to achieve the right pattern of payoffs\ for the state-contingent debt. Thus, inflation is above normal upon the receipt of 'bad news' about the government's fiscal situation and below normal upon receipt of 'good news'. One empirical counterpart to good and bad news is the beginning and end of wars - inflation should be high during the war and prices should jump down at the conclusion of the war.

3. Data and Methodology

This study investigates the relationship between money supply (M2), prices as measured by Consumer Price index (CPI) for the end of the year, total government expenditures (GE) and growth as measured by the rate of change of real GDP for Cyprus during the period 1980-2009. All selected data are in annual base and gathered from reliable sources; GDP, CPI and GE data are derived from the World Economic Outlook (WEO, i.e. International Monetary Fund database), while M2 annual observations are drawn from the World Development Indicators (WDI, i.e. World Bank database). Authors' calculations are conducted using the E-views 7.1 software (2010). All data sets are transformed into logarithmic returns in order to achieve mean-reverting relationships and to make econometric testing procedures valid.

To check the stationarity properties of the univariate time series, Augmented Dickey-Fuller (ADF) test is employed in order to test for the unit roots of the concerned time series variables (Dickey and Fuller, 1979). It consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, by employing a constant and a time trend. This can be expressed as:

$$\Delta y_t = a_1 y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + x'_{it}\delta + \varepsilon_t \qquad (1)$$

The test for a unit root is conducted on the coefficient of (y_{t-1}) in the regression. If the coefficient is significantly different from zero then the hypothesis that (y) contains a unit root is rejected. Rejection of the null hypothesis implies stationarity.

Furthermore, the time series has to be examined for co-integration. Cointegration analysis helps to identify long-run economic relationships between two or several variables and to avoid the risk of spurious regression. Co-integration analysis is important because if two non-stationary variables are cointegrated, a Vector Autoregression (VAR) model in the first difference is misspecified due to the effect of a common tend. If a cointegration relationship is identified, the model should include residuals from the vectors (lagged one period) in the dynamic Vector Error Correcting Mechanism (VECM) system. In this stage, the Johansen (1988) cointegration test is used to identify a cointegrating relationship among the variables. Within the Johansen multivariate cointegrating framework, the following system is estimated:

$$\Delta z_t = \Gamma \Delta z_{t-1} + \Gamma_{k-1} \Delta z_{t-k-1} \Pi z_{t-1} + \mu + \varepsilon_t : \text{t=1,..,T} \tag{2}$$

where, Δ is the first difference operator, z′ denotes a vector of variables, $\varepsilon_t \sim$ n iid $(0,\sigma^2)$, μ is a drift parameter, and Π is a (p x p) matrix of the form $\Pi = \alpha\beta'$, where α and β are both (p x r) matrices of full rank, with β containing the r cointegrating relationships and α carrying the corresponding adjustment coefficients in each of the r vectors. The Johansen approach can be used to carry out Granger causality tests as well. In the Johansen framework, the first step is the estimation of an unrestricted, closed p-th order VAR in k variables. Johansen (1988) suggested two tests statistics to determine the cointegration rank. The first of these is known as the trace statistic:

$$N\{trace\left(r_0 / k\right) = -T \sum_{i=r_0+1}^{k} \ln\left(1-\hat{\lambda}_i\right) \tag{3}$$

where, $\hat{\lambda}_i$ are the estimated eigenvalues $\lambda_1 > \lambda_2 > \lambda_3 > \ldots > \lambda_\kappa$ and r_0 ranges from zero to k-1 depending upon the stage in the sequence. This is the relevant test statistics for the null hypothesis $r \leq r_0$ against the alternative $r \geq r_o+1$. The second test statistic is the maximum eigenvalue test known as λ_{max}; we denote it as λ_{max} (r_0). This is closely related to the trace statistic, but arises from changing the alternative hypothesis from $r \geq r_o+1$ to $r = r_o+1$, thus improving the power of the test by limiting the alternative to a cointegration rank, which is just by one more than the null hypothesis. The λmax test statistic is:

$$\lambda_{max}(r_0) = -\text{T in } (1-\lambda_i) \text{ for } i = r_0 + 1 \tag{4}$$

The null hypothesis is that there are r cointegrating vectors, against the alternative of (r+1) cointegrating vectors. Johansen and Juselius (1990) indicated that the trace test might lack power relative to the maximum eigenvalue test. Based on the power of the test, the maximum eigenvalue test statistic is often preferred when the sample size is smaller (n<40) because it produces more sophisticated results.

In order to examine the short term relationships between the tested variables, the Error Correction Mechanism (ECM) is employed and works in the following manner; Firstly, the relevant equation is run. After noting the produced residuals from the regression a second regression is run in first differences including the residuals observations. The so called speed of adjustment (i.e. residual coefficient) produced from the regression if negative and statistically significant indicates the level of the short term predictability of the model. Otherwise, the model is unpredictable in the short run.

On the other hand, according to Granger (1969), Y is said to 'Granger-cause' X if and only if X is better predicted by using the past values of Y than by not doing so with the past values of X being used in either case. In short, if a scalar Y can help to forecast another scalar X, then we say that Y Granger-causes X. If Y causes X and X does not cause Y, it is said that unidirectional causality exists from Y to X. If Y does not cause X and X does not cause Y, then X and Y are statistically independent. If Y causes X and X causes Y, it is said that feedback exists between X and Y. Essentially, Granger's definition of causality is framed in terms of predictability. To implement the Granger test, a particular autoregressive lag length k (or p) is assumed and Models (5) and (6) are estimated by OLS:

$$X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i} X_{t-i} + \sum_{j=1}^{k} b_{1j} Y_{t-j} + \mu_{1t} \tag{5}$$

$$Y_t = \lambda_2 + \sum_{i=1}^{k} a_{2i} X_{t-i} + \sum_{j=1}^{k} b_{2j} Y_{t-j} + \mu_{2t} \tag{6}$$

Furthermore, an F-test is carried out for the null hypothesis of no Granger causality; $H_0 : b_{i1} = b_{i2} = \ldots = b_{ik} = 0, i = 1,2$. where, the F statistic is the Wald statistic of the null hypothesis. If the F statistic is greater than a certain critical value for an F distribution, then we reject the null hypothesis that Y does not Granger-cause X, which means Y Granger-causes X.

A time series with a stable mean value and standard deviation is called a stationary series. If d differences have to be made to produce a stationary process, then it can be defined as integrated of order d. Engle and Granger (1987) state that if several variables are all I(d) series, their linear combination may be cointegrated, that is, their linear combination may be stationary. Although the variables may drift away from equilibrium for a while, economic forces are expected to restore equilibrium. Thus, they tend to move together in the long run irrespective of short run dynamics. The definition of Granger causality is based on the hypothesis that X and Y are stationary or I(0) time series. Therefore, the fundamental Granger method for variables of I(1) cannot be applied. In the absence of a cointegration vector, with I(1) series, valid results in Granger causality testing are obtained by simply first differentiating the VAR model. With cointegration variables, Granger causality will require further inclusion of an error term in the stationary model in order to capture the short term deviations of series from their long-term equilibrium path. Hassapis et al. (1999) show that in the absence of cointegration, the direction of causality can be decided upon via standard F-tests in the first differenced VAR. The VAR in the first difference can be written as:

$$N\{\Delta X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i} \Delta X_{t-i} + \sum_{j=1}^{k} b_{1j} \Delta Y_{t-j} + \mu_{1t} \tag{7}$$

$$N\{\Delta Y_t = \lambda_2 + \sum_{i=1}^{p} a_{2i} \Delta X_{t-1} + \sum_{j=1}^{p} b_{2j} \Delta Y_{t-j} + \mu_{2t} \tag{8}$$

4. Empirical Results

Table 1 reports the descriptive statistics for the data sample. Overall, calculations indicate that all variables are not normally distributed and are characterized as leptokurtic and skewed.

Table 1: Descriptive Statistics

Statistics	GDP	M2	GE	CPI
Mean	3.863742	9.846529	9.786292	4.851277
Median	3.893692	9.938806	9.825702	4.879286
Maximum	4.118728	10.67719	10.28321	5.038306
Minimum	3.539578	8.900302	9.184803	4.578490
Std. Dev.	0.182419	0.532776	0.324815	0.135105
Skewness	-0.305028	-0.275481	-0.232383	-0.342003
Kurtosis	1.837073	1.886127	1.946685	1.937453
Jarque-Bera	2.155711	1.930339	1.656848	1.996088
Probability	0.340325	0.380919	0.436737	0.368600

Table 2 displays the estimates of the Augmented Dickey – Fuller (ADF) test in levels and in first differences of the data with an intercept, with an intercept and trend and with no intercept or trend. The tests have been performed on the basis of 5 percent significance level, using the MacKinnon Critical Values (MacKinnon, 1996). The lag length was determined using Schwarz Information Criterion (Schwartz, 1978). Initially, ADF test with an intercept implies that all variables are not stationary at levels even at 10 percent level of significance. However, at 1st differences GDP, M2, GE and CPI are all stationary at 1 percent significance level. Similar results presents the unit root test with an intercept and trend, since all variables show no significance at levels but at 1st differences all variables are integrated of order one. Finally, ADF test with no intercept or trend reports that at levels none of the examined variables have a unit root. However, at 1st differences all variables are stationary at an accepted significance level (i.e. 5 percent). Collectively, all test results imply that all variables are not stationary at levels at any accepted level of significance (i.e. 5 percent significance level or higher). These are stationary at 1st differences. So, robust results indicate that all three variables are integrated of order one i.e. I(1).

Table 2: Augmented Dickey – Fuller Unit Root Test Results

Variables	Test with Intercept		Test with Intercept and Trend		Test with no Intercept or Trend	
	Levels	1st Differences	Levels	1st Differences	Levels	1st Differences
GDP	-2.5878	-4.8488***	-0.3948	-6.2849***	0.5984	-2.9635**
M2	-1.1677	-4.7938***	-1.5933	-4.8252***	3.5968	-2.2698**
GE	1.9529	-5.1994***	-2.2693	-5.6902***	5.6984	-2.3967**
CPI	-2.4296	-3.7753***	-2.7029	-4.5547***	7.9657	-2.0624**

Note: *, **, *** denote significance at 10%, 5% and 1% respectively. This note also applies to the subsequent tables.

Table 3 provides the results from the application of Johansen cointegration test among the data sets. Empirical findings show that both the maximum eigenvalue and the trace tests reject the null hypothesis of no cointegration at the 5 percent significance level according to critical value estimates. Thus, empirical results imply that there are long run relationships among the tested variables at accepted significance levels.

Table 3: Johansen Co-integration Test Results

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
r* = 0	52.3480**	47.8561	28.5753**	27.5843
r ≤ 1	30.7677**	29.7970	21.2703**	21.1316
r ≤ 2	16.4983**	15.4947	15.3940**	14.2646
r ≤ 3	2.6588	3.8415	2.6495	3.4896

Note: * r is the number of co-integrating vectors under the null hypothesis.

Table 4 presents the results from the application of the Error Correction Model in order to test the existence of short run equilibrium among the variables. Regression results show that adjustment coefficient is negative and significant (-0.3782). These findings suggest that 37.82 percent of the disequilibrium will be corrected immediately, i.e. in the next period.

Table 4: Error Correction Model Estimates (Dependent Variable ΔGDP)

Variable	Coefficient	Std. Error	T-Statistic
Δ M2	0.0187	0.0330	3.7687**
Δ CPI	0.2274	0.2058	3.8947**
Δ GE	0.4501	0.1016	4.4316***
$U_1(-1)$	-0.3782	0.1685	-3.7710**
C	0.0050	0.0041	1.2123

Moreover, the Granger causality test is employed for investigating the bilateral or unidirectional causal links between the variables. Calculations are tabulated in Table 5. Overall calculations indicate that there are no bilateral causal links between the tested macroeconomic variables for Cyprus. On the other hand, empirical results show that unidirectional causality exists between growth, inflation and money supply running from GDP to CPI and M2. Furthermore, public spending emerges as a key variable for the economy of Cyprus; the results imply that GE granger-causes economic growth, M2 and CPI. Finally, the relationship between CPI and M2 is also unidirectional running from money supply to inflation.

Table 5: Granger Causality Test Results

	F - Statistics			
Null Hypothesis	**Lag 1**	**Lag 2**	**Lag 3**	**Lag 4**
CPI does not Granger-cause GDP	2.1411	1.5695	1.2454	0.5590
GDP does not Granger-cause CPI	12.2253***	4.9542**	3.4174**	3.5421**
GE do not Granger-cause GDP	4.8185**	3.8478**	3.7508**	2.6104*
GDP does not Granger-cause GE	0.8092	0.6533	0.5208	0.4636
M2 do not Granger-cause GDP	0.0782	0.0137	0.7424	1.2958
GDP does not Granger-cause M2	4.6223**	3.4381**	2.7663*	1.7606
GE does not Granger-cause CPI	5.6122***	3.6609**	1.9476	1.5064
CPI does not Granger-cause GE	0.1533	0.2835	0.8847	0.7265
M2 do not Granger-cause CPI	11.1312***	5.6812***	5.5982***	5.2208***
CPI does not Granger-cause M2	0.2393	0.9292	1.5429	1.2375
M2 do not Granger-cause GE	1.4246	0.7879	0.7111	0.4623
GE does not Granger-cause M2	3.9914**	3.6842**	3.4084**	3.3330**

5. Concluding Remarks and Policy Implications

The central objective of this study is to investigate the relationship between four key macroeconomic variables (i.e. money supply, inflation, government expenditures and economic growth) for a developed economy, Cyprus.

The survey is of particular interest considering the impact of the global financial crisis on the economy of Cyprus. After more than two decades of rapid economic growth and significant improvements in its citizens' standard of living, Cyprus entered recession mostly due to the country's exposure to the European sovereign debt crisis. The economic achievements of Cyprus during the preceding decades have been impressive, bearing in mind the severe economic and social dislocation created by the Turkish invasion of 1974 and the continuing occupation of the northern part of the island by Turkey. The success of Cyprus in the economic sphere has been attributed to the adoption of a market-oriented economic system, the pursuance of sound macroeconomic policies by the government as well as the existence of a dynamic and flexible entrepreneurship and a highly educated labor force. Moreover, the economy benefited from the close cooperation between the public and private sectors. However, in recent times, concerns have been raised about the state of public finances and spiraling borrowing costs demanding radical economic transformations in order for Cyprus to maintain economic prosperity.

