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Joint Audit and Accuracy of the Auditor's Report
An Empirical Study

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Abstract

This study examines the effects of a joint audit on auditor's report consensus and accuracy. We investigate whether a joint audit, particularly the report issued, improves an audit's quality. We measure the audit's quality using the degree of auditor consensus in the auditor's report. We also use an expected opinion, which we believe is appropriate in the defined circumstances, as a scale for the measurement of the report's accuracy. Participants in the study were statutory auditors from Austria and Germany. At present, manners of improving audit quality and auditing decisions are being intensively discussed in the European Union and everywhere in the world. The joint audit approach is a very current topic in this discussion. Regulators and standard setters are extensively examining the benefits of various audit approaches. Nevertheless, in most countries, the joint audit approach is still utilised on a voluntary basis and is not very common. Our study provides evidence that auditors who use a joint audit approach achieve higher consensus and greater accuracy. In light of current discussion on improving the quality of audits by implementing new methods and regulations, these results are significant for both auditing practice and audit research. Despite this importance, there are very few studies and little research on improving quality through the use of a joint audit approach. Our results demonstrate the need for further investigation of the determinants of audit performance when using a joint audit approach. Using a case study research design and an interview, we draw conclusions and discuss necessary future research.

Keywords: Audit quality, Auditor's report, Consensus, Empirical study, Joint audit

JEL Classification: C12, M40, M42

1. Introduction and Background

Criticism of the audit profession that resulted from the recent spate of business and financial scandals has had a major impact on regulators' activities worldwide. Auditing

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failures have produced significant changes to auditing methods. One recent audit trend is an increased focus on strengthening audit quality, especially in terms of improving the auditor's report (consistent with Benston and Hartgraves, 2002; Francis, 2004; Knechel, 2009).

The auditor's role, position and liability and the rules governing audits within the European Union have been subject to differing regulations in the member states. The increasing number of significant financial failures has led to a call for the harmonisation of audit regulations. Even before the audit directive[1] – a result of the harsh criticism of the audit profession in general and the Sarbanes-Oxley Act in the U.S. – several European Union-level regulations existed. In an effort to address essential concerns, the European Commission issued the audit directive, which achieves only minimum harmonisation at the European Union level because member states are allowed to add national stipulations. In addition to many new regulations, such as audit reporting or transparency report requirements, national and international standard setters and legislators continue to attempt to find new methods[2] of improving the audit process and the audit report.

The recent scandals have demonstrated that auditor independence is a very important factor for audit quality. Auditor independence can be defined as an auditor's freedom from those pressures and other factors that compromise or can reasonably be expected to compromise an auditor's ability to formulate unbiased audit judgments. The Sarbanes-Oxley Act and the European Commission's directive[3] prohibit an auditor or an audit firm from performing an audit if there is any direct or indirect financial, business, employment or other relationship, including the provision of additional non-audit services, between the auditor, audit firm or network and the audited entity that would cause an objective, reasonable and informed third party to conclude that the auditor's or audit firm's independence is compromised. If auditor's (or audit firms) independence is threatened by self-review, self-interest, advocacy, familiarity, trust or intimidation, safeguards must be applied to mitigate these threats. If the threats are still significant despite safeguards and independence is compromised, the auditor or audit firm may not perform the audit.

For example, obligatory internal or external rotations are methods of improving audit quality. Internal rotation is widely used around the world. However, the European Commission explicitly rejected the concept of external rotation up to the last year[4] because there appear to be no indications that it would improve audit quality. An analysis revealed that external rotation is considered a quality safeguarding measure in only a few states, whereas internal rotation is common in most countries. There is no scientific evidence that rotation duty influences the auditor's quality and judgment, and any discussion is based

[1] Therefore, see European Union, 2006, as well as the European Green Paper "Audit Policy: Lessons from the Crisis", published in October 2010.

[2] For examples of new audit approaches – Fee, 1996; Ferlings et al., 2007; Ferlings et al., 2007a.

[3] For further details, see European Union, 2006.

[4] Since November 2011 there are two new proposals for strengthen the audit, see *European Commission* KOM (2011) 778/2 and KOM (2011) 799/4

on suppositions. There is still little empirical and scientific research proving that rotation obligation has a positive influence on audit quality and the auditor's report.

Another method of improving audit process quality is to perform audits in compliance with the International Standards on Auditing (ISAs). ISA 220 and International Standard on Quality Control (ISQC) 1 stipulate that audits and audit firms shall be subject to a system of quality assurance, which will also result in higher audit quality. Under ISQC 1, an audit firm has an obligation to establish a system of quality control designed to provide it with reasonable assurance that the firm and its personnel comply with professional standards and regulatory and legal requirements and that the auditor's reports that the firm or engagement partners issue are appropriate in the circumstances. According to ISA 220, the engagement team should implement quality control procedures that are applicable to the individual audit engagement. For audits of listed entities' financial statements, ISQC 1 and ISA 220 further require that audit firms establish an engagement quality review that provides an objective evaluation of the engagement team's significant judgments and the conclusion reached in formulating the report.

These examples represent some of the policies that have resulted from the current audit and auditor regulations. In addition to many other regulations, such as those that require audit reporting and transparency reports, national and international standard setters and legislators are constantly searching for new methods to improve the quality of financial statement. The objective of all these new policies is to strengthen audit quality and the auditor's report by implementing new regulations concerning the auditor's independence (for example rotation) and the audit process[5].

Joint audits are also being discussed in this context, but the joint audit approach is not mandatory in most European Union member states. In the recent European Green Paper[6] the joint audit approach is one of the proposals to strengthen the statutory audit. Even if the two November 2011[7] proposals for regulation of the quality of public-interest entity audits and a directive to enhance the single market for statutory audits do not mandate joint audit standardisation, they are highly recommended by the European Commission. In France, all publicly listed companies that prepare consolidated (group) financial statements are required to be jointly audited by two independent auditors. Therefore, the question regarding whether a joint audit can be seen as a quality improvement measure arises. The term "joint audit" is used to describe a situation in which two auditors who are collectively assigned to plan and perform the audit, including the interpretation of the results of audit procedures, complete the engagement and issue an audit opinion. In the current literature, the term "audit group" is used when two auditors appear to jointly resolve a specific problem, for example. However, this concept is not equivalent to a joint audit. The aim of this research project is to determine whether a joint audit contributes

[5] For example, the adoption of the ISAs or the implementation of a quality assurance system.

[6] Especially in the Green Paper "Audit Policy: Lessons from the Crisis" (published in October 2010).

[7] For the new proposals, see European Commission KOM (2011) 778/2 and KOM (2011) 799/4.

to audit quality. To address this question, a case-based empirical study, combined with an interview and observation, is used. This methodology is chosen because case study research is extremely useful for raising questions, highlighting issues, developing and testing theory, and providing guidance for solving problems (consistent with Dopuch et al., 1989; Cooper and Morgan, 2008). Prior studies have revealed that cases can be selected for the purpose of understanding discontinuity and disequilibrium, whereas studies employing large samples tend to assume temporal stability and emphasise equilibrium. This difference implies a crucial advantage of the use of case studies (Cooper and Morgan, 2008; Yin, 1989; Schön, 1983). For example, Schön (1983) argues that case studies are valuable to the "entire process of reflection in action, which is central to the "art" by which practitioners sometimes address situations of uncertainty, instability, uniqueness and value conflict".