In this spirit, this study supports that investigating empirically the interdependence of dominant macroeconomic variables, such as inflation, liquidity, public spending and economic growth can provide useful information with important economic implications. As presented in Section 3, this paper employs the Error Correction Mechanism (ECM) to determine the short run relationship between the variables while Johansen co-integration test is used to find out long run associations. Moreover, Granger causality test indicates the direction of causality. The empirical results presented and analyzed econometrically in Section 4 robustly indicate that co-integration relationships exist between the tested variables.

In conclusion, the impact of monetary and fiscal policies is significant in Cyprus. Increase in public spending by deficit financing effects positively the real output. These results show that during the tested period, the government of Cyprus has succeeded in promoting economic growth through government expenditures. However, deficit financing in the case of Cyprus could cause liquidity effects and inflationary pressure in the economy. Government should closely monitor inflation rates. Moreover, the economy can benefit greatly in terms of real output as money supply grows, since M2 positively affects real GDP. However, excess money supply could also lead to inflationary pressure. Government should control its current expenditure which stimulates aggregate demand and focus more on development expenditure which stimulates aggregate supply and increase real output level.

Finally, it is important to highlight that our results may be sensitive to the choice of sample period, selection of variables and methodology adopted. This also indicates the sensitivity of Granger causality and that is why results based on Granger causality should be interpreted with care. Results may also suffer from the omission of other relevant variables. Hence, future research may include more relevant variables, such as government expenditure components (i.e. military expenditures, health expenditures, expenditures for education etc.), employment/unemployment data, real interest rates, tax revenues or poverty (e.g. Gini index), in order to further improve this survey's findings.

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Short-Term Stock Price Reversals May Be Reversed

Andrey Kudryavtsev[1]

Abstract

In present study, I explore intraday behavior of stock prices. In particular, I try to shed light on the dynamics of stock price reversals and namely, on the short-term character the latter may possess. For each of the stocks currently making up the Dow Jones Industrial Index, I calculate intraday upside and downside volatility measures, following Becker et al. (2008) and Klossner et al. (2012), as a proxy for reversed overreactions to good and bad news, respectively. I document that for all the stocks in the sample, mean daily returns following the days when a stock's upside volatility measure was higher or equal to its downside volatility measure are higher than following the days when the opposite relationship held, indicating that stock prices display a short-run 'reversals of reversals' behavior following corrected, or reversed, overreactions to news. Furthermore, I construct seven different portfolios built upon the idea of daily adjusting a long position in the stocks that according to 'reversals of reversals' behavior are expected to yield high daily returns, and a short position in the stocks, whose daily returns are expected to be low. All the portfolios yield significantly positive returns, providing an evidence for the practical applicability of the 'reversals of reversals' pattern in stock prices.

Keywords: Intraday Stock Prices, Intraday Volatility, Overreaction, Stock Price Reversals, Reactions to News

JEL Classifications: G11, G14, G19

1. Introduction

In the last few decades, an increasing number of papers have investigated stock market anomalies, reporting strong evidence that daily stock returns show empirical regularities that are difficult to explain using standard asset pricing theories. The main bottom line of these studies suggests that the use of historical data could be of some help for predicting future returns, with obvious implications for the efficiency of equity markets.

In this context, one of the most widely-discussed phenomena is based on the concept of overreaction. Since the pioneering papers by Shiller (1984) and De Bondt and Thaler

[1] Economics and Management Department, The Max Stern Yezreel Valley Academic College, Emek Yezreel 19300, Israel, andreyk@yvc.ac.il, Phone: (972) 54-564-5735.

(1985) a large volume of theoretical and empirical research work has analyzed price overreaction in financial markets reflecting market inefficiency. Typically, the literature closely links price overreaction to forecastability of stock prices and the prospect for investors to earn above-average returns. In order to distinguish stock price overreaction and market inefficiency from predictable changes in expected returns, Lehman (1990) suggests examining returns over short time intervals. In fact, the focus on long-term dynamics in stock returns in the papers by Shiller (1984) and De Bondt and Thaler (1985) is more recently realigned to short-run return behavior, ranging over time periods from a few days up to a month, in the major part of the subsequent literature (e.g., Zarowin, 1989; Atkins and Dyl, 1990; Cox and Peterson, 1994; Park, 1995; Bowman and Iverson, 1998; Nam et al., 2001). The major focus of these studies is on identifying potentially profitable contrarian strategies built on a reverting behavior of stock prices in the short run. For example, Lehmann (1990) and Jegadeesh (1990) show that contrarian strategies that exploit the short-term return reversals in individual stocks generate abnormal returns of about 1.7% per week and 2.5% per month, respectively. Remarkably, Conrad et al. (1994) document that reversal profitability increases with trading activity.

One of the potential means of measuring the degree of intraday stock price overreaction is by employing the daily high and low prices. Since the seminal study by Parkinson (1980), daily highs and lows are widely agreed to contain useful information on return volatility. Parkinson (1980) shows, for example, that the daily price range, given by the difference of the high and the low prices, is a more efficient volatility estimator than the variance estimator based on close-to-close return data. Brandt and Diebold (2006) emphasize that using daily open, close, high, and low prices, instead of ultra-high frequency returns, has the advantage that these data not only are widely available, in many cases over long historical spans, but also yield results being fairly robust against micro-market structure noise arising from bid-ask spread and asynchronous trading. Cheung (2007) argues that the high and the low correspond to the prices at which the excess demand is changing its direction - the information that is not reflected by data on closing prices.

The main goal of the present study is to shed a little more light on the dynamics of stock price reversals and namely, on the short-term character the latter may possess. I employ the intraday upside and downside volatility measures proposed by Becker et al. (2008) and Klossner et al. (2012) as a proxy for intraday overreaction to good and bad news, respectively. These measures are built upon the idea of stock price moves that are corrected, or reversed, on the very same trading day, indicating, thus, stock price overreaction to news during that specific day. The main hypothesis of my research is that these price reversals taking place towards the end of the trading day will, by themselves, be overhit and therefore, reverted during the next trading day. In other words, I expect that if today, a significant stock price move occurs and is reversed, than on the next trading day, the stock price will continue to drift in the direction of the initial today's move, that is, against the direction of today's reversal. I test this hypothesis against the opposite one, suggesting that stock prices may continue to move in the direction of the reversal.

I analyze intraday price data on thirty stocks currently making up the Dow Jones

Industrial Index, and find supporting evidence for my research hypothesis. For each trading day, I compare each stock's measures of upside and downside volatility, and also compare them with the respective measures for the previous trading day, as well as with the same day's average and median measures for the total sample of stocks, and document that daily stock returns tend to be higher following the days with relatively high corrected overreactions to good news, and lower following the days with relatively high corrected overreactions to bad news. Based on this result, I construct a number of daily-adjusted portfolios involving a long position in the stocks on the days when, according to the result, their returns are expected to be high and a short position in the stocks on the days when, according to the result, their returns are expected to be low, and demonstrate that the returns on these portfolios are significantly positive. I conclude that stock prices tend to exhibit a 'reversals of reversals' behavior.

My findings amplify the results documented in the previous literature with respect to the profit potential embedded in the short-term stock price reversals. While previous studies, in general, show that (i) considerable long-term price changes may be, in fact, too strong, creating a possibility to yield consistently significant returns by following the contrarian strategy (e.g., Shiller, 1984; De Bondt and Thaler, 1985), and (ii) short-term stock price reactions to news may be also too strong, leading to subsequent short-term price reversals (e.g., Lehmann, 1990; Jegadeesh, 1990; Conrad et al., 1994), I make an effort to 'move one step forward' and show that intraday (extremely short-term) price *reversals are, by themselves, too strong*. In other words, if within a trading day, as a result of some news, there is a relatively strong stock price move followed by a reversal, then one may generally expect that the total daily stock return does not sufficiently reflect the underlying news, and the effect of this news will continue on the next trading day.

The rest of the paper is structured as follows: In Section 2, I describe the data sample. Section 3 comprises the research hypotheses and the results. Section 4 concludes.

2. Data description

For the purposes of present research, I employ daily opening, high, low, and closing prices of thirty stocks currently making up the Dow Jones Industrial Index over the period comprised from January 2, 2002 to September 30, 2011 (overall, 2456 trading days)[1]. I adjust all the prices to dividend payments and stock splits, and for each stock in the sample and for each trading day in the sampling period, calculate:

1. Stock's open-to-high price difference, as:

$$R_{OH,it} = \frac{P_{H,it}}{P_{O,it}} - 1 \tag{1}$$

where: $R_{OH,it}$ is stock i's open-to-high price difference on day t; $P_{H,it}$ is stock i's highest price on day t; and $P_{O,it}$ is stock i's opening price on day t.

[1] The data were taken from the Yahoo Finance website.

2. Stock's open-to-low price difference, as:

$$R_{OL,it} = \frac{P_{O,it}}{P_{L,it}} - 1 \tag{2}$$

where: $R_{OL,it}$ is stock *i*'s open-to-low price difference on day *t*; and $P_{L,it}$ is stock *i*'s lowest price on day *t*.

3. Stock's high-to-close price difference, as:

$$R_{HC,it} = \frac{P_{H,it}}{P_{C,it}} - 1 \tag{3}$$

where: $R_{HC,it}$ is stock *i*'s high-to-close price difference on day *t*; and $P_{C,\,it}$ is stock *i*'s closing price on day *t*.

4. Stock's low-to-close price difference, as:

$$R_{LC,it} = \frac{P_{C,it}}{P_{L,it}} - 1 \tag{4}$$

where: $R_{LC,it}$ is stock *i*'s low-to-close price difference on day *t*.

5. Stock's daily (close-to-close) return, as:

$$R_{D,it} = \frac{P_{C,it}}{P_{C,it-1}} - 1 \tag{5}$$

where: $R_{D,it}$ is stock *i*'s daily return on day *t*.

Of course, since the following relations between the intraday prices hold:

$$P_{H,it} \geq P_{O,it}\,; \qquad P_{H,it} \geq P_{C,it}\,; \qquad P_{L,it} \leq P_{O,it}\,; \qquad P_{L,it} \leq P_{C,it} \tag{5}$$

the first four price differences are defined so that they are non-negative, representing the absolute values of the respective price changes.

Table 1 comprises the basic descriptive statistics of the intraday price differences and returns for the thirty sample stocks. At this stage, we may note that, as it might be expected for the largest industrial companies of the US, 27 out of 30 stocks have positive mean daily returns, the remaining 3 showing negative, yet close to zero daily returns. Overall, the mean daily returns range from -0.005 to 0.076 percentage points, with standard deviations ranging from 1.183 to 3.568 percentage points. The four intraday mean price differences are highly correlated in the cross-section, that is, all of them are relatively high for certain stocks and relatively low for other ones. One more thing to note is that for 22 out of 30 stocks, the mean open-to-low differences are greater than the mean open-to-high differences, and for 23 out of 30 stocks, the mean low-to-close differences are greater than the mean high-to-close differences. This is an indication for the higher downside intraday price volatility to be defined in the next Subsection.

3. Research hypotheses and Results

3.1 Upside and downside volatility measures

In order to obtain a proxy for intraday stock price overreactions, I use separate measures of intraday upside and downside volatility. These measures capture the deviation of daily high and low prices from the starting and the end points of the intraday price movement. This one-sided concept, which allows distinguishing between upward and downward overreaction, has the advantage to potentially detect asymmetric return behavior.

Following Becker et al. (2008) and Klossner et al. (2012), for each stock *i* and for each trading day *t*, I define daily measures of intraday upside and downside price volatility by:

$$UV_{it} = R_{OH,it} * 100 * R_{HC,it} * 100 \tag{6}$$

$$DV_{it} = R_{OL,it} * 100 * R_{LC,it} * 100 \qquad (7)^{2}$$

where: UV_{it} represents the upside volatility measure for stock *i* on day *t*; and DV_{it} represents the downside volatility measure for stock *i* on day *t*.

Both UV_{it} and DV_{it} are nonnegative and can be considered as measuring the distance of daily extreme prices from opening and closing prices. Intraday overreactions to good news are characterized by a price increase which is corrected the very same day, thereby causing UV_{it} to be rather large, as the highest price on that day will be significantly above both opening and closing price. In an analogous way, DV_{it} is an indicator of high-frequency overreactions to bad news.

Table 2 presents the descriptive statistics of the intraday volatility measures. For 28 out of 30 stocks, the mean downside measures are larger than the mean upside measures. This result is in line with the findings by Becker et al. (2008) and Klossner et al. (2012), who argue that during the same trading day, stock prices overreact to bad news significantly stronger than they do to good news.

3.2 Upside and downside volatility, and the market efficiency

The concept of stock price reversals is well-documented and widely-discussed in financial literature. Many studies show that stock prices often overreact to news and subsequently revert themselves in order to arrive at some 'fair' reaction. In this study, I make an effort to 'move one step forward' and ask the following question: 'Are the short-run stock price reversals too strong (especially, in the light of the fact that today's investors are well aware of the concept of reversals and, expecting the latter to take place, may substantially increase their magnitude) or may the short-run stock price reversals actually be insufficient? To put it simply, I suggest that if today a significant stock price move

[2] Multiplying twice by 100 is made as a normalization, in order to express the up- and downside volatility measures in percentage points.

occurs and is corrected, or in other words, reversed, then tomorrow there may be either a 'reversal of the reversal', leading to the price drift in the direction of today's initial move, or a 'continuation of reversal', leading to the price drift in the direction of today's reversal. Therefore, I hypothesize that:

Hypothesis 1a: Daily stock price returns should be higher following the days of substantial corrected overreactions to good news.

against: Daily stock price returns should be lower following the days of substantial corrected overreactions to good news.

Hypothesis 1b: Daily stock price returns should be lower following the days of substantial corrected overreactions to bad news.

against: Daily stock price returns should be higher following the days of substantial corrected overreactions to bad news.

As mentioned in the previous Subsection, intraday upside and downside volatility measures may serve as a proxy for corrected overreactions to good and bad news, respectively. Therefore, as a first step in testing the Hypotheses, for each stock in the sample, I compare the mean daily returns following the days when the stock's upside volatility measure was higher or equal to its downside volatility measure, that is, for the days when $UV_{it-1} \geq DV_{it-1}$ holds[3], with the mean daily returns following the days when the stock's downside volatility measure was higher or equal to its upside volatility measure, that is, for the days when $UV_{it-1} < DV_{it-1}$ holds[4].