2. Related Research

All new regulations and standards worldwide have the aim of improving audit quality (FRC, 2006) and, consequently, the audit report. However, the joint audit approach is rarely mentioned in this context[8]. In the literature to date, the joint audit has only been mentioned in cases in which the auditors needed to possess specialised knowledge. In these cases, auditors with different areas of expertise are responsible for different parts of an audit. Whether a joint audit, in which both auditors have the same qualifications and are jointly responsible for the audit, increases audit quality has not yet been empirically tested.

No empirical studies of joint audits exist. Only the study "Assessing France's Joint Audit Requirement: Are Two Heads Better than One?" (this remark refers to Francis et al., 2006) has addressed the topic. This study was presented at the 2006 International Symposium of Audit Research. Its primary research question asked "whether higher quality auditing occurs in France when there is information asymmetry arising from the separation of ownership and control, as argued in agency theory literature and, secondly, whether auditor choice has an observable effect on the quality of reported earnings in France". The authors conclude that they do not know if the joint audit requirement in France is more efficient or effective than the standard audit approach used in the rest of the world (this remark refers to Francis et al., 2009).

Hardly any studies of joint audit effects exist, but many studies have demonstrated that group judgment is superior to that of individuals (for example, Einhorn et al., 1977; Solomon, 1987; Rutledge and Harrel, 1994; Maines, 1995; Gigone and Hastie, 1997). However, furthermore, there are numerous studies that examine group decision-making quality (versus individual decision-making quality) or various elements of group decision making per se in accounting settings (for example, Uecker, 1982; Trotman et al., 1983; Bloom et al., 1984; Daroca, 1984; Trotman, 1985; Kiesler and Sproull, 1992; Libby and Luft, 1993; Scott and Tiessen, 1999; Hunton, 2001; Kotchetova and Salterio, 2007). Most

[8] Consistent with IDW, 2002. First discussion in the Green Paper "Audit Policy: Lessons from the Crisis".

of the published research on audit judgment and decision making has utilised one or more of the "standard" theoretical frameworks employed in nonaudit judgment and decision making studies (for example, Choo, 1989; Choo and Trotman, 1991; Ashton and Ashton, 1995a; Gibbins and Swieringa, 1995; Libby, 1995; Messier, 1995; Solomon and Shields, 1995; Bonner et al., 1996). Because a joint audit entails a two-person decision, high audit process quality can be expected to have positive effects. We use multiperson information processing theory along with the evaluation criteria consensus and accuracy as the theoretical framework for our research[9].

Solomon (1982 and 1987) conducted a similar study. She investigated the extent to which individuals and groups of auditors assess similar subjective probabilities. Subjective probability judgments of financial statements account values provided by individual auditors were compared with those provided by three-member auditor groups interacting within different structures. Consensus, calibration, and extremeness were employed as evaluation criteria. The results were mixed, with group judgments consistently exhibiting greater consensus and extremeness and individual judgments exhibiting superior calibration. Although a variety of evaluation criteria is used, consensus has been one of the most common criteria in audit judgment and decision making studies. Consensus is a fairly quality surrogate for accuracy in accounting tasks (Davis et al., 2000; Keasey and Watson, 1989; Ashton, 1985).

Hasnah (1996) and Libby and Lewis (1982) state that certain criteria are needed to measure the accuracy of auditors' judgment. However, these criteria do not tend to exist in auditing. Because the auditors are required to possess particular qualifications and undergo similar training in the auditing field, they are expected to have similar opinions on certain matters. Thus, consensus is often used as a measurement of audit opinion accuracy (for example, see Haron et al., 2009; Pincus, 1990). Consensus can be measured by correlating the mean ratings of a pair of subjects at the same point in time. A high level of consensus may be used as a surrogate for the accuracy of a decision (Keasey and Watson, 1989). If the level of consensus among auditors is low, the authors conclude that the auditors' decisions are less accurate (Libby and Lewis, 1982).

The purpose of an audit is to enhance the degree of intended users' confidence in financial statements. This enhancement is achieved through the auditor's expression of an opinion regarding whether the financial statements are prepared, in all material respects, in accordance with an applicable financial reporting framework. In the case of most general purpose frameworks, that opinion regards whether the financial statements are presented fairly in all material respects or provide a true and fair view in accordance with the framework. Auditing standards require the auditor to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, as the basis for his or her opinion.

Because of our awareness of the presence of accounting fraud in our case materials, we also use an expected opinion, which we believe is appropriate in the defined circumstances,

[9] For other audit quality indicators, see Bedard et al., 2010.

as a scale for measuring report accuracy. Because the case includes fraud, we determined that a qualified audit report is accurate in the given circumstances.

Finally, we argue for accuracy and consensus in terms of auditors' frequent verification of their judgments and decisions through requests for advice from colleagues. For example, when evaluating a potential client, an auditor may ask another auditor or colleague for an opinion on the likelihood of the presence of material errors in the company's financial statements. If the two auditors disagree, they know that at least one of them is incorrect. However, if the two agree, they typically will presume that they are correct. Therefore, the requirement stated in the International Standard on Auditing (ISA) 220 constitutes another argument. For special engagements, this standard requires an engagement quality control review that provides an objective evaluation of the engagement team's significant judgments and the conclusion reached in formulating the report. The aim of this requirement is a third person's objective review and its assurance that all decisions are appropriate. A decision accepted by the auditor and the quality control reviewer is a good (better) decision.

Therefore, we use consensus and accuracy as criteria in our study.

In a joint audit, two auditors from different auditing companies share a mandate and must reach consensus regarding the audit opinion. They work together as the responsible auditor, according to the legal requirements. The audit's result is the two auditors' shared audit opinion. In practice, the company contracts two auditors, from different firms, who divide the auditing tasks and jointly review each other's work (consistent with IDW, 1999). In English-speaking countries, a joint audit can be understood differently: a joint audit can also be a cooperative effort between internal auditors and external auditors or between an auditor and a tax consultant (consistent with Moore and Hodgson, 1993). A joint audit is not comparable to an engagement quality review process because with the joint audit, the auditors originate from different auditing companies and the audit procedures are performed by both auditors. In contrast, the engagement quality reviewer is a partner, another person in the firm, or a suitably qualified external person, not part of the engagement team, who has sufficient and appropriate experience and authority to objectively evaluate the engagement team's significant judgments and the conclusions it reached in formulating the auditor's report.