Table 3 reports the results that strongly support the first versions of the hypotheses. For *all* the sample stocks, mean daily returns are higher if during the previous trading day, corrected overreactions to good news, as expressed by higher UV_{it-1} measures, prevailed. 25 out of 30 respective mean return differences are statistically significant, including 21 at the 5% level, and 14 at the 1% level. Moreover, for *all* the sample stocks, mean daily returns are positive if during the previous trading day, their intraday upside volatility exceeded their intraday downside volatility, and for 28 out of 30 stocks, mean daily returns are negative if during the previous trading day, their intraday downside volatility exceeded their intraday upside volatility. Thus, the results clearly demonstrate that stock prices display a short-term reverting behavior following corrected overreactions to news. Such behavior may be called 'reversals of reversals', and seems to contradict the market efficiency.

3.3 Portfolios based on 'reversals of the reversals' stock price behavior

In the previous Subsection, we have seen that stock *i*'s return on day-*t* tends to be higher if $UV_{it-1} \geq DV_{it-1}$ holds, then if $UV_{it-1} < DV_{it-1}$ holds. This evidence suggests that Hypotheses 1a and 1b, in the first versions, jointly hold. Now, I proceed to separately testing the Hypotheses. I do that by constructing a number of portfolios, approach that in

[3] Indicating the prevalence of corrected overreactions to good news during the previous trading day.

[4] Indicating the prevalence of corrected overreactions to bad news during the previous trading day.

addition to testing the Hypotheses, allows me to consider a number of potentially profitable investment strategies. All the portfolios are built of the sample stocks and upon the idea of holding and daily adjusting a long position in the stocks that according to 'reversals of reversals' pattern are expected to yield high daily returns[5], and a short position in the stocks that according to 'reversals of reversals' pattern are expected to yield low daily returns[6]. The portfolio adjustment transactions are supposed to be performed at the end of each trading day. The total values of the long and the short positions are supposed to be equal, that is, the total market value of each portfolio at the end of each trading day, after the daily adjustment, is supposed to be zero.[7]

a) Portfolios based on upside volatility measures:

Portfolio UP ('Upside volatility - Previous day's upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then their upside volatility measures for the previous trading day, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

Portfolio UA ('Upside volatility - Average upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then today's average upside volatility measure for the sample stocks, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

Portfolio UM ('Upside volatility - Median upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then today's median upside volatility measure for the sample stocks, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

The idea of these three portfolios is based on employing the first version of Hypothesis 1a. That is, an investor is supposed to hold, and continuously adjust, an equally-weighted long position in the stocks whose previous day's upside volatility measures were relatively high, and an equally-weighted short position in the stocks whose previous day's upside volatility measures were relatively low. The portfolios do not suggest any initial investment, since the total values of the long and the short positions are equal.

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[5] Stocks that on previous trading day experienced relatively high corrected overreactions to good news and/or relatively low corrected overreactions to bad news.

[6] Stocks that on previous trading day experienced relatively low corrected overreactions to good news and/or relatively high corrected overreactions to bad news.

[7] In constructing the portfolios, I assume that all the portfolio adjusting transactions are performed at the closing prices based on the intraday up- and downside volatility measures that are readily available. Of course, at the time of the transactions, the closing stock prices, and respectively, the intraday volatility measures, are yet not exactly known. But I suggest that if the portfolio adjusting transactions are performed sufficiently close to the market closing time, then the volatility measures available and the transaction prices should be sufficiently close to those based on the actual closing prices.

b) Portfolios based on downside volatility measures:

Portfolio DP ('Downside volatility - Previous day's downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then their downside volatility measures for the previous trading day, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

Portfolio DA ('Downside volatility - Average downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then today's average downside volatility measures for the sample stocks, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

Portfolio DM ('Downside volatility - Median downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then today's median downside volatility measures for the sample stocks, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

The idea of these three portfolios is based on employing the first version of Hypothesis 1b. That is, an investor is supposed to hold, and continuously adjust, an equally-weighted short position in the stocks whose previous day's downside volatility measures were relatively high, and an equally-weighted long position in the stocks whose previous day's downside volatility measures were relatively low. Once again, the portfolios do not suggest any initial investment, since the total values of the long and the short positions are equal.

c) Portfolio based on the comparison of upside and downside volatility measures:

Portfolio U-D ('Upside volatility – Downside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater or equal to their today's downside volatility measures, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

The idea of this portfolio is based on jointly employing the first versions of Hypotheses 1a and 1b. That is, an investor is supposed to hold, and continuously adjust, an equally-weighted long position in the stocks whose previous day's upside volatility measures were higher than the respective downside ones, and an equally-weighted long position in the stocks whose previous day's upside volatility measures were lower than the respective downside ones. This portfolio too, does not suggest any initial investment, since the total values of the long and the short positions are equal.

According to the definitions, the portfolios in paragraphs (a) and (b) refer to testing Hypotheses 1a and 1b, respectively, while the portfolio in paragraph (c) tests for the joint effect of both tendencies, the issue presented and discussed in Table 3 in the previous Subsection.

Table 4a concentrates the daily performance measures over the sampling period for all the seven portfolios. Strikingly, all the portfolios yield significantly positive mean daily returns. These results, first of all, provide a strong support for both research hypotheses, even when these are separately tested. That is, daily stock returns are significantly higher following the days of the relatively high (with respect to the previous day or to the sample's daily average or median) corrected overreactions to good news and also following the days of the relatively low corrected overreactions to bad news. Moreover, from the practical point of view, at least if the trading commissions are not a problem, the seven portfolios represent potentially profitable investment strategies. The mean returns of about 0.1 percentage point may, at the first glance, seem not quite impressive, but since we are talking about daily returns, the mean annual return of about 34% on Portfolio U-D, for example, looks promising (recall that the portfolios do not request any initial investments and yield *significantly* positive returns).

Finally, as a robustness check, I apply a slightly different approach to calculating the upside and the downside volatility measures, normalizing them by the variance of the respective stocks' returns. That is, I recalculate the intraday volatility measures as follows:

$$UV\_Adj_{it} = \frac{R_{OH,it} * 100 * R_{HC,it} * 100}{\sigma_i^2} \tag{8}$$

$$DV\_Adj_{it} = \frac{R_{OL,it} * 100 * R_{LC,it} * 100}{\sigma_i^2} \tag{9}$$

where: UV_Adj_{it} represents the adjusted upside volatility measure for stock *i* on day *t*; DV_Adj_{it} represents the adjusted downside volatility measure for stock *i* on day *t*; and σ_i^2 is stock *i*'s daily return variance over the sampling period.

Respectively, I reconstruct the seven portfolios, as described above, based on the adjusted intraday volatility measures. Table 4b reports the portfolios' performance measures. First of all, it should be noted that the results for the portfolios UP, DP and U-D remain unchanged, since the normalization of the volatility measures by stock returns' variance does not affect the relationship either between the same stock's upside and downside volatility measures for the same trading day or between the same stock's upside or downside volatility measures for the two consecutive trading days. The results for the portfolios UA, UM, DA and DM slightly differ from those presented in Table 4a, providing even a little stronger evidence of significantly positive daily portfolio returns.

Overall, the results in this Section strongly support the intuition that stock price reversals may be overhit. Investment strategies built upon the expectation of 'reversals of reversals' may, therefore, possess a non-negligible potential.

4. Conclusion

This paper explores intraday behavior of stock prices. In particular, I try to shed light on the dynamics of stock price reversals and namely, on the short-term character the latter may possess. As a proxy for overreactions to good and bad news, I employ intraday upside and downside volatility measures, respectively, which are built upon the idea of stock price moves that are corrected, or reversed, on the very same trading day, indicating, thus, stock price overreaction to news during that specific day. I expect that these price reversals taking place towards the end of the trading day will, by themselves, be overhit and therefore, reversed during the next trading day, that is, if today, a significant stock price move occurs and is reversed, then on the next trading day, the stock price will continue to drift in the direction of the initial today's move and against the direction of today's reversal. I test this hypothesis against the opposite one, suggesting that stock prices may continue to move in the direction of the reversal.

I employ daily opening, high, low, and closing prices of thirty stocks currently making up the Dow Jones Industrial Index, and find supporting evidence for my research hypothesis. First of all, I document that for *all* the stocks in the sample, mean daily returns following the days when a stock's upside volatility measure was higher or equal to its downside volatility measure are higher than following the days when the opposite relationship held. Moreover, for *all* the stocks, mean daily returns are positive if during the previous trading day, their intraday upside volatility exceeded their intraday downside volatility, and for all the stocks but two, mean daily returns are negative if during the previous trading day, their intraday downside volatility exceeded their intraday upside volatility. These findings clearly demonstrate that stock prices display a short-run reverting behavior following corrected overreactions to news. Such 'reversals of reversals' behavior seems to contradict the market efficiency.

Furthermore, I test if on the basis of these findings it is possible to define potentially profitable investment strategies. I compare each stock's volatility measures to their previous trading day's measures, as well as to today's average and median measures for the total sample of stocks, in order to obtain a proxy for substantial intraday corrected overreactions to news. Based on these comparisons, I construct seven different portfolios built upon the idea of daily adjusting a long position in the stocks that according to 'reversals of reversals' behavior are expected to yield high daily returns, and a short position in the stocks, whose daily returns are expected to be low. All the portfolios are found to yield significantly positive returns, providing an evidence for the practical applicability of the 'reversals of reversals' pattern in stock prices.

Overall, my findings amplify the results documented in the previous literature with respect to the profit potential embedded in the short-term stock price reversals. Lehmann (1990), Jegadeesh (1990) and Conrad et al. (1994) analyze stock price reactions to news and conclude that these are usually too strong (overreaction), and therefore, short-term price reversals may be generally expected. In this study, I make an effort to 'move one step forward' and show that intraday (extremely short-term) price reversals are, by themselves, too strong. In other words, if within a trading day, as a result of some news, there is a relatively strong stock price move followed by a reversal, then one may generally expect that the total daily stock return does not sufficiently reflect the underlying news, and the effect of this news will continue on the next trading day. Thus, not only are the stock price reactions to different kinds of news too strong, as shown by the previous literature, but the subsequent reversals (inspired partially by the results shown in the literature?) are probably exaggerated.

To summarize, at least in a perfect stock market with no commissions, the daily-adjusted strategies based on the expectations of the ‘reversals of reversals’ look promising. This may prove a valuable result for both financial theoreticians in their eternal discussion about stock market efficiency, and practitioners in search of potentially profitable investment strategies. Potential directions for further research may include expending the analysis to other stock exchanges and greater samples, though in the latter case some care has to be taken when defining the benchmarks for high and low volatility measures and also applying similar kind of analysis to longer time intervals.

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Appendix: Tables

The table presents for each of the 30 sample stocks and over the sampling period, the mean intraday price differences, as well as the mean and the standard deviation of daily stock returns, calculated as follows:

$$R_{OH,it} = \frac{P_{H,it}}{P_{O,it}} - 1;\ R_{OL,it} = \frac{P_{O,it}}{P_{L,it}} - 1;\ R_{HC,it} = \frac{P_{H,it}}{P_{C,it}} - 1;\ R_{LC,it} = \frac{P_{C,it}}{P_{L,it}} - 1;\ R_{D,it} = \frac{P_{C,it}}{P_{C,it-1}} - 1$$

where: *R* and *P* denote the difference/return and the price, respectively; capital indexes *O*, *C*, *H*, and *L* stand for Opening, Close, High, and Low, respectively; and small indexes *i* and *t* refer to stock and time, respectively.

Table 1: Descriptive statistics of sample stocks' intraday price differences and daily returns

Company (Ticker symbol)	Mean intraday price differences, %				Daily return, %	
	Open-to-high ($R_{OH,it}$)	Open-to-low ($R_{OL,it}$)	High-to-close ($R_{HC,it}$)	Low-to-close ($R_{LC,it}$)	Mean	St. Deviation
Alcoa Inc. (AA)	1.496	1.852	1.695	1.653	-0.004	2.884
American Express (AXP)	1.436	1.470	1.400	1.508	0.054	2.621
Boeing (BA)	1.224	1.304	1.225	1.303	0.047	1.979
Bank of America (BAC)	1.437	1.612	1.582	1.469	0.010	3.568
Caterpillar (CAT)	1.290	1.436	1.317	1.408	0.076	2.189
Cisco Systems (CSCO)	1.427	1.400	1.453	1.374	0.019	2.365
Chevron Corporation (CVX)	1.053	1.092	1.039	1.107	0.058	1.762
E.I. Du Pont de Nemours (DD)	1.149	1.233	1.172	1.209	0.029	1.867
Walt Disney (DIS)	1.237	1.247	1.163	1.320	0.038	2.020
General Electric (GE)	1.118	1.342	1.226	1.234	-0.005	2.120
Home Depot Inc. (HD)	1.312	1.330	1.315	1.326	0.011	2.020
Hewlett-Packard (HPQ)	1.438	1.291	1.303	1.423	0.031	2.225
IBM (IBM)	1.029	0.914	0.943	1.001	0.033	1.597
Intel Corporation (INTC)	1.391	1.427	1.430	1.389	0.017	2.338
Johnson & Johnson (JNJ)	0.782	0.784	0.771	0.794	0.021	1.225
JP Morgan Chase & Co (JPM)	1.484	1.593	1.513	1.566	0.047	2.936
Kraft Foods Inc. (KFT)	0.941	0.937	0.903	0.978	0.020	1.393
Coca-Cola (KO)	0.845	0.842	0.808	0.878	0.033	1.304
McDonald's Corporation (MCD)	1.059	1.016	1.003	1.072	0.071	1.566
3M Company (MMM)	0.941	0.983	0.937	1.986	0.029	1.512
Merck & Company Inc. (MRK)	1.174	1.182	1.151	1.204	0.012	1.919
Microsoft Corporation (MSFT)	1.132	1.109	1.147	1.095	0.015	1.889
Pfizer Inc. (PFE)	1.053	1.156	1.120	1.088	-0.004	1.693
Procter & Gamble (PG)	0.818	0.794	0.744	0.867	0.035	1.183
AT&T Inc. (T)	1.130	1.221	1.172	1.178	0.022	1.753
The Travelers Companies (TRV)	1.218	1.272	1.241	1.250	0.037	2.088
United Technologies Corp. (UTX)	1.023	1.098	1.022	1.099	0.054	1.708
Verizon Communications (VZ)	1.044	1.169	1.065	1.147	0.023	1.681
Wal-Mart Stores Inc. (WMT)	0.936	0.948	0.950	0.934	0.011	1.391
Exxon Mobil Corporation (XOM)	1.031	1.033	0.989	1.075	0.048	1.710

The table presents for each of the 30 sample stocks and over the sampling period, the mean and the standard deviation of the upside (UV_{it}) and the downside (DV_{it}) volatility measures calculated as follows:

$$UV_{it} = R_{OH,it} * 100 * R_{HC,it} * 100; \; DV_{it} = R_{OL,it} * 100 * R_{LC,it} * 100$$

where: $R_{OH,it}$ is stock *i*'s open-to-high price difference on day *t*; $R_{OL,it}$ is stock *i*'s open-to-low price difference on day *t*; $R_{HC,it}$ is stock *i*'s high-to-close price difference on day *t*; and $R_{LC,it}$ is stock *i*'s low-to-close price difference on day *t*.