It can be suggested that the joint audit approach strengthens the auditors' independence by providing further opportunities to express conflicting opinions (consistent with Rödl, 2002; Rufin, 2003; 2005). Joint audits may also improve the quality of the audit and the reports issued because of broader technical expertise. Joint audits can counteract companies' tendency to be aggressive towards their auditors. The quality of work may also be higher because one auditor might detect misstatements that the other auditor missed. Furthermore, the joint audit's preventive effect may have been underestimated until now. Another advantage of the joint audit could be that each of the auditors may have an area of internal specialisation. Increased quality assurance, as well as quality improvement, is likely to offset the higher costs (the use of two auditors results in more time for decision making) that a joint audit incurs. Increased costs are the most commonly cited objection to

joint audits. Differences in the auditors' opinions can lead to disagreements and even block decision making in certain circumstances. The tendency to be insufficiently detailed if one auditor relies on the work of the other, although this practice is not allowed, constitutes a structural danger. Joint audits have only been used in a few countries, but they appear to be a logical solution, both technically and ethically. Although joint audits exist in both the UK and the U.S., they are currently mandatory only in France, for all publicly listed companies. They are still unusual in Austria and Germany, although a few major groups, such as banks and insurance companies, have been appointing two auditors through their own initiative for years. This scarcity is applicable in other European countries, where only some companies conduct joint audits. A joint audit is essentially conducted in the same manner as a single audit, but the monitoring process between the two auditors, as well as the discussion of audit findings, is of particular importance. Based on the literature review, we conclude that very little research exists on the joint audit and, as a result, that little is known about the impact of a joint audit on the audit process, the audit report, and audit quality, for example. Therefore, our research question arises as described below.

3. Study

3.1 Research Question

This research project examines the following question that arises when exploring this issue: *Does a joint audit lead to an auditor's report that is more accurate than that produced by a standard audit of financial statements?*[10]

The accuracy of the auditor's report is measured using the degree of consensus between auditors in the auditor's report. We do not discuss theories related to group decision making or, more specifically, the audit review process[11].

3.2 Hypothesis Development

In a joint audit, important decisions cannot be made by a single auditor; this method reduces the risk of mistakes. Concentrating the attention of two auditors shall increase both problem solving efficiency and the quality of the results. The auditor's responsibilities must not be separated, and one auditor is not allowed to rely on the other's work. Therefore, an essential characteristic of the joint audit is the auditors' provision of intensive mutual supervision.

Together, the auditors should plan and perform an audit with an attitude of professional scepticism, recognising that circumstances may exist that cause the financial

[10] This research project was accepted as a dissertation at Innsbruck University (Severus, 2007).

[11] For examples of such theory development, see Trotman et al., 1983; Guzzo and Salas, 1995; Rich et al., 1997a; 1997b; Gibbins and Trotman, 2002.

statements to be materially misstated. Furthermore, both auditors should plan and perform the audit in a manner that reduces audit risk to an acceptably low level that is consistent with the objective of an audit and plan the audit in a manner that allows the engagement to be performed effectively. Planning an audit involves the establishment of an overall audit strategy for the engagement and development of an audit plan to reduce audit risk to an acceptably low level. The audit strategy establishes the scope, timing and direction of the audit and guides the development of the more detailed audit plan. Planning also involves both auditors and other key members of the engagement team so that their experience and insight can be beneficial and the effectiveness and efficiency of the planning process can be enhanced. During the audit planning process, the extent, nature and timing of audit procedures will also be discussed. According to the high degree of supervision, these activities in the joint audit process should be of higher quality. As a result, we expect that the high degree of mutual supervision during the joint audit should lead to higher opinion consensus. Thus, our first hypothesis is as follows:

H_I: Ceteris paribus, mutual supervision leads to no difference between a joint audit and a standard audit in terms of audit opinion consensus.

The second fundamental characteristic of the joint audit is the possibility and the necessity of intensive discussion between the auditors regarding audit findings. Both auditors should perform procedures to obtain sufficient appropriate audit evidence that the work of the other auditor is adequate for the audit's purposes. Before the auditors' report and their joint opinion is issued, through review of the audit procedures performed and documentation, as well as discussion with the other auditor, both auditors should be satisfied that sufficient, appropriate audit evidence has been obtained in support of the conclusions reached and the issuance of the auditor's report. The auditors should both obtain sufficient, appropriate audit evidence (also, from the work that the other performs) for the drawing of reasonable conclusions on which to base their joint audit opinion. Therefore, a high degree of communication between the auditors involved and intensive discussion of audit findings might be necessary. Because of the intensive exchange of audit findings and high degree of discussion between the auditors involved, the audit process and the audit report issued should be of a higher quality. Therefore, we expect that a higher consensus in the audit opinion should be reached when a joint audit approach is used. Therefore, our second hypothesis is as follows:

H_{II}: Ceteris paribus, intensive discussion of audit findings leads to no difference between a joint audit and a standard audit in terms of audit opinion consensus.

The first hypothesis refers to the effects that a joint audit has on the audit opinion because of a more qualitative audit planning process and evidence-gathering process. The second hypothesis examines the effects that the necessity of jointly issuing an audit opinion has on the audit report.

3.3 Research Design and Adopted Methodology

The empirical research was conducted through the use of a case-based experimental study in combination with an observation and an interview. It is very difficult to explore the impact of a joint audit on audit opinion if one considers the entire audit process. Therefore, we developed a specific case study, which allows for exact understanding of the auditors' discussion and communication process and allows for the assessment of the detected audit findings' effects on audit opinion.

Before we conducted the research, we performed a pre-test (test run). A pre-test was necessary, especially so that we could test our questionnaire and our observation guideline. Using the pre-test, we gained useful insight into the documents used for our case-based research and were afforded the opportunity to clarify ambiguities in the different formulations and technical issues. After the pre-test, we discussed criticism and suggestions for improvement and included useful suggestions in our final research. The pre-test was performed with 10 participants, who did not participate in the final study.

Because of the methodology's complexity, only the use of a small examination group is possible. In our case-based study, the participating auditors were divided into two groups. The single auditor group consisted of twenty-three auditors. Twelve auditors participated in the joint audit group. The auditors were employed by different audit companies. In total, thirty-five auditors participated in the study. The auditors were given a case study that included a short financial statement (a consolidated balance sheet and consolidated statements of income). In the case study, a summary of the audit decisions made during the financial statement audit was provided. The case focuses on the audit work performed with regard to the sales/accounts receivable cycle. Among other increases, the represented information revealed a high increase in sales. The purpose of the summarised information was to develop the auditor's ability to recognise problems and provide solutions related to audit risk procedures, audit planning, internal control, materiality, and audit evidence. The auditors were then asked to assess the audit work performed and identify deficiencies. The study utilised only one case study but was performed in two manners.