Table 2: Descriptive statistics of upside and downside volatility measures

Company (Ticker symbol)	Upside volatility (UV_{it}), %		Downside volatility (DV_{it}), %	
	Mean	Standard Deviation	Mean	Standard Deviation
Alcoa Inc. (AA)	2.607	7.831	3.546	9.797
American Express (AXP)	2.405	7.245	3.103	9.739
Boeing (BA)	1.438	3.160	1.840	5.242
Bank of America (BAC)	3.351	8.715	4.668	10.457
Caterpillar (CAT)	1.695	4.282	2.197	6.518
Cisco Systems (CSCO)	2.148	5.474	2.015	5.123
Chevron Corporation (CVX)	1.129	3.424	1.379	4.994
E.I. Du Pont de Nemours (DD)	1.396	4.076	1.593	4.166
Walt Disney (DIS)	1.461	3.413	1.906	5.146
General Electric (GE)	1.581	4.702	2.453	10.730
Home Depot Inc. (HD)	1.848	4.479	1.989	5.804
Hewlett-Packard (HPQ)	2.048	6.382	2.169	8.310
IBM (IBM)	1.021	2.545	1.055	3.161
Intel Corporation (INTC)	1.901	3.640	1.905	4.153
Johnson & Johnson (JNJ)	0.658	1.697	0.758	2.540
JP Morgan Chase & Co (JPM)	2.594	7.446	3.260	10.133
Kraft Foods Inc. (KFT)	0.867	2.042	0.999	2.867
Coca-Cola (KO)	0.707	1.929	0.811	2.311
McDonald's Corporation (MCD)	1.108	3.321	1.225	4.152
3M Company (MMM)	0.873	2.187	1.232	10.354
Merck & Company Inc. (MRK)	1.500	4.148	1.742	7.227
Microsoft Corporation (MSFT)	1.316	3.052	1.321	4.403
Pfizer Inc. (PFE)	1.251	4.771	1.475	6.172
Procter & Gamble (PG)	0.637	1.759	2.151	11.673
AT&T Inc. (T)	1.525	4.204	1.692	4.268
The Travelers Companies (TRV)	2.135	8.798	2.007	10.555
United Technologies Corp. (UTX)	1.007	2.654	1.324	4.094
Verizon Communications (VZ)	1.192	3.345	1.524	3.667
Wal-Mart Stores Inc. (WMT)	0.900	2.139	1.028	3.772
Exxon Mobil Corporation (XOM)	1.031	2.672	1.250	5.075

The table presents for each stock i and over the sampling period, the mean daily returns ($R_{D,it}$) following the days when the stock's upside volatility measure was higher or equal to its downside volatility measure ($UV_{it-1} \geq DV_{it-1}$), and following the days when the stock's upside volatility measure was lower than its downside volatility measure ($UV_{it-1} < DV_{it-1}$), and the number of days in each category.

The rightmost column of the table reports the differences between the respective mean daily returns, and their statistical significance.

Table 3: Daily stock returns following the days with prevailing corrected overreactions to good and bad news

Company (Ticker symbol)	Mean daily returns ($R_{D,it}$), %, for the days when:		
	$UV_{it-1} \geq DV_{it-1}$ (No. of days)	$UV_{it-1} < DV_{it-1}$ (No. of days)	Difference (t-statistic)
Alcoa Inc. (AA)	0.085 (1118)	-0.079 (1336)	0.164 (1.40)
American Express (AXP)	0.268 (1162)	-0.139 (1292)	***0.407 (3.85)
Boeing (BA)	0.139 (1137)	-0.034 (1317)	**0.173 (2.15)
Bank of America (BAC)	0.080 (1254)	-0.063 (1200)	0.143 (1.00)
Caterpillar (CAT)	0.161 (1113)	0.005 (1341)	*0.156 (1.75)
Cisco Systems (CSCO)	0.219 (1277)	-0.204 (1177)	***0.423 (4.45)
Chevron Corporation (CVX)	0.162 (1144)	-0.032 (1310)	***0.194 (2.72)
E.I. Du Pont de Nemours (DD)	0.131 (1141)	-0.062 (1313)	**0.193 (2.56)
Walt Disney (DIS)	0.123 (1131)	-0.037 (1323)	*0.160 (1.95)
General Electric (GE)	0.096 (1113)	-0.088 (1341)	**0.184 (2.14)
Home Depot Inc. (HD)	0.113 (1213)	-0.088 (1241)	**0.201 (2.46)
Hewlett-Packard (HPQ)	0.185 (1271)	-0.139 (1183)	***0.324 (3.62)
IBM (IBM)	0.167 (1325)	-0.126 (1129)	***0.303 (4.55)
Intel Corporation (INTC)	0.248 (1202)	-0.210 (1252)	***0.458 (4.88)
Johnson & Johnson (JNJ)	0.078 (1241)	-0.038 (1213)	**0.116 (2.36)
JP Morgan Chase & Co (JPM)	0.126 (1153)	-0.026 (1301)	0.152 (1.28)
Kraft Foods Inc. (KFT)	0.045 (1179)	-0.001 (1275)	0.046 (0.83)
Coca-Cola (KO)	0.155 (1133)	-0.070 (1321)	***0.225 (4.28)
McDonald's Corporation (MCD)	0.158 (1209)	-0.015 (1245)	***0.173 (2.73)
3M Company (MMM)	0.117 (1181)	-0.052 (1273)	***0.169 (2.76)
Merck & Company Inc. (MRK)	0.086 (1188)	-0.056 (1266)	*0.142 (1.84)
Microsoft Corporation (MSFT)	0.139 (1284)	-0.123 (1170)	***0.262 (3.44)
Pfizer Inc. (PFE)	0.186 (1180)	-0.180 (1274)	***0.366 (5.39)
Procter & Gamble (PG)	0.078 (1210)	-0.006 (1244)	*0.084 (1.75)
AT&T Inc. (T)	0.151 (1126)	-0.088 (1328)	***0.239 (3.38)
The Travelers Companies (TRV)	0.138 (1161)	-0.054 (1293)	**0.192 (2.26)
United Technologies Corp. (UTX)	0.112 (1141)	0.002 (1313)	0.110 (1.59)
Verizon Communications (VZ)	0.172 (1075)	-0.095 (1379)	***0.267 (3.92)
Wal-Mart Stores Inc. (WMT)	0.093 (1269)	-0.076 (1185)	***0.169 (3.01)
Exxon Mobil Corporation (XOM)	0.139 (1171)	-0.035 (1283)	**0.174 (2.52)

Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 4a: Historical performance measures of the portfolios based on the 'reversals of reversals' stock price behavior (based on 'unadjusted' intraday volatility measures)

Daily-adjusted portfolios	Daily portfolio performance measures over the sampling period (2456 days)		
	Mean, %	Standard Deviation, %	t-statistic (Mean=0)
Portfolio UP	0.039	0.815	**2.35
Portfolio UA	0.102	1.122	***4.49
Portfolio UM	0.082	0.720	***5.65
Portfolio DP	0.080	0.892	***4.47
Portfolio DA	0.072	1.141	***3.13
Portfolio DM	0.067	0.743	***4.47
Portfolio U-D	0.116	1.069	***5.36

Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

The table presents the means and the standard deviations of daily returns over the sampling period (January 2, 2002 to September 30, 2011) for 7 portfolios implying daily adjustments based on intraday stock volatility measures:

Portfolio UP ('Upside volatility - Previous day's upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then their upside volatility measures for the previous trading day, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

Portfolio UA ('Upside volatility - Average upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then today's average upside volatility measure for the sample stocks, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

Portfolio UM ('Upside volatility - Median upside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater then today's median upside volatility measure for the sample stocks, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

Portfolio DP ('Downside volatility - Previous day's downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then their downside volatility measures for the previous trading day, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

Portfolio DA ('Downside volatility - Average downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then today's average downside volatility measures for the sample stocks, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

Portfolio DM ('Downside volatility - Median downside volatility'): Portfolio implying an equally-weighted short position for the next trading day in the stocks whose today's downside volatility measures are greater then today's median downside volatility measures for the sample stocks, and an equally-weighted long position for the next trading day in the rest of the sample stocks.

Portfolio U-D ('Upside volatility – Downside volatility'): Portfolio implying an equally-weighted long position for the next trading day in the stocks whose today's upside volatility measures are greater or equal to their today's downside volatility measures, and an equally-weighted short position for the next trading day in the rest of the sample stocks.

The intraday volatility measures are calculated as follows:

$$UV_{it} = R_{OH,it} * 100 * R_{HC,it} * 100\,; \quad DV_{it} = R_{OL,it} * 100 * R_{LC,it} * 100$$

where: $R_{OH,it}$ is stock *i*'s open-to-high price difference on day *t*; $R_{OL,it}$ is stock *i*'s open-to-low price difference on day *t*; $R_{HC,it}$ is stock *i*'s high-to-close price difference on day *t*; and $R_{LC,it}$ is stock *i*'s low-to-close price difference on day *t*.

The rightmost column of the table reports t-statistics for the hypothesis that the means return for each of the portfolios equals zero.

Unlike Table 4a, the intraday volatility measures are calculated as follows:

$$UV\_Adj_{it} = \frac{R_{OH,it}*100*R_{HC,it}*100}{\sigma_i^2} \quad DV\_Adj_{it} = \frac{R_{OL,it}*100*R_{LC,it}*100}{\sigma_i^2}$$

where: UV_Adj_{it} represents the adjusted upside volatility measure for stock *i* on day *t*; DV_Adj_{it} represents the adjusted downside volatility measure for stock *i* on day *t*; and σ_i^2 is stock *i*'s daily return variance over the sampling period.

The rightmost column of the table reports t-statistics for the hypothesis that the means return for each of the portfolios equals zero.

Table 4b: Historical performance measures of the portfolios based on the 'reversals of reversals' stock price behavior (based on 'adjusted' intraday volatility measures)

Daily-adjusted portfolios	Daily portfolio performance measures over the sampling period (2456 days)		
	Mean, %	Standard Deviation, %	t-statistic (Mean=0)
Portfolio UP	0.039	0.815	**2.35
Portfolio UA	0.107	0.868	***6.11
Portfolio UM	0.103	0.639	***7.99
Portfolio DP	0.080	0.892	***4.47
Portfolio DA	0.077	0.802	***4.73
Portfolio DM	0.059	0.649	***4.53
Portfolio U-D	0.116	1.069	***5.36

Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

What do we know about pro-poor growth and regional poverty in Nigeria?

Hyacinth Eme Ichoku[1], Chukwuma Agu[2], John Ele-Ojo Ataguba[3]

Abstract

This study investigates the pro-poorness of income growth in Nigeria. Using nationally representative data for 1996 and 2004, overall income growth in Nigeria was found not to be pro-poor. The richer segments of the population appropriate greater share of benefits from economic growth. Household size was a critical determinant of poverty levels. Sector of employment also impacts on the probability of a household being poor; with those in agriculture being relatively worse off. The need for smaller family size has to be an integral part of policy aimed at poverty reduction in Nigeria. The support of the government in creating value in critical sectors (like agriculture and industry) that employ a large proportion of Nigerians in order to make growth pro-poor is critical. There is also a need for region-specific policies addressing the peculiarities of poverty in the different parts of the country. One size does not fit all. Deliberate effort of the government in redistributing income is also required to ensure pro-poorness of growth in Nigeria.

Keywords: Economic growth, pro-poor growth, poverty, Nigeria

JEL Classification: I32, O40

1. Introduction

It is difficult to discuss poverty in Nigeria and its causes without reference to the structural transformations that have occurred in the composition and performance of the components of gross domestic product (GDP) over time. At the inception of the oil mania following the end of the civil war in 1970, agriculture accounted for 47.6 percent of GDP. By 1980, this share had reduced to only 30.8 percent and over the period, the share of petroleum rose from 7.1 percent to 22 percent. By 2001, oil accounted for 36.3 percent while the share of agriculture still stood 34.4 percent. Prior to then, the services sector had witnessed a

[1] Department of Economics, University of Nigeria, Nsukka, Enugu State, Nigeria; ichoku.hyacinth@unn.edu.ng, hichoku@yahoo.com
[2] Institute for Development Studies, University of Nigeria, Enugu Campus, Enugu, Nigeria and African Institute for Applied Economics, Enugu; shookslife@yahoo.com, shookslife@gmail.com
[2] Health Economics Unit, School of Public Health and Family Medicine, University of Cape Town, South Africa; John.Ataguba@uct.ac.za

surge in growth, rising to as much as 40 percent of GDP in 1999 before declining back to about 30% in 2001. But the sub-sectors (including telecommunications and financial services) that led the growth in services are not necessarily high employers of labour. There was also huge growth in informal services that provided substantial employment but lacked the capacity for significant value addition. This structural transformation in turn mirrors the changing (often inconsistent, discontinuous, and poorly implemented) policy programmes that have been adopted by different governments over the years. Because Nigeria operates a three-tier system of governance comprising the federal, states and local governments, significant geopolitical economic disparities can be partly traced to governance and institutional differences of component states.