- In the first group (single study), the individual auditors had to provide their own opinion on the basis of the information in the case study. On an answer sheet, they also had to mark the information that they would have discussed if the audit had been a joint audit.
- In the second group (joint study), two auditors worked together. They had to discuss the audit process steps that were included in the case study, and they had to explain which audit procedures and audit evidence they would or would not have used. Through this method, we observed the mutual supervision, discussion and corporation exhibited between the two participating auditors. On the basis of the case study and the discussion, each pair then had to jointly decide which opinion is appropriate. Their answer sheet was slightly different because they had

to define the extent of their discussion concerning mutual supervision. As part of the observation, they were also asked about their personal opinions. We were interested in differences between the personal opinions and the joint opinions of joint audit group members. With regard to this issue, the effect on the consensus criterion can be better assessed.

The difference between the two studies is that in the single auditor group, each of the auditors had to formulate his or her personal opinion and, in the joint audit group, two auditors had to formulate an opinion together. These two studies provide information on whether the results that auditors arrive differ according to whether they utilise a standard audit or a joint audit. Finally, we expected the auditors to judge the given information in the form of a modified audit opinion. The case study was designed in such a manner that we believe that a qualified audit opinion should have been issued. Additionally, drawing on the literature, in accordance with a general understanding of an accurate opinion,[12] we determined that an opinion appears to be appropriate when most of the auditors come to the same conclusion (consensus).

After the case study, members of both groups were asked to provide some demographic data, including audit experience, qualifications, size of the firm for which they work and previous experience in joint auditing. The purpose of the interview was to obtain information on the auditors' perceptions of and experiences with joint audits. We needed this additional information to verify the results of the case study and the interview. In addition to the case-based study and the interview, an observation was conducted. The observation provides information in addition to the results of the case-based study and the interview. We intensively observed the discussion between the auditors and their cooperation. The evaluation of the results of the case-based study and the interview, according to our two hypotheses, are provided below.

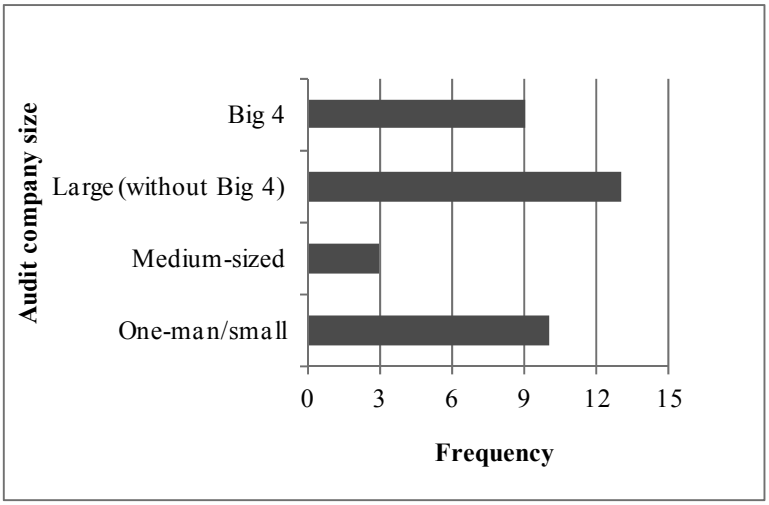
3.4 Results

3.4.1 Sample and Descriptive Analysis

Before the results of statistical analyses are provided, the sample used for the study is illustrated and initial descriptive analyses are conducted. As stated above, thirty-five auditors participated in the study. The study was conducted in 2007. The participating auditors were from audit companies of various sizes in Austria and Germany. More than half of the auditors were working for Big 4 or other large audit companies.

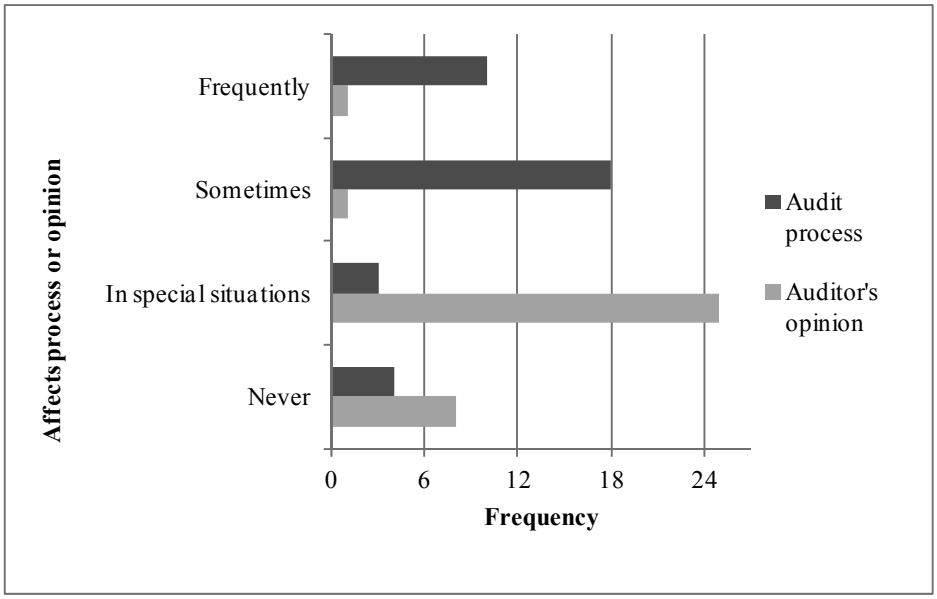
[12] For a general understanding of an accurate opinion see Davis et al., 2000.

Figure 1: Participating auditors were from audit companies of different sizes



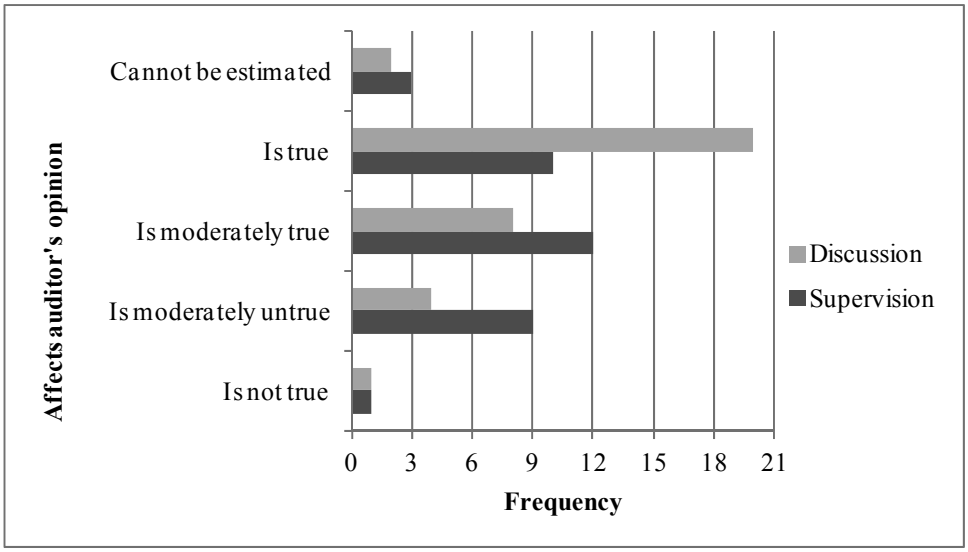
Only certified public accountants were allowed to participate in the study. The mean number of years of audit experience among the participating auditors was approximately fifteen, with a standard deviation of approximately nine years. The minimum amount of audit experience was three years; the maximum was forty. When asked about their previous joint auditing experience, nineteen of the auditors – more than half of all participants – said that they had already conducted a joint audit, although it is not mandatory in Austria or Germany. Only sixteen of the participating auditors have never conducted a joint audit before. Most of the auditors (53%) had a neutral attitude, stating that their experience in joint auditing was neither positive nor negative. Only 20% had a negative attitude. The reasons for the negative attitudes were different in nature. The most common causes of the negative attitudes were the increased costs of joint auditing and the high discussion level between the auditors that is required. In this context, the analysis of responses to the assertion that a joint audit costs more than a standard audit of financial statements revealed that most of the participants (approximately 90%) expected higher costs if two auditors were involved in the audit process. Only 6% did not observe increased costs when conducting a joint audit. For most of the participants, the higher costs are economically justifiable. Responding to questions on the interview, approximately 80% of the participants said that a joint audit sometimes (51%) or frequently (29%) influences the audit process. Most of the interviewed auditors stated a belief that a joint audit very often influences the manner of auditing. In contrast, an influence on the auditor's opinion is primarily observed only in special situations (72%). The following figure illustrates the auditors' points of view.