While growth slowed down in the earliest periods, there has been some significant rebound since 2000. Though fluctuating, the per capita growth rate has remained decidedly positive since then, with aggregate growth averaging over 5 percent compared to 2.8 percent estimated population growth rate. Poverty reduction has neither been consistent nor widespread relative to the growth numbers. Importantly too, growth is only pro-poor when the poor get a significantly higher proportion of increases in output than the rich. It is not clear that this has been the case in Nigeria and indeed, the rate of poverty reduction has apparently not mirrored the rate of growth. Even though the two major household surveys used for this work were conducted between 1996 and 2004 and growth was not as significant as it has been between 2004 and 2009, yet the little that occurred did not seem to have helped the poor so much. So it is possible policy programmes have not done enough to redistribute income in a manner that raises the welfare of the poor or at least mitigates the free-fall in welfare for the vulnerable group.

Nigeria has apparently not been fortunate with implementing poverty reduction programmes. At least in policy discussions, poverty reduction has been at the centre of the country's economic policy and development programmes since independence. While it was not explicitly targeted in earlier development plans (1962 to 1975), it featured in more pronounced ways in latter programmes and projects, many of which specifically targeted elimination of poverty. These targeted programmes and projects covered a wide range of sectors including agriculture, health, education, housing and finance. In fact, they became so scattered that the Obasanjo regime (1999-2007) had to set out to rationalize and merge them in 1999. The various institutions that have arisen from the disparate poverty reduction programmes were then consolidated into the National Poverty Eradication Programme (NAPEP). This, headed by no less than the President himself, was charged with the sole mandate of eradicating poverty.

Empirical evidence and views are diverse as to the overall impact of these programmes. Some researchers (see for example Obadan, 1994; Faruquee, 1994; Canagarajah, et al., 1997) believe that these programmes have impacted positively on the lives of the poor, while others such as Osinubi (2003) insist that they have not. Researchers in the latter group believe that overall growth in Nigeria is not necessarily pro-poor and that the poor are not benefiting from growth. Ironically, the Federal Government itself admits Nigeria is set to miss the MDG (FRN, 2005). This is despite the fact that there has been sustained growth in income and income per capita over the past decade. Even though actual growth does not match MDG-required rates yet, there has been a substantial departure from the 1990s where per capita growth was negative. But beyond relatively improved growth, the question as noted by the likes of Ravallion and Datt (1999), Eastwood and Lipton (2001) and Kakwani and Pernia (2000) is whether achieving this growth rate in itself is capable of meeting the challenges of poverty, hunger, poor health and inequality in Nigeria. It seems there are equally big challenges with the nature, content and direction of growth in the country.

There are also regional and sectoral dimensions to the growth and poverty challenge in Nigeria. The regional distribution of gains from growth has also been anything but equitable. Poverty has worsened in some parts of Nigeria while it improved in others. While some southern states witnessed significant reduction in poverty between 1996 and 2004, the majority of states in the north remained largely unaffected. It seemed that by 2004, some segments of the country got disproportionately better-off than they were in 1996 while others got worse-off. But Nigeria is a federation where not only the policies of the central government, but also those of the state and local governments, influence growth and poverty reduction. Sometimes policies at lower levels of governance are far more important than those at the national level primarily because they are close to the people. The cocoa and palm plantations and the groundnut pyramids have disappeared in favour of oil. But oil employs only about 2 percent of the workforce. The rest are engaged in other economic activities. Regional distribution of employment in the different sectors also differs significantly. As yet, it is not known to what extent these replacement sectors and economic activities have helped the cause of growth, poverty reduction and equitable income distribution? And to what extent they could account for the differences in regional growth and poverty performances. For example, it is not clear that the stagnancy in the labour intensive but largely rudimentary agricultural sector has been accompanied by increasing share of other labour intensive modern sectors.

There is a clear need to evaluate the trajectory of the growth process over time in objective terms using standardized methodologies to assess the degree of pro-poorness of its distribution. It is important to hold up Nigeria's growth trends to formal tests of pro-poorness using standard measures in the literature. That, in part, is what this work intends to do. If growth in itself indeed cannot translate into improved standards of living of the poor and marginalized, what other margins of policy can be explored to reduce poverty and how? There has hardly been much assessment of the pro-poorness of growth in the country and the implications of the findings to underscore policy design. Meanwhile, though growth has rebounded, unemployment is still high (and in fact not even properly estimated because of existing policy programmes with temporary employment leading to individuals living on less than the minimum wage). So it becomes important to properly link growth with poverty reduction programmes, disaggregate sources of growth and poverty and measure the pro-poorness of growth as input into sustainable poverty reduction programmes.

This paper intends to decompose income growth and identify the contribution of different sectors of employment to the incidence of poverty. It intends to investigate the kind of economic activities that are associated with decreases in poverty at the household and regional levels. More specifically, with an estimated 5 to 10 percent new entrants into the labour market getting a job, and unemployment for the 15 to 29 age group estimated at up to 60 percent, it is important to ask whether witnessed growth in the country has been pro-poor, sufficient, and in the 'right' sectors? To what extent has the nature and sectoral composition of growth been responsible, not only for widespread unemployment but also for differences in regional poverty experiences? Are regional differences in poverty exacerbated by sectoral dynamics or just by demographics? Again, to what extent do these sectoral and regional employment challenges exacerbate regional poverty?

This paper therefore aims to explore pattern and linkages of economic growth and poverty in Nigeria from an analytical standpoint that combines econometric estimates of determination of poverty in the regions. It aims to determine pro-poorness of economic growth in Nigeria from 1996 to 2004 using various methods and assess how sector of employment and household demographics impact on poverty in the different regions.

2. Brief Literature Review

2.1 Trickle-Down Versus Pro-Poor Growth Strategies

The idea that the benefits of economic growth get to the poor indirectly through the spending of the rich as economic growth first benefits the rich and those with initial capacity was part of the inherited economic development thought from the 1950s and 1960s. The trickle-down theory and the consequent 'indirect benefit' approach to economic thought and policy received a big boost with the highly influential Dollar and Kraay (2000) study that finds that income of the poor rises one-to-one with overall growth. But these findings have also been highly contested by researchers including Kakwani and Pernia (2000) that produced counter evidence showing that there could also be 'immiserizing growth' (Bhagwati, 1988). And thus the need for deliberate pro-poor growth and poverty intervention policies that do not leave distribution to market forces as suggested by the trickledown theory. Poverty reduction is then seen as the fundamental objective of and a metric for assessing the effectiveness of development. Poverty reduction interventions employed alongside economic growth become therefore influential tool in combating income poverty (Essama-Nssah and Lambert, 2006).

Pro-poor growth strategies are diverse and depend critically on the structure of the economy in consideration and the distribution of income among the different sectors that employ the relatively poor and the wealthy. In Africa for example, where the bulk of the poor live in the rural areas and incomes are tied to agricultural production, different authors have argued that an increase in the productivity and growth in the sector is likely to have significant impacts on poverty reduction. They support such assertion by references to China and Bangladesh where growth in the primary sectors had greater impact on poverty reduction (Ravallion and Chen, 2004; Ricardo, 2005). Countries like Indonesia, Bangladesh and Vietnam have shown that increasing access to markets directly or indirectly through the creation of labour intensive projects that create jobs for the poor is a viable pro-poor growth policy (see Ricardo, 2005). Other policies that have been identified as a viable option for pro-poor growth especially for agrarian communities include proper property rights and effective risk management (see Ricardo, 2005).

2.2 Some Empirical Studies on Growth and Poverty Reduction

Following the understanding that poverty reduction can be triggered or managed, a number of studies have proceeded to evaluate both the approaches and instruments for doing this. A huge genre of literature has evolved to either strengthen the theory using further empirical data or show different sizes and composition of alternative methodologies for weighing in on poverty reduction (see for example, Son (2004) for applications to Thailand). Ravallion and Chen (2003) applying the measure of pro-poor growth as the mean growth rate for the poor on dataset from China explored China's growth process in the 1990s. Over the years 1990-1999, they observed that the ordinary growth rate of household income per capita was 6.2% per annum and the growth rate by quintile ranged from 3% (poorest percentile) to 10% (richest percentile) and the rate of pro-poor growth was around 4%. They also observed that this trend was reversed in the mid-1990s for a few years.

The sort of analyses presented in some of these studies ostensibly help structure policy intervention in a manner that will ameliorate (if not correct) discrepancies in benefits from growth. However, such studies have generally not been available for African countries including Nigeria. For example, there have not been studies conducted that tests for the convergence of the various methodologies proposed to test for the pro-poorness of growth in countries. In Nigeria specifically, there is dearth of studies in the area of pro-poor growth especially as it relates to income distribution and sectoral allocation of such growths from a micro-macro analytical perspective. This study is a preliminary step towards helping to fill this huge knowledge gap.

3. Poverty, Growth and Economic Policy in Nigeria

The challenge of poverty in Nigeria was aptly captured by the World Bank in a 1996 publication on Nigeria titled: *Poverty in the midst of plenty: The challenge of growth with inclusion*. Even official reports from government, regularly accused by the civil society of exaggerating growth and underreporting poverty and unemployment, still indicate rising poverty over the last three decades since 1980. The National Bureau of Statistics figures indicate that national poverty incidence reduced from approximately 65.6 percent to about 54.4 percent between 1996 and 2004. However, with increases in absolute population from an estimated 115 million to 140 million between the two periods, this actually amounts to an increase in the population in absolute poverty from 75.4 million to 76.2 million between the two periods. So a fall in relative poverty numbers may not mean a fall in the total population of the poor. There may be arguments about the relative size and composition of the poor, but there is no argument about poverty as a critical fact in Nigeria. And there is no question it has trended up for many years. Income poverty moved up from 28.1 percent in 1980 to 65.6 percent in 1996 before it returned to 54.4 percent in 2004. Even at that, self-assessed poverty was 75.5 percent in 2004 (FOS, 2004).

Inequality has also been on the increase. Nigeria's overall Gini coefficient rose from 0.387 in 1985 to 0.465 in 1996. By 2004, this has further increased to 0.515 and rose even further to 0.58 in 2007. So here is a society where poverty has increased, but then, inequality has increased even much more over time. This rising Gini coefficient is not only a matter for urban areas, where there is always the tendency for it to be very high. In fact, Nigeria's case is unique relative to many developing countries; its rural inequality coefficient of 0.581 is higher than its urban inequality, with coefficient of 0.528 (Canagarajah et al, 1997; Canagarajah and Thomas, 2001; Aigbokhan, 1999; World Bank, 2003; and Oyekale et al, 2007).

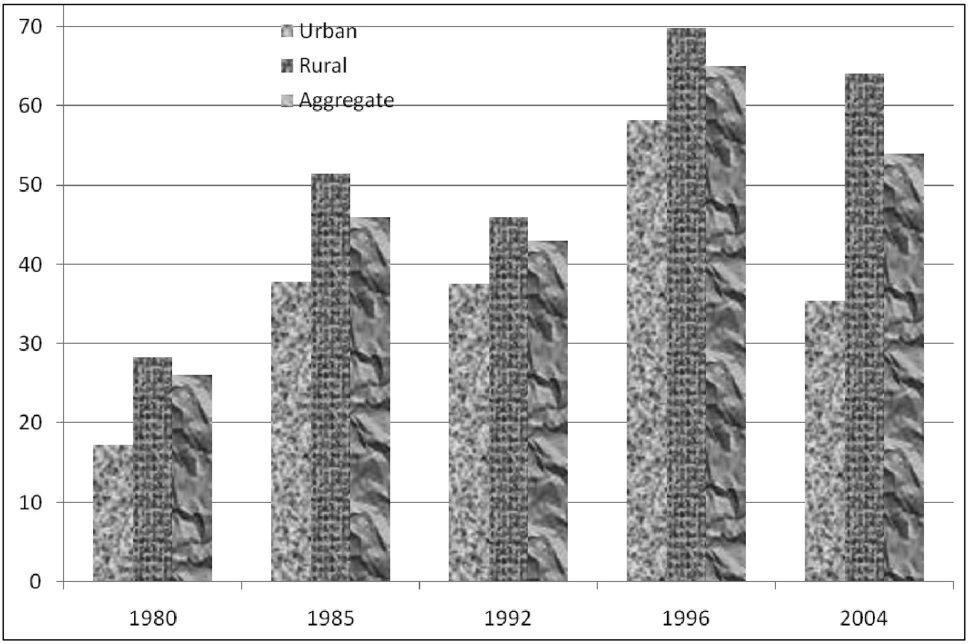
Following independence in 1960, the country aggressively pursued growth by promoting agriculture in the geopolitical regions. Regional agriculture was then the pivot of economic growth as each of the then four regions exploited its comparative advantage, the north in groundnut, the south east in palm produce and the south west in cocoa. The massive growth of the first six years after independence was interrupted by the three year civil war that began in 1967 and ended in 1970. By 1970, oil export began a steady rise and soon became the mainstay of the economy. The splintering of the regions into component states also led to a weakening of the government base and support for the regional agricultural products. Growth in the 1970s was therefore primarily driven by oil exports.

The oil boom of the 1970s had decidedly real effects on growth; there were significant increases in real GDP in both aggregate and per capita terms throughout the decade. As at 1980, per capita income of the country had risen to US$1215. Then the oil glut of 1979/1980 appeared which led to sharp drop in growth rate post-1979. By year 2000, per capita GDP was only US$706, a 42 percent fall in PPP terms from its 1980 value. The 2004 National Living Standards Survey (NLSS) indicates that about 20 percent of the population are in the core poor group while another 38 percent are moderately poor.

However, aggregate poverty statistics mask the huge spatial disparities that exist across urban – rural divide and the six geopolitical zones of the country. Figure 1 above shows that poverty is more concentrated in the rural than in the urban areas. Rural poverty is consistently higher than national average. But the greater challenge is the huge regional discrepancies in poverty especially in terms of broad categories of north and south. Poverty is relatively more concentrated in the northern parts of the country. In 1996, only 4 out of 23 states with poverty levels over 60 percent are in the south, while the remaining 19 states representing 83 percent are in the north.