Figure 2: Effect of a joint audit on audit process and auditor's opinion



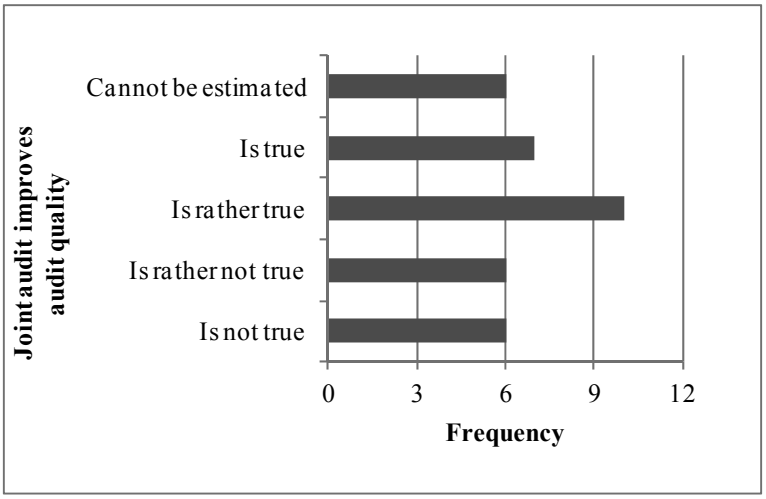
Frequent discussions and a high degree of communication are typical characteristics of a joint audit. Approximately 66% of the participating auditors stated that discussion and communication were high for all audits, not only in special cases. Approximately 30% of the interviewed auditors observe high levels of discussion and communication during a joint audit in special cases. Whether the high discussion and communication levels of a joint audit are viewed as positive or negative is illustrated in the next figure. Most of the participants agreed with the assertion that the mutual supervision of the audit planning process and the audit procedures in a joint audit improves the quality (accuracy) of the issued audit opinion. Most participants also agreed that the discussion between the auditors in a joint audit has a positive influence on the audit process and the audit report issued. The following figure presents and compares the effects of discussion and supervision on the auditor's opinion.

Figure 3: Discussion and Supervision affect the auditor's opinion



A more detailed analysis of the effect of discussion and supervision on the auditor's opinion, as viewed by the participating auditors, is shown in figures 6 and 8. The analysis of the assertion that a joint audit is a suitable quality assurance instrument demonstrates that the participants' views varied widely.

Figure 4: Joint audit improves audit quality



The descriptive results have demonstrated that the participating auditors observe some positive effects when conducting a joint audit. Next, we want to analyse if there is indeed a positive effect.

3.4.1 Statistical Analysis

Nonparametric tests were computed to test the following two-tailed hypothesis.

H_o:	Mutual supervision leads to no difference between a joint audit and a standard audit in terms of audit opinion consensus.
H_1:	Mutual supervision leads to a difference between a joint audit and a standard audit in terms of audit opinion consensus.

The results of the tests are discussed in the following portion of the paper.

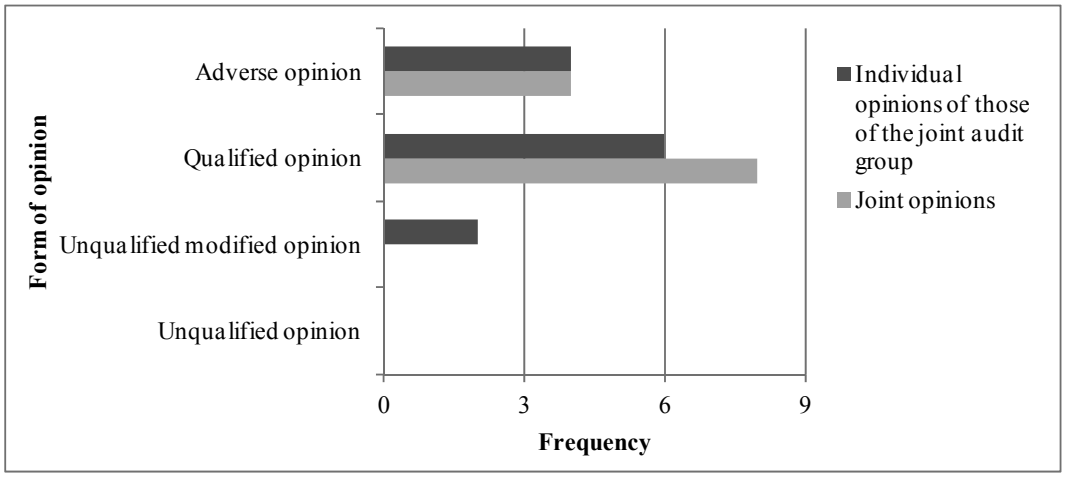
The auditors in both groups were provided with the same information, but the joint auditors also possessed a shared responsibility. This shared responsibility was intensively noted to the auditors at the beginning of the case study. We have observed that the auditors demonstrated strong supervision of one another. Because of these monitoring activities between the joint auditors, the auditors' opinion was expected to be characterised by a higher degree of consensus. We use a between-subjects design, and the subjects are not matched across conditions. The dependent variable (audit opinion) is ordinal scaled, and the independent variable (auditor) has only two levels (joint/single). Therefore, a Mann-Whitney U test is appropriate. The results demonstrate that there are highly significant differences between the mean rank of the single auditors' opinions and the joint auditors' opinions. The joint audit group assessed the information on audit planning and audit procedures in the specific case study much more critically than the single auditor group, and there is much less variety in opinion in the joint audit group. The mean rank of the single auditor group is 14.00; that of the joint audit group is 25.67. Therefore, the joint audit group has judged the information in the case study considerably more critically than the single audit group. The joint auditors have more often issued a modified report. Given that a greater consensus is a generally accepted indicator of an accurate audit opinion, we can state that mutual supervision of audit performance improves the quality of the audit and of the opinion because there is significantly less variety in the audit opinions. Because the exact p-value is lower than the specified level, we can reject the H_0 Hypothesis. Thus, we have sufficient evidence to conclude that the mutual supervision in a joint audit leads to a higher audit opinion consensus. Because we use consensus as a substitute criterion for accuracy, our evidence supports the assumption that a joint audit leads to a more accurate audit opinion.

Using a Kruskal-Wallis test, we investigated further to determine if the auditor's personal opinions had the same rank distribution in the joint opinion. We found that the rank distribution is not the same and that there are significant differences in the rank distribution.

These differences signify that there is further evidence in support of the rejection of the H_0 Hypothesis, in favour of the alternative hypothesis (H_1).

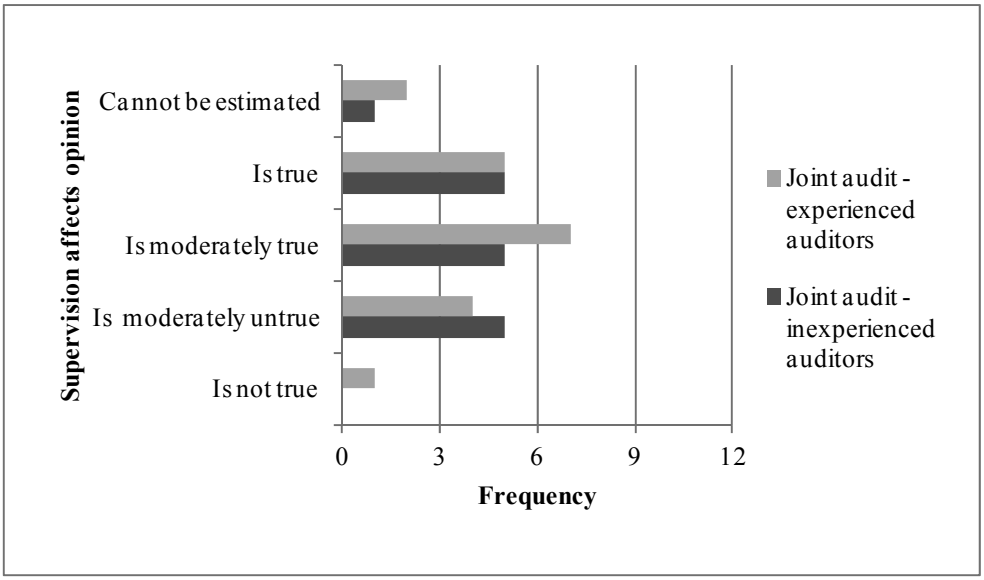
In a joint audit, personal opinions are normally reflected in the joint opinion. To determine if there were any differences between the personal and joint opinions, we asked for personal opinions during the interview. We used a cross tabulation to investigate whether the personal opinions of the joint audit group participants were reflected in the joint opinion. We again found a significant correlation between the personal opinions issued and the joint opinion. The following figure illustrates the change in the diversity of the opinions. The diversity of the personal judgments is greater. When formulating a joint opinion, the form of an unqualified opinion was no longer used. This result was produced by intensive discussion of the audit findings.

Figure 5: From the personal opinion to the joint decision (opinion)



Finally, the assertion that mutual supervision of the audit judgments in a joint audit improves the quality of an audit and the audit opinion issued was analysed in more detail through the use of an interview. The analysis demonstrated that more than 60% of the participants who had already been involved in a joint audit considered the mutual supervision to have a positive influence on the audit process and the audit opinion. The following figure presents and compares the results in terms of the joint audit-experienced auditors' and joint audit-inexperienced auditors' assertions.

Figure 6: Auditor's opinion is affected by supervision



In addition to mutual supervision, we expected communication between auditors and discussion of audit findings to have a positive effect on opinion accuracy. Supervision was measured during the case study when the auditors discussed risk procedures, internal controls and audit findings. The final discussion between the auditors concerning the audit opinion was investigated during a designated phase at the end of the case study.

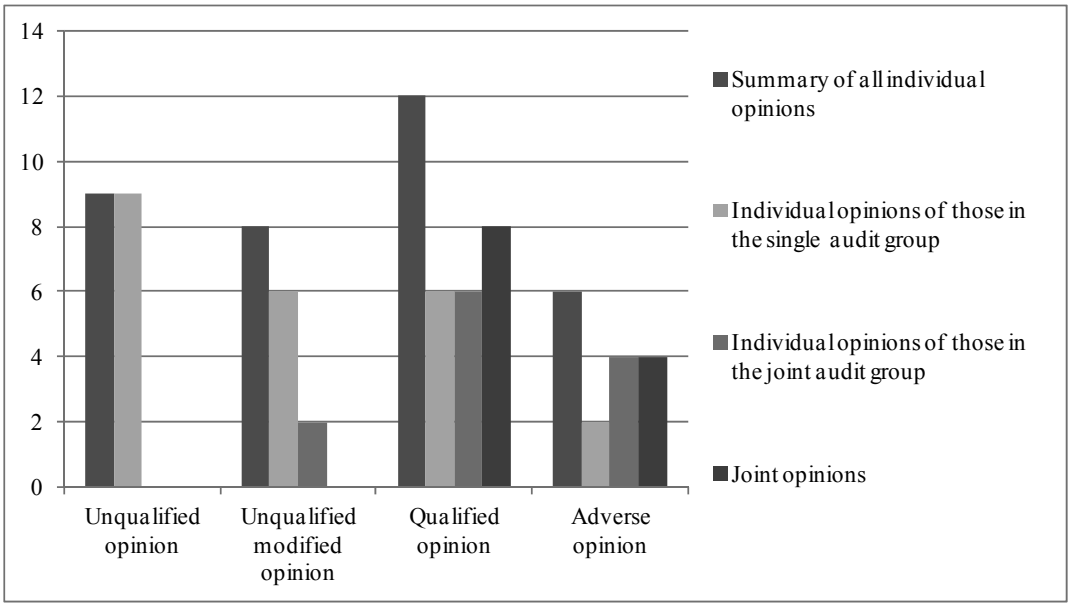
The results of the tests of our second hypothesis are discussed below:

H_0:	Intensive discussion on audit findings leads to no difference between a joint audit and a standard audit in terms of audit opinion consensus.
H_1:	Intensive discussion on audit findings leads to a difference between a joint audit and a standard audit in terms of audit opinion consensus.

We again use a Mann-Whitney U test to determine whether there are highly significant differences in the mean rank between the groups. The results demonstrate very significant differences in audit opinion between the joint audit group and the single audit group. We observed the discussions in the joint audit group and could perceive that these discussions lead to a more critical assessment of the case study information than that observed for the single auditor group. We further find that there was less variety in audit opinions for the joint audit group.