Not only is poverty more pervasive in the northern region, it is also more persistent. Little positive changes occurred in the region between the 1996 and 2004 surveys; in fact, the region fared worse on the aggregate in 2004 compared to its poverty position in 1996. The bulk of poverty reduction that occurred between 1996 and 2004 came from the south. Figure 2 shows poverty incidence in the six geopolitical regions based on the 1996 and

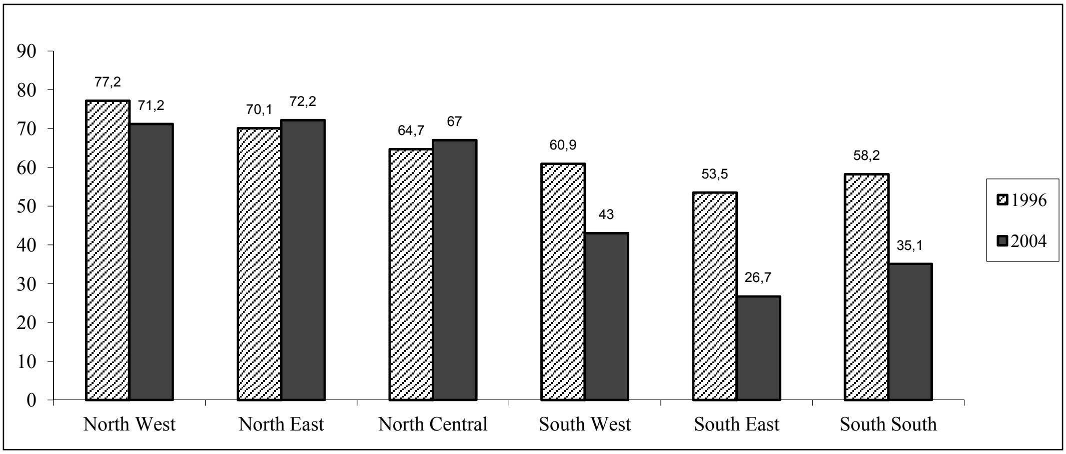
Figure 1: Trends in Income Poverty, 1980 – 2004



Source: Original data from the NLSS 2004

2004 living standards surveys. The first three sets of columns shows the northern region – north-west, north east and north central respectively while the last three shows the southern region – south west, south east and south south. Poverty incidence fell only by 1 percentage point (from 77.2 to 71.2) in the northwest through the more than one decade between 1994 and 2006. It increased in the north east and north central respectively from 70.1 percent to 72.2 percent and from 64.7 percent to 67 percent. In contrast, the southwest had nearly 18 percentage point reduction in the proportion of the population in poverty (from 60 percent down to 42 percent). The proportion in the southeast in poverty was reduced by nearly 27 percent (from 53 percent to 26 percent) while the proportion in poverty in the south-south dropped by 23 percent (from 58 percent to 25 percent). It is possible this development aggravated regional and spatial inequality making Nigeria one of the most unequal countries in the world. Interestingly, disparities in concentration of poverty among the regions reflect in disparities in economic, social and infrastructural developments. The UNDP (1994), for example, found that life expectancy in Edo and Delta States in the south-south was 18 years higher than in Borno state in the northeast, the latter being among the lowest in the world. Demographic and Health Survey conducted in 2004 showed that child mortality in northwest is more than two and half times the rate in the southeast. Similarly, a recent World Bank study showed that rural poverty in Jigawa state (northwest) is four and half times the rate in Oyo state (southwest).

Figure 2: Poverty Incidence by Regions in Nigeria



Source: FRN, 2005

The spatial poverty situation in Nigeria is complex and does not lend itself to easy explanations. However, it is on record that colonial patterns of settlement and activities of early missionaries gave the southern geopolitical zones a head-start in the development of education, health and social infrastructure (Ityavyar, 1987). But such explanation does not suffice for the persistence of this situation nearly one hundred years later. It has been suggested by some authors that cultural and other differences between the north and the south largely account for the differences in poverty incidence. While these may be true, it is also important to note the role oil rents could have played over time. Economic volatility arising from weak institutions may have been accentuated by rent from oil. In fact, the abolition of the groundnut pyramids and reliance on the less employment-generating oil sector may have affected the north more than other parts of the country. It is also possible that sectoral distribution of gains from increases in income could have been skewed against the sectors engaging the larger proportion of the workforce in the northern parts of the country. In this case, there are both income and substitution effects from the shift away from core agriculture to oil as a major source of revenue to government. Oil has been a critical contributor to the instability that has characterized Nigeria's political economy. Oil revenue has over time become a source of entrenched rent-seeking that undermined productive effort giving rise to what has been appropriately described as prebendalism, a state of intensive struggle for the control of resources by fractious power blocks (Joseph, 1987). But the political volatility is only an epiphenomenon of the greater volatility that characterizes the international oil market with its frequent booms and bursts. But it might be difficult to make clear statements on these without examining sectoral contributions to poverty, which is integral to this paper.

The universal weakness of a prebendalistic economy is the absence of strong institutional framework to organize productive efforts. Governance institutions are compromised and accountability and transparency are undermined. The cost of doing business increases and investment and economic growth are sacrificed, increasing poverty. While exact estimates do not exist, there are indications that poverty and inequality in Nigeria owe largely to the historical impacts of rents from oil. While oil accounts for over 90 percent of exports and 80 percent of government revenue, it employs only about 2 percent of the workforce. But oil could equally have accentuated poverty through its impact on institution building. Rents from oil do not trickle down to the poor when they are not invested in productive efforts that will create jobs but rather invested in securing the sources of the rents and increasing access to the privileged few. Under such circumstances, economic growth can be consistent with increasing poverty.

In the Nigerian case, agriculture was largely abandoned and incentives were pitched against the productive sectors. Poor infrastructural development, little attention to research and poor industrial development strategy gave rise to still-born manufacturing sector. Lack of investment in rural infrastructure acted as a disincentive to rural agricultural life and a pull factor to the cities, giving rise to one of the highest urbanization rates in the world. With huge pressure mounting on the largely unplanned and under-developed urban infrastructure, the result was the emergence of sub-urban ghettos. But there are other ways in which oil hurt the poor in Nigeria. Influx of petrodollars led to Dutch disease, exchange rate overvaluation and import dependence. With almost no mechanism for support, the poor bear a disproportionate share of these disincentives. Volatility in growth of the oil sector also meant huge swings in real income of the poor. Besides, quality of government expenditure decides overall impact of oil rents on the poor. These are midwived through existing institutions – and for all the efforts put into building them, these institutions have not been facilitative of poverty reduction in Nigeria.

The government has seemingly never left off fighting poverty in the country. Several programmes aimed at reducing poverty have been initiated and implemented since independence. Even military governments advertised poverty reduction as their major goal and were not left out in the struggle to reduce poverty. This gave rise to a plethora of programmes over time. While the development planning era targeted broad economic growth on the understanding that they would yield poverty reduction, subsequent governments were more direct in line with the shift in global paradigm to explicit poverty reduction targets. Most of these were through defined programmes giving rise to sharp increase in the number of institutions and projects aimed at poverty reduction. The Babangida administration (1985-1993) for example established the Peoples' Bank, community banks, small scale credit schemes, National Directorate of Employment (NDE), the Family Support Programme (FSP), Directorate of Foods, Roads and Rural Infrastructure (DFRRI) among a host of others. The Abacha administration (1993-1998) established the Family Economic Advancement Programme (FEAP) and the Petroleum Trust Fund (PTF). Most of these programmes were housed directly under the Presidency to depict the extent of relevance and support they received from the administration of the day. The poverty reduction strategy process initiated by the World Bank was equally housed under the Presidency. But by the first term of his administration, Obasanjo decided to rationalize institutions tackling poverty and set up the National Poverty Eradication Programme (NAPEP) as the coordinating body for poverty reduction. The administration also introduced the National Economic Empowerment and Development Strategy (NEEDS) alongside its States and Local Government counterparts (SEEDS and LEEDS) all of which ran as encompassing national reform programmes (Osinubi, 2003; FRN, 2005). Even specialized institutions of government like the Central Bank of Nigeria set up programmes like the Small and Medium scale Investment Equity Insurance Scheme (SMIEIS) in pursuit of poverty reduction.

4. Methodology and Analytical Framework

4.1 Study Population and Data

Nigeria occupies approximately 923,768 square kilometres of land mass and is politically divided into 36 states and the Federal Capital Territory, Abuja. For operational convenience, the country is divided into six geo-political zones – north east, north-west, north central, south east, south west and south south. With a population of over 140 million, over 50 percent of which live in the rural areas and lack basic amenities (FRN, 2005), it is the most populous and second largest economy in sub-Saharan Africa

The 1996 General Household Survey (GHS) and the 2003/04 National Living Standard Survey (NLSS) datasets were used in the study. These are nationally representative datasets covering the 36 states of the Federation including the Federal Capital Territory. Both surveys used the National Integrated Survey of Households (NISH) frame and employed multi-stage sampling with data on living standards. The GHS contained information on about 22,000 households while the NLSS contained information on about 1900 households. To ensure uniformity in assessing 'pro-poor growth', income was proxied by real expenditure values (in 2004 prices) based on the consumer price indices (CPIs) available from the National Bureau of Statistics (NBS). Unlike the GHS, the NLSS contains disaggregated expenditure items. To compare with the GHS a similar measure of expenditure was constructed for the NLSS by summing up the various components that comprise a category of expenditure. In part, this is mainly for the segment of the work concerned with assessing pro-poorness of growth. For the sectoral and regional analyses involving estimation of relationships, the major data were the 2004 NLSS. Most of the quantitative assessments in the work were handled with STATA 11 and SPSS 16. The analytical techniques for evaluating the different measures of pro-poor growth and unemployment and their implications for the Nigerian economy are contained below.

4.2 Measuring Pro-Poor Growth

To determine pro-poorness of economic growth from 1996 to 2004, we adopt various approaches including Ravallion and Chen's (2003) approach, Son's (2004) approach, Kakwani and Pernia's (2000) approach and Kakwani et al.'s (2004) methodology. We then compare the conclusions from these methodologies to assess the convergence of conclusion on the pro-poorness of growth in Nigeria over the two sample periods.

Modifying Kakwani (1993), Ricardo (2005) shows that the relationship between poverty, inequality and growth can be simply expressed as:

$$P = p(y, I) \tag{1}$$

where (1) is the level of poverty. y is the level of income and I is a measure of inequality Changes in poverty following the total change representation can be written as

$$dP = \frac{\partial p(y^*, I^*)}{\partial y} dy + \frac{\partial p(y^*, I^*)}{\partial I} dI + \frac{\partial y}{\partial I} \tag{2}$$

Rearranging and simplifying, we obtain

$$\%\Delta P = \zeta_y \cdot g + \zeta_I \cdot \%\Delta I + (\partial y / \partial I) \cdot (1 / p) \tag{3}$$

where: ζ_y = elasticity of poverty to income, g = income growth rate, ζ_I = elasticity of poverty to inequality, $\%\Delta I$ = percentage change in inequality, and $\partial y / \partial I$ = correlation between inequality and growth.

Equation (3) represents the percentage change in poverty which shows that changes in poverty is a function of changes in inequality, economic growth and the correlation between income disparities and growth rates. This clearly shows that poverty changes when any of its constituent units as found in (3) changes.

The poverty incidence curve analysis of Ravallion and Chen (2003**)** asserts that a measure of pro-poor growth should satisfy the following axioms:

(i) The measure should be consistent with the direction of change in poverty, in that a positive (negative) rate of pro-poor growth implies a reduction (increase) in poverty.

(ii) The measure of poverty implicit in the measure of pro-poor growth should satisfy the standard axioms for poverty measurement

The measure of pro-poor growth proposed is the actual growth rate multiplied by the ratio of the actual change in the Watts index to the change that would have been observed with the same growth rate but no change in inequality.

A modified Watts Index can be written in terms of the quintiles function as:

$$W_t = \int_0^{H_t} \log[z / y_t(p)] dp \tag{4}$$

where $y_t(p)$ is the income of the pth quintile at time t, H_t is the headcount measure of poverty at time t, z is the poverty line.

After differentiating (4) with respect to time, we obtain:

$$-\frac{dW_t}{dt} = \int_o^{H_t} \frac{d \log y_t(p)}{dt} dp = \int_0^{H_t} g_t(p) dp \tag{5}$$

Dividing (5) by H_t gives the measure of pro-poor growth which is measured by the mean growth rate for the poor given by:

$$= \frac{1}{H_t} \int_0^{H_t} g_t(p) dp \tag{6}$$

Son's (2004) methodology distinguished Growth Poverty Curve from the growth incidence curve used by Ravallion and Cheng (2003). Following Son (2004), we define $L(p)$ as the Lorenz curve which describes the percentage share of income (or expenditure) enjoyed by the bottom p percent of the population which we may define as:

$$L(p) = \frac{1}{\mu}\int_0^x yf(y)dy \tag{7}$$

where $p = \int_0^x f(y)dy$ and μ is the mean income of the population and y is a person's income with the probability density $f(y)$.

For all poverty indices, Son (2004) showed that growth is unambiguously pro-poor when the Lorenz curve shifts upward i.e. $\Delta L(p) \geq 0$ for all p.

Reformulating the Lorenz curve as $L(p) = \frac{\mu_p p}{\mu}$ and by logarithmic transformation, Son (2004) obtained:

$$Ln(\mu_p) = Ln(\mu L(p)) - Ln(p) \tag{8}$$

Obtaining a growth form through first difference, we arrive at

$$g(p) = \Delta Ln(\mu L(p)) \tag{9}$$

where: $g(p) = \Delta Ln(\mu_p)$ is the referred to as the growth rate of the mean income of the bottom p percent of the population ranking individuals according to their per capita income. $g(p)$ which changes according to the changing values of $0 \leq p \leq 100$ may be called the poverty growth curve.

From (9), if $g(p) > g$ for all $p < 100$, growth is pro-poor and it is not pro-poor, if otherwise. Here, g is defined as the overall growth rate. If however, $0 < g(p) < g$ for all $p < 100$, then growth reduces poverty but is accompanied with increasing inequality (trickle-down growth) where the poor receive proportionally less benefits than the non-poor. If $g(p) < 0$ and $g > 0$ for all $p < 100$, it implies that overall growth increases poverty and inequality.

Kakwani and Pernia (2000) method basically aims to decompose total change in poverty into the pure growth effect (i.e. the percentage change in poverty when the distribution of income does not change) - O_g and the inequality effect (i.e. the change in poverty when inequality changes in the absence of growth) - O_I. O_g is a non-positive quantity because positive growth reduces poverty while O_I could either be positive or negative depending on whether growth increases or reduces inequality respectively. Pro-poor growth can then be measured as:

$$\phi = \eta / \eta_g \tag{10}$$

where ϕ is the pro-poor growth index (PPGI), and η / η_g is the ratio of poverty elasticities. Growth is pro-poor when $\phi > 1$. It leads to an increase in poverty when $\phi < 0$ and when $0 < \phi < 1$ it reduces poverty but redistributes income in favour of the rich.