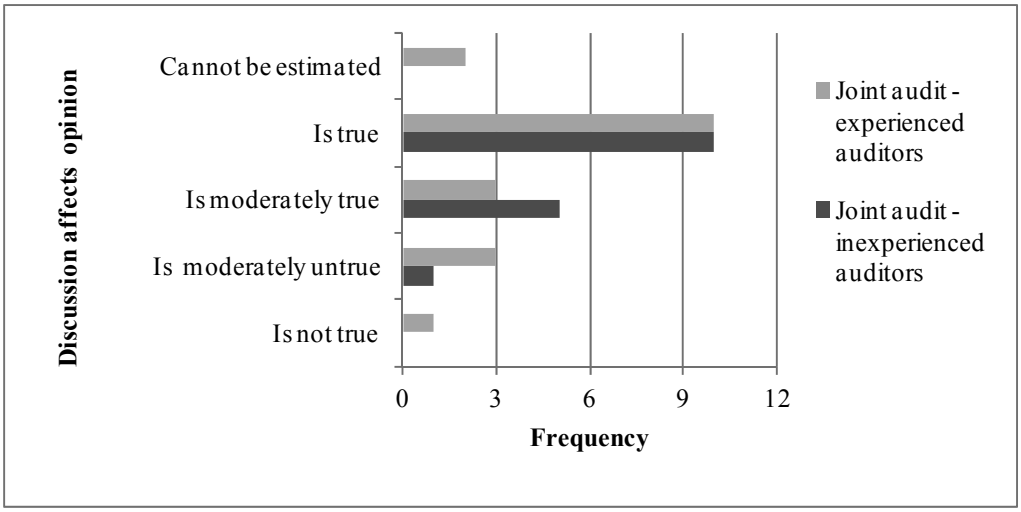
Next, we wanted to determine whether there was any relationship between level of coordination (discussion) and quality of joint opinion. To reach this determination, the level of coordination was assessed twice: once by the participants and once by the study observer. The coordination levels that the joint auditors mentioned and that the observer assessed were identical. Because of the joint audit group's small size, we were not able to analyse this result statistically with correlation coefficients. However, we can perceive that 67% of the joint auditors issued an audit opinion (qualified opinion), which is the opinion that we defined as correct. The next figure illustrates the variety of opinions in the study. As can be observed, the highest consensus is reached in the joint audit group.

Figure 7: Illustration of the variation in auditors' opinions



The results demonstrate that communication at the end of the audit process and discussion of audit findings leads to a more accurate audit opinion. Finally, the assertion that the communication between the auditors involved and the discussion of audit findings in a joint audit improves the quality of the audit opinion was analysed in more detail. We use the interview to analyse this aspect. The results reveal that more than 60% of the participants with experience in joint auditing believe that communication between auditors and discussion of audit findings have a positive effect on the accuracy of the audit opinion. The following figure presents and compares the results for the joint audit-experienced and joint audit-inexperienced auditors regarding this assertion.

Figure 8: Auditor's opinion is affected by discussion



Based on these results, the communication between the auditors and the discussion of audit findings can be viewed to constitute a factor that strengthens the audit report's accuracy.

A limitation of our study can be observed in the small group of participants and the case materials that were used. We believe that case research allows and encourages us to consider our research question, whereas it may not be considered when using other research approaches. We are confident that case research can enhance research on auditing.

Prior studies have demonstrated that case study research is extremely useful but has a number of limitations, as with other research streams (Pentland, 1993). For example, the data are not as extensive as might be desired. There is an increasingly frequent tradition of the use of case studies on audit work and audit firms' operation (for example, Covaleski et al., 1998; Dirsmith and Covaleski, 1985).

Our research focuses primarily on the manner in which an audit is produced. Therefore, a smaller number of participants is appropriate because of the high effort that this research method necessitates. In accordance with former studies, we state that for an initial study on joint audits with a highly elaborate research design, the number of thirty-five participants is all that is possible.

4. Conclusions and Future Research

Auditor reputation has reached a critical point worldwide. There is currently a significant amount of discussion on improving the quality of audits, especially in terms of issued audit reports, through the implementation of new methods and regulations. National and international suggestions regarding reorganisation of auditing focus on ensuring that

auditors are independent of their clients, are highly qualified and perform their work in accordance with high technical standards.

The auditor's judgment process has been subjected to extensive study since Ashton's seminal work in 1974. In general, the results of audit judgment research are consistent with those of prior psychological research. The literature review revealed that much of this research suggests that audit judgment can be improved through the use of decision aids. The purpose of our research was to analyse the effect of a joint audit on the auditor's report. The area of study concerning the joint audit is relatively untouched, in contrast to that concerning general group decision making in accounting, and there has been little empirical research on the joint audit. As Francis et al. (2009) acknowledged in their paper, "…we do not know if the joint audit requirement in France is more efficient or effective than the single audit approach used in the rest of the world".

Examples of case study research in managerial accounting, auditing and financial accounting have illustrated the strengths of case studies for theory development and their potential in terms of the generation of new knowledge. Therefore, a case-based study was used to answer the following research question: "Does a joint audit lead to a more accurate auditor's report than that produced through the use of a standard financial statement audit?" In combination with a standardised interview and a close observation of the participants, the results of our case-based empirical study reveal that a joint audit has a positive influence on accuracy. The accuracy of the audit report was measured using the degree of consensus between auditors in terms of opinion. We also used an expected opinion as a scale for the measurement of the accuracy of the auditor's report.

However, much progress must still occur before sufficient evidence exists that supports a joint audit approach and answers the question regarding under which circumstances a joint audit is superior to a single audit. To move research towards this goal, our research provided evidence that, generally, two auditors working together issue more accurate opinion. Our results demonstrate that joint opinions are more conservative and are indicative of higher quality.

The group used in this empirical study was quite small and culled from the auditing profession in only Austria and Germany. Although audits in these countries are conducted in compliance with the principles of the International Standards on Auditing, there is a clear need for further research using larger, more representative groups and case studies that cover additional aspects.

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Appendix

Experiment instrument and case materials (summarised English translation)

PART I: INTRODUCTION

Company Background

JA Company was incorporated 10 years ago and is a wholesale distributor. JA Company is a growing company that produces special kitchens for commercial kitchens. In previous years, a financial statement audit was conducted. You have been the auditor for the JA Company since 2009. One focus of this year's risk-based audit (2010) is the audit of the sales/accounts receivable cycle.

Financial Data

The company's key financial data for 2009 and 2010 are summarised below (in Euros):

	2009	2010
Sales Revenues	179,886,000	**177,291,000**
Operating Expenses	43,851,000	**43,674,000**
Operating Income	18,372,000	**6,561,000**
Earnings Before Tax	22,317,000	**37,257,000**
Accumulated Profit	67,743,000	**75,081,000**
Profit	87,060,000	**112,668,000**
Total Assets	416,070,000	**526,428,000**

In the following case, a summary is provided of the audit decisions reached for the financial statement audit of JA Company for the fiscal year ending in 2010.