Kakwani et al.'s (2004) model is built on Kakwani and Pernia's (2000) framework to address the monotonicity axiom (i.e. the magnitude of poverty reduction should be a monotonically increasing function of the pro-poor growth rate) and to satisfy a necessary and sufficient condition for poverty reduction. They note that ‘while the PPGI captures the distribution of growth benefits among the poor and non-poor, it does not take into account the level of the actual growth rate’ (p. 6). Kakwani et al. (2004) proposed the poverty equivalent growth rate (PEGR) represented as:

$$\gamma^* = (\delta / \eta)\gamma = \phi\gamma \tag{11}$$

where $\delta / \eta = \phi$ is the same as that in (10) and γ is the current growth rate in income. γ^* is the growth rate that would yield the same level of poverty reduction as the current growth rate γ if there is no change in inequality accompanying the growth process. Growth is pro-poor (pro-rich) when $\gamma^* > \gamma$ ($\gamma^* < \gamma$). When $0 < \gamma^* < \gamma$ growth is accompanied by an increasing inequality and poverty is reducing.

4.3 Assessing impact of sector of employment and region of origin on poverty incidence

Using a Probit model we assess the impact of several variables on poverty across the six geo-political zones. The primary data employed here is the 2003/2004 NLSS. In preparing the NLSS, the National Bureau of Statistics classified households as poor or non-poor using standard Foster-Greer-Thorbecke (FGT) method. The nominal poverty line is NGN22, 928.00 (Twenty two thousand, nine hundred and twenty eight Naira) only. If a household is non-poor this dichotomous dependent variable takes the value of 1 and if poor it takes the value of 0. The explanatory variables are therefore the determinants of the probability that a given household is poor or non-poor. The coefficients are interpreted in terms of the signs (i.e. positive or negative) and not necessarily in relative sizes. A positive sign will indicate that a particular explanatory variable increases the probability of being non-poor while a negative sign increases the probability of being poor.

Sectors of employment, sex, location and academic qualifications are the major explanatory variables and each is defined in line with NBS classification from the surveys. The trade and sales sector are used as control for employment, females as benchmark variable for sex, rural area as benchmark variable for location and those with tertiary education as benchmark for academic qualifications. Trade is selected as benchmark group for employment because of the higher growth of the sector relative to the rest of the sectors between 1996 and 2009. Rural areas and females are usually considered disadvantaged in poverty analysis; so we respectively benchmark urban and male to these. Those with tertiary education, on the other hand, are generally considered relatively well-off and studies indicate in terms of assets and income, they are usually better off than those with other academic qualifications. So the group will be used as benchmark for poverty among education groups. For each group, we estimate poverty incidence in the other groups relative to the benchmark groups.

There are presently no recent data based on national surveys reflecting household demographics, sectoral and/or occupational or education in the country. However, a recent World Bank (2010) survey of 2250 households indicates national average household size to be about 6 persons per household. There are however, regional differences. Average household size for families in the north at over 7 persons is relatively higher than that for families in the south at about 5 persons. Household sizes also differ between urban and rural households, with rural families generally having larger household sizes. To what extent this drives poverty or is itself a function of the varying poverty levels in each region and location is not known, the former being the object of this research. Following the collapse of the clearly demarcated regional agricultural systems, agricultural employment diminished in most of the south. But the north has remained predominantly engaged in agriculture. This could partly be attributed to resource endowment, which in turn also affects willingness to migrate and take up alternative jobs from a people's immediate location (Komolafe, 2002). For example, whereas the entire northern region has large landmass and benefits from irrigation programmes, the south east is much less endowed. This partly accounts for the high migration from the region and less attention to agriculture. Therefore, agriculture-employment-induced poverty might affect the north much more than it would affect the south east.

Impact of education on poverty comes in several forms. Higher level of education is associated with enhanced capacity for mobility which implies better ability to take up opportunities elsewhere when the immediate environment does not present full opportunities. Docquier and Marfuok (2006) analysis of international migration by educational attainment classically demonstrates how this works. In Nigeria, as in many other places, available evidence indicates that the less educated are also less mobile and so have limited opportunities for improving their income beyond their immediate environment. Currently, educational attainment varies widely by regions as well. In fact, national average literacy rates sometimes disguise the wide regional differences. Primary school enrolment in some northern states is as low as 45 percent and as high as 95 percent in some southern states. The religious and cultural attitudes of each people towards western education play significant part in this. People in urban areas also generally have greater access to a wider range of educational services than those in rural areas. So literacy rate in urban areas is generally higher than it is in rural areas.

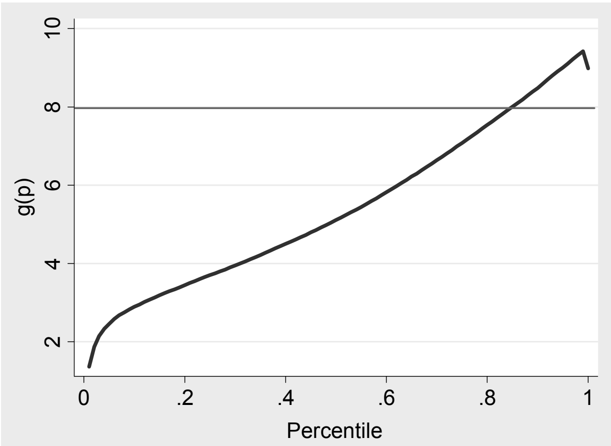
The NLSS and other surveys in the country capture the range of incomes of respondents. It is easy therefore to model the determinants of income among respondents in the surveys. Though modelling directly on income could reveal relative poverty (World Bank, 2005), we however model determinants of poverty in a dichotomous choice framework as we are particularly interested in absolute poverty and the distinction between the poor and the non-poor. In addition, it is not clear that an analysis of the determinants of income may yield results different from that regularly conducted on income determination at the broader macro level and which has already received much attention.

5. Findings

5.1 Has Growth in Nigeria been Pro-Poor?

In Figure 3, the poverty growth curve based on the framework of Son (2004) is presented. The horizontal line denotes the average overall growth rate (i.e. g). It is important to note that the result based on this framework does not rely on the specification of any poverty line. Based on the chart, if the growth rate at the bottom p percentile is greater than the overall growth rate (i.e. $g(p) > g$ for all $p < 100$), growth within the period 1996-2004 is pro-poor. However, the poverty growth curve shows that up until the poorest 80 per cent of the population, growth is not pro-poor. This is because $g(p) < g$ for $p < 80$. However, the upward sloping nature of the curve implies that generally, there are improvements as you move up the ladder but such improvements do not imply pro-poor growth for the poorest segments of Nigerians.

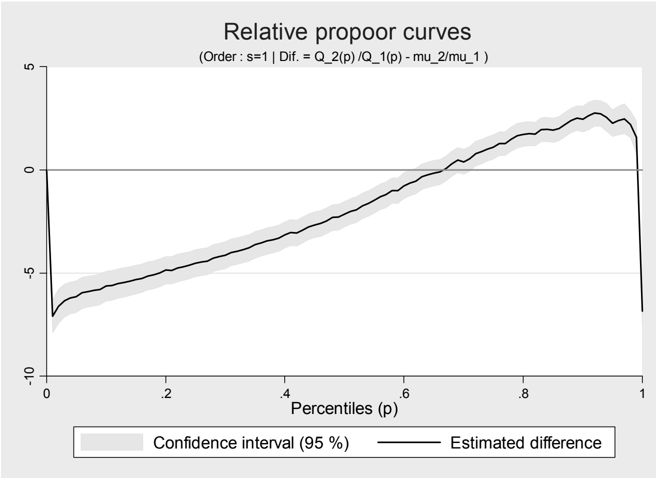
Figure 3: Poverty growth curve (1996-2004)



Specifically, Figure 3 shows that $g(p) > 0$ for all $p < 100\%$. This implies that growth reduces poverty (across all percentiles) but is accompanied with increasing inequality (trickle-down growth) where the poor receive proportionally less benefits than the non-poor from the process of growth. These show that even though national poverty statistics indicate a decline of poverty headcount from about 66% (1996) to 54% (2004), and an increment in growth over the same period, the dividends from growth is disproportionately benefiting the rich than the poor. This works through the inequality linkage.

Similar to the poverty growth curves, we present in Figure 4 relative pro-poor curves (see Abdelkrim and Duclos, 2007). The results are similar to the poverty growth curves. At all percentiles below 70 percent, the curve lies below the horizontal line (zero). The curve is only above the horizontal line at the top percentiles. These figures also show that while growth has been positive between the periods (1996-2004), it is benefiting the rich more than it does to the poor because of the increasing inequality in incomes.

Figure 4: Relative pro-poor growth curves (Dual approach)



While the curves presented are informative, they do not provide an 'index' to assess overall pro-poorness of growth in Nigeria. In Table 1, we present results showing selected pro-poor growth indices using the FGT(α) (Foster et al., 1984) class indices. Specifically, poverty headcount (α = 0) was used as the measure of poverty (the Ravallion and Chen, 2003 measure requires only the headcount measure).

Table 1: Selected pro-poor indices (α = 0)

Poverty line =2645; Parameter alpha = 0.00				
Pro-poor Indices	Estimate	Standard error	Lower bound	Upper bound
Growth rate (g)	7.982741	0.346410	7.303790	8.661691
Ravallion & Chen (2003) Index	0.926187	0.016550	0.893750	0.958624
Ravallion and Chen (2003) - g	7.056554	0.342562	-7.727962	-6.385145
Kakwani & Pernia (2000) Index	0.778632	0.010212	0.758618	0.798647
PEGR Index	6.215619	0.283503	5.659963	6.771275
PEGR - g	-1.767122	0.110670	-1.98403	-1.550213

From the tables, the overall growth rate is 7.98% (with standard error of 0.35%). To assess the extent of pro-poorness, this is compared with the respective indices (except for the Kakwani and Pernia index). The Ravallion & Chen (2003) index of 0.93 implies that growth over the period 1996 – 2004 is not pro-poor. Specifically, this can be understood as a trickle-down growth because (0.93 < 7.98). The Kakwani et al. (2004) measure uses the Poverty Equivalent Growth Rate (PEGR) (γ*). If $\gamma^* > g$ (i.e. the overall growth rate), then we have a pro-poor growth. If ($0 < \gamma^* <$ g), we have a trickle down growth; and if (γ^* < 0), we have an immiserizing growth. As shown in the table, the PEGR is less than the actual growth rate (i.e. 6.22% < 7.98%). This implies a trickle-down growth which is not necessarily pro-poor in the strict sense. This is also consistent with the results of the Son (2004) growth poverty curve and that obtained using the Ravallion and Chen approach. For the Kakwani and Pernia index (ϕ), we have that $0 < \phi < 1$ which again confirms a trickle down growth process between the period of 1996 – 2004.

A comparison of all the methods used shows that there is some level of agreement in predicting the nature of growth in Nigeria between 1996 and 2004. Because these methods use different evaluative frameworks, we cannot compare the magnitudes of their indices. However, the overall picture is still illuminating. Even though there was remarkable growth experience over the period in Nigeria, it did not translate into a reduction in inequality. Though the growth process in Nigeria was able to reduce the magnitude of poverty to some extent, this did not translate to improvements in inequality.

In part, this may not have been very difficult to understand.

5.2 Determinants of Poverty

5.2.1 Factors Affecting Poverty in the Regions

Demographic Factors and Regional Poverty

We provide an assessment of the determinants of poverty in the regions. The regression results in Table 2 show impact of selected demographic factors on incidence of poverty in the six regions. Explanatory factors include household size, age of the household head, location of the household (urban versus rural) and sex for all regions.

Table 2: Selected Demographic Factors and Poverty Incidence in Regions

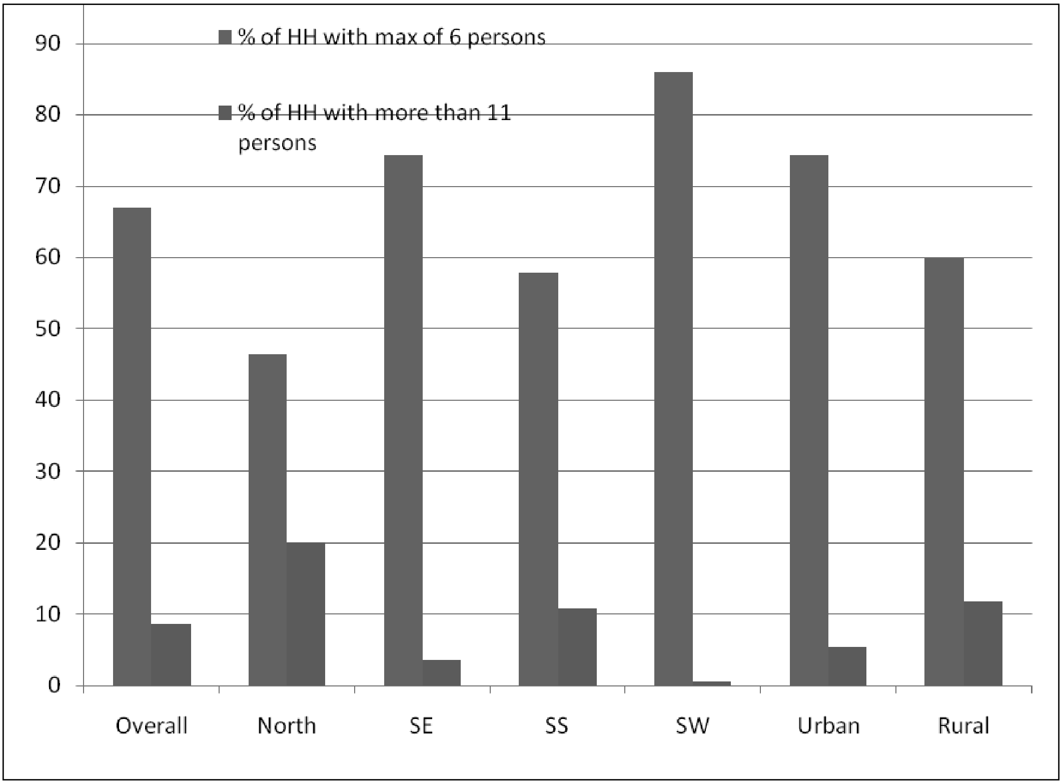
	HH Size		Age Group		Location (Urban vs Rural Areas)		Sex (Male vs Female)	
	Coef	z	Coef.	z	Coef.	z	Coef.	z
South South	-0.253**	-20.72	-0.008	-0.67	0.413	5.41	-0.009	-0.13
South East	-0.229**	-18.03	0.071**	5.72	0.361	3.72	-0.021	-0.3
South West	-0.229**	-17.35	0.033**	3.07	0.168	2.59	0.023	0.32
North Central	-0.139**	-14.89	-0.019*	-1.9	0.195	3.05	0.055	0.66
North East	-0.210**	-20.59	0.010	1.02	0.392	4.44	0.018	0.15
North West	-0.144**	-15.7	0.008	0.79	0.603	6.92	-0.366**	-2.11

*,** significant at 10% and 1% respectively

Source: Authors' estimates

From the estimates, it can be seen that household size is quite critical in defining poverty across all regions. This indicator remained consistently relevant across all estimations. From this result, it is plausible to relate differences in average household sizes in the different regions to differences in poverty incidence in each region. According to World Bank (2010) household survey it is clear that regions with very high household sizes are also the ones with very high incidences of poverty, confirming that household size matters for poverty in Nigeria. Nearly 90 percent of households in the south west have maximum of 6 persons (the national average) while only about 1 percent are made up of 11 persons or more (see Figure 5). By contrast, only 48 percent of households in the north have maximum of 6 persons in the household while as much as 20 percent of households in the region have 11 persons or more. It is not clear what drives differences in fertility across the regions. But some of the factors responsible may not be unconnected with levels of development, cultural practices and literacy levels, indicating circular causation between poverty and these factors (an issue that has been harped upon in the literature).

Figure 5: Household Size by Regions



Source: WB 2010 (Note: North includes north-west, north east and north central)

Age group of the household head seems to be more critical for poverty in some regions than in others. It is very significant for the south east and south west regions. Older households fair better than younger households in these two regions on the average (possibly on account of accumulation and inheritance). Age is also important for the north central region but negatively so. Older households are poorer. In other regions, it is not very important. Location also matters, and nearly evenly so, for all regions of the country. Urban areas are generally significantly better off than the rural areas in all regions. But the impact of sex in the regions is worth observing. In the south south and south east, female headed households were marginally better off. But for regions like south west, north central and north east, male headed households are marginally better off. In the north-west, the difference is much more significant – female headed households are much better off than male headed households. Again, this goes to the root of cultural practices. The male headed households in the homogenous north-west have more members (with many wives and children) than the female headed households. So whatever income that comes to the household has to be spread among members. These are besides other restrictive practices against women in the region. By contrast, female headed households do not have to carry the burdens of extra 'husbands' and numerous children. They are generally slimmer.

5.2.2 Impact of Occupation on Poverty across Regions

The regional equations using the benchmark group (sales and related activities) indicate that sector of employment is critical for poverty. Relative to the benchmark group, students, unemployed and retired persons are very negatively affected across all regions. However, the level of relative wellbeing for this group is worse in regions like the south east, south west and north-west than in other regions of the country. The margin is smaller in the south south and north east and smallest in the north central region. This may not be unconnected with the relative stock and welfare of this group in the two southern regions relative to the rest of the country. In fact, as can be seen from Table 3, more than in any other region, nearly all groups (except clerical and services) fare much worse than traders in the south east. This is partly because more than any other region, the south east has the highest proportion of persons in trade and related services. The south east is a major hub of trade (both wholesale and retail) in the country and many of those employed in it have significantly higher income than the rest of the society. As such, it takes much larger earning power for an employee of any other occupation in the south east to be better off than a trader. Hosting prominent commercial centres like Lagos and Ibadan, the same goes for the south west to a lesser degree.

Table 3: Relative Poverty among Occupation Groups (Benchmark = Sales and Related)

	South South		South East		South West		North Central		North East		North West	
	Coef.	z	Coef.	z	Coef.	z	Coef.z		Coef.	z	Coef.	z
Student, Retired, Unemployed	-0.18	-1.28	-0.57	-3.66	-0.23	-2.22	-0.05	-0.43	-0.312	-1.44	-0.71	-3.93
Professional or technical	-0.05	-0.33	-0.35	-1.94	-0.03	-0.24	0.08	0.65	0.22	1.26	0.02	0.1
Administration	0.11	0.16	-0.84	-0.88	-0.12	-0.29	0.60	1.65	0.76	1.11	-0.28	-0.3
Clerical	-0.11	-0.85	0.02	0.09	0.02	0.18	-0.26	-1.95	0.05	0.29	-0.13	-0.84
Services and related	-0.17	-1.26	0.02	0.08	-0.36	-2.77	0.04	0.27	0.11	0.55	-0.31	-1.77
agriculture and forestry	-0.16	-1.69	-0.60	-4.69	0.11	1.22	0.15	1.64	-0.45	-3.45	-0.76	-6.6
Production and transport	0.15	0.85	-0.28	-1.29	-0.09	-0.61	0.05	0.29	-0.39	-1.6	-0.03	-0.18
Manufacturing and Processing	0.05	0.26	-0.04	-0.15	-0.02	-0.12	-0.15	-0.72	0.74	1.47	0.18	0.56
Others	-0.06	-0.38	0.05	0.25	-0.17	-1.51	-0.06	-0.35	-0.14	-0.61	-0.33	-1.55

Source: Authors' estimates

Professionals and technicians do not fare the same across regions either. They are worse off in the entire southern region, and especially so in the south east. In the north, they fare better and this is not surprising. The wide array of employment groups in the south, including the booming trade, can comfortably compete with professionals and technicians. But in the north, the relatively fewer professionals would always fare better than the predominantly agricultural employees. Those employed in administration and clerical jobs do not fare much worse than those in trade. There are both positive and negative differences across regions, but these are mostly minor except in the north central. There are also no significant regional differences in the welfare of those employed in administration and clerical jobs relative to those in trade. Relative poverty among employees in the services subsector is much higher in three geopolitical regions (south south, south west, and north-west) and (marginally) lower in the other three.

Worsening relative poverty is deepest and most pervasive among agricultural employees – being most significant and covering the widest range of regions. In fact, poverty among agricultural employees was significantly worse in nearly all regions (except south west and north central). The south east, north east and north-west were the most heavily affected. In effect, the sector of employment most significantly affected by rising poverty is agriculture – and this cuts across two-thirds of all regions in the country. Meanwhile, in nearly all regions, agriculture is the highest employer of labour. It is only in the south west and north central that agricultural employees seem to have managed to hold favourable income relative to sales employees. It is worth noting that states in the north central region, particularly Benue and Kogi states, have retained their status as the food basket of the nation for a very long time. Taking into account the fact that agriculture employs more than half the labour force in the country, it is not difficult to see why growth has not been pro-poor over the period under consideration. Whatever growth that fails to impact on agriculture would have left out more than half the entire labour force in the country. Where such growth is skewed against agriculture, as available data seem to indicate has been the case, it favours only a small proportion of the working population and the gains from it are very unevenly distributed among the population. Agriculture lost share in GDP significantly between 1970 and 1997 before it marginally gained 2 percent of GDP between 1997 and 2009. All this while, it was not losing share in employment by nearly as much. The implication is that the sector continues to employ nearly the same proportion of persons, but these persons continued to lose income to other sectors. In fact, in absolute terms, factoring in the impact of rising population, total population engaged in agriculture has actually been increasing over time, yet there has been little improvement in either the size of total income that accrues to them or their share of total national income. When this is the experience of more than half the labour force, then neither rising poverty nor skewness in income distribution is difficult to understand.

Relative poverty in the production and transport sector is also much higher than in sales group in four regions – the same number of regions as were affected in agriculture. The difference is that they are not nearly as deep (significant) as the relative poverty in agriculture. The regions where relative income was negative was also nearly the same as those affecting agriculture except that in the place of south south, the south west completes the number. Relative poverty among this group was not as bad in the south south and north central. Manufacturing employees also fared relatively worse (marginally) in three of the six regions – the south east, south west and north central. Again, as in the production and transport group, the impact is not as deep as in agriculture. They seem also less pervasive. This group performed marginally better in the south south, north east and north-west, with the strongest relative welfare performance being in the north east. Again, this might indicate generally lower manufacturing intensity in the concerned regions than in the rest. For example, the proportion of manufacturing employees in the north east is relatively low compared to such regions as the south west and south east. The north east has some concentration of manufacturing, but relative to the overall population and size of the region, manufacturing penetration is still small. In effect, manufacturing employees are relatively very poor in the regions with the bulk of manufacturing concerns with the exception of the north-west.

5.2.3 Education and Regional Poverty

The benchmark group for estimating impact of education across the regions consists of those with tertiary education. Results from the regressions show that relative to this benchmark group, virtually all other groups performed worse. This result remains consistent across all regions and for all education qualifications as shown in Table 4. The only variations are in the level of significance of the coefficient estimates in different groups in different regions. The results consistently indicate that across all regions, the most significantly backward group consists of those without any education at all. The level of significance of the coefficients for this group remained the highest and most consistent across all regions. Relative poverty (compared to the benchmark group) among the rest of the groups is also high. In very few cases, the coefficients are less significant than the rest as is the case among those with elementary education in the south west and north central and those with primary education in the north east. In effect, the impact of education on relative poverty in the country cuts across regions with only minor variations in coefficient.

Table 4: Relative Poverty for Academic Qualifications– Benchmark = Tertiary Education

	South South		South East		South West		North Central		North East		North West	
Level of Education	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z
None	-0.949	-6.68	-0.811	-4.27	-0.559	-4.87	-0.737	-7.2	-0.934	-5.6	-1.202	-6.76
Elementary	-0.576	-1.83	-0.974	-3.54	-0.497	-1.41	-0.475	-1.58	-1.444	-3.14	-1.021	-3.55
Primary	-0.721	-4.53	-0.715	-3.58	-0.545	-3.05	-0.299	-1.89	-0.357	-1.57	-0.455	-1.81
Secondary	-0.674	-5.22	-0.499	-2.76	-0.383	-3.77	-0.543	-5.52	-0.600	-3.58	-0.564	-3.17
Others	-0.319	-1.8	-0.688	-3.02	-0.182	-1.21	-0.254	-1.95	-0.740	-4.27	-0.915	-5.15

Source: Authors' estimates

6. Conclusion

This paper sets out to evaluate the pro-poorness of growth and factors that affect poverty in Nigeria. Pro-poor growth was analyzed using the 1996 General Household Survey and the 2004 National Living Standards Survey while analysis of determinants of poverty was with the 2004 NLSS only. All three methodologies used to assess the pro-poorness of growth in the country are consistent in indicating that growth has not been pro-poor. The study also found that poverty in the country is affected by both micro and macro variables. At the micro level, major demographic indices of the household like education, family size, sex, location of the household and age of the household head affect poverty significantly. Some of these micro factors like education, household size, and location of the household fall into categories that can be affected by decisions of members of the family, but others like sex of the household head are not easily amenable to policy. Sex is a critical factor only in one region – the north-west and only marginally in the rest of the regions. But there are also macro variables that affect household poverty prominent among which is the sector of employment. The Nigerian economy has evolved and transformed over the last two decades and some sectors have grown while others shrank. It was found that those engaged in trade has been significantly better off than employees in most other segments of the economy. Agricultural employees have performed poorly alongside those in industry, manufacturing and other services. With the bulk of the labour force being in agriculture, it is then not surprising that overall growth has not been pro-poor.

So what could be done about poverty in Nigeria? It must be appreciated that one of the biggest challenges is a demographic transformation, particularly in the north where family sizes are relatively large. It is important that significant resources be committed to enlightenment of the populace in these areas to the dangers of massive family sizes that stretch resources and make capital deepening and investment in the child extremely difficult. Presently, this is interacting with the poor education factor to create unsustainable situations where children go into adulthood without any care or useful investment made in their lives, thus reducing their overall relevance to the economy. Such enlightenment programmes have to be the combined effort of government, the civil society (including traditional institutions) and development partners in the country.

But in addition, the challenge of rural development has continued to come to the fore. Agriculture, which has been the traditional employer in the rural areas, is not growing fast enough to catch up with the income need of those engaged in it. Agriculture continues to be predominantly rain-fed, with rudimentary technology that cannot even guarantee preservation of harvests up to the point of sales. As such, even when weather conditions are good enough to result in high yields, farmers could still incur significant post-harvest losses. Infrastructure in much of the rural areas is anything but attractive. Frustration with these limitations accounts for the large rural-urban migration that continues even where there is sufficient guarantee that life in the urban areas could be more difficult for households. Interestingly, rural poverty and agricultural poverty challenges are interlinked and can be solved by marginally improving conditions in the agricultural sector and placing some safeguards against price and storage losses for farm outputs.

It is also necessary to pay attention to the regional distribution of factors of production, growth and employment. It has become imperative that policies put in place for dealing with poverty demonstrate understanding and therefore incorporate sectoral and regional diversities of growth, employment and poverty. In addition to the demand-driven measures consistently pursued by successive administration to tackle poverty, some attention needs to be paid to supply-side constraints that affect the poor more stringently than the rich across sectors and regions. Specifically, the role played by oil in sectoral employment and value added needs to be once again evaluated. The Nigerian economy need not be an oil economy that cripples productivity in other sectors as has been the case over the years. Minor improvements in policy attention to the real sector (especially agriculture and manufacturing) can yield huge differences in income for a large proportion of workers. Clearly, there is need for region-specific policies addressing the peculiarities of poverty in the different parts of the country. For example, decades of experiences shows the north would have done better depending on the groundnut pyramids of the 1960s than it has done depending on oil. It is therefore not enough to pursue one-size fits all poverty reduction policies for the entire country. While it is not realistic to advocate a return to the pre-1970 agricultural system, poverty policies have to identify supply-side sectors that can absorb the teeming young population of the country and reduce poverty among them. Four decades of hand-outs and sharing of oil revenue have proved inadequate in handling the complicated poverty issues in these parts of the country. Clearly, the government cannot continue to ignore the uneven spatial distribution of factors of production as well as other differences in development indices between southern and northern Nigeria if it is to promote speedy growth.

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