PART II: REQUIREMENTS

The annual audit of the JA Company for the year 2010 has been performed. It is now March 31, and all planned fieldwork has been completed. Assume that you are the auditor responsible and you have the following summarised information available. The aim of the case is to provide a judgment, or issue an audit opinion, for the 2010 financial statement audit.

Therefore, you must evaluate the audit testing process and the audit evidence gathered. Finally, you should make an assessment of the facts and provide your personal (and, if required, your joint) opinion. You can assume that sufficient audit evidence

has been gathered. It is not possible to extend the audit evidence to obtain further audit evidence. Based on the given information, you shall form an opinion regarding whether the financial statement has been prepared in accordance with the applicable financial reporting framework in all material respects.

After the issue of your personal and, if required, your joint judgment, some aspects of the judgment process will be discussed through the use of a questionnaire.

Finally, please provide us with some demographic data and some facts regarding your experience so that conclusions on the results of this study can be drawn.

All information will be processed on a strictly anonymous basis.

PART III: OVERVIEW OF "JA" COMPANY AUDIT

Audit Planning

Planning of the audit involves establishment of the overall audit strategy for the engagement and the development of an audit plan. You and other key members of the engagement team have been involved in planning this audit. You have established an overall audit strategy that establishes the scope, timing and direction of the audit and that guides the development of the audit plan.

In establishing the overall audit strategy, you have:

- identified the engagement's characteristics;
- ascertained the reporting objectives of this engagement to plan the timing of the audit and the nature of the communications required;
- considered the factors that, in your professional judgment, are significant in directing the engagement team's efforts;
- considered the results of preliminary engagement activities and knowledge gained of other engagements performed; and
- ascertained the nature, timing and extent of resources necessary for the performance of the engagement.

Risk Assessment and Planning Materiality

Details regarding the activities of the JA Company, the company's past performance and economic conditions in which it operated are well known and have been assessed.

The JA Company's financial situation have grown rapidly. This growth has occurred because of a financial interest in an associated company during the last three years. The number of employees increased from 80 to 120. The accounting system and the organisation of the company are currently in accordance with the company's increased size. Therefore, an increased control risk can be assumed.

When determining the overall audit strategy, you have determined materiality for the financial statement as a whole and materiality levels for particular classes of transactions, account balances and disclosures, for which misstatements of lesser amounts than materiality for the financial statements as a whole can reasonably be expected to influence the economic decisions of users on the basis of this financial statement. The determination of materiality involved your professional judgment.

Materiality level for the financial statements as a whole is defined using 5% of earnings before tax:

2009:	1,115,850	Euro
2010:	**1,862,850**	**Euro**

Materiality level for particular classes of transactions, account balances and disclosures is defined using 50% of the materiality level for the financial statements as a whole:

2009:	557,925	Euro
2010:	**931,425**	**Euro**

Audit Evidence

Accounts Receivables

The major audit work in the accounts receivable area consisted of the confirmation of customer balances. At year-end, JA Company possessed receivables with a book value of 86.629.000 Euros. Based on preliminary estimates, a random sample of 56% of the book value was selected for positive confirmation.

	2009[13]	**2010**
Book value of all accounts receivables (balance per JA Company)	67,176,000	**86,629,000**
Audited sample (% of accounts receivables)	38,962,080 (58%)	**48,744,820 (56%)**
Balance per audit	38,955,256	**48,735,256**
Differences	6,823	**9,563**

The difference has been discussed with the company. The JA Company is not willing to adjust these differences.

[13] For better information, the sample size and the results of the previous audit are provided.

Furthermore, the accounts receivables include accounts receivables from subsidiaries companies, which have a value of 58,653,000 Euros. Of this amount, 53,653,000 Euros (2009: 26,869,000) are apportioned to trade account receivables and 5,000,000 Euros (2009: 5,000,000) to loans.

In addition to the audited 48,744,820, additional 36,000,000 accounts receivables from subsidiaries companies are audited in connection with the audit of sales transactions.

Sales Transactions

In terms of sales transactions, invoices were randomly selected and audited:

	2009	**2010**
Book value of sales transactions	179,886,000	**177,291,000**
Audited sample (% of sales transactions)	73,834,900 (41%)	**79,241,401** **(45%)**
Balance per audit	73,702,665	**79,089,808**
Differences	132,235	**151,593**

The difference has been discussed with the company. The JA Company is not willing to adjust these differences.

The audit of two additional revenue allocations (not included in the audit sample) regarding affiliated companies, dated on 27.12.2010 and each having a value of 18,000,000, have demonstrated that the claim in this respect on the balance sheet is not accurate, and a need for adjustment is communicated.

This difference has been discussed with the company. The JA Company has fully adjusted these differences.

Provisions

The audit of the provisions has revealed that the account "Other provisions" contains an indemnity bond of 50.000 Euros for a bank loan from a subsidiary company. However, at the time of the audit, the subsidiary company had met all of its obligations on time and in full.

Furthermore, the audit team observed that a currently pending liability case by a customer at 1,752,800 Euros is not considered in the provisions. There is conflicting information from the JA Company management regarding whether a judge will grant the claim substantially. There are no disclosures in the appendix in this regard.

Both audit adjustments have been discussed with the company. The JA Company is not willing to adjust these differences or to disclose these facts.

Other Audit Evidence

The audit of all other classes of transactions, account balances and disclosures have provided confirmatory evidence for the reported values. Only small and negligible adjustments have been observed and are recorded in the summary of audit differences.

Going Concern

In evaluating management's assessment, the audit team has considered whether management's assessment includes all relevant information of which the audit team is aware as a result of the audit. For this evaluation, an automatic early warning system was used. Therefore, the probability of insolvency will be classified as low, medium, high or very high.

According to the audit, the audit team has evaluated the management's assessment of the entity's ability to continue as a going concern and has judged that going concern is very likely. The early warning system indicates that there is a very low probability that the entity's continuation as a going concern will not occur.

Management Discussion and Analysis

The management report is consistent with the financial statement. Other disclosures in the annual report do not provide a false impression of the company's situation.

Management Representations

A written representation from management and those charged with governance has been obtained. The management and those charged with governance believe that they have fulfilled their responsibility for the preparation of the financial statements and for the completeness of the information provided. The date of the written representation is the date on which the auditor received the financial statements for the audit.

Furthermore, as in the case, the JA Company does not desire the inclusion of attached corrections (adjustments to the financial statement).

PART IV: OPINION – SINGLE AUDIT

Based on the given information, please characterise your personal audit opinion:

unqualified opinion	*unqualified modified opinion*	*qualified opinion*	*adverse opinion*
❒	❒	❒	❒

In a few words, document the reasons for your decision.

Other comments:

PART V: OPINION - JOINT AUDIT
(Only relevant for those participants who participate in the joint audit study.)

Based on the given information, please characterise your joint audit opinion:

unqualified opinion	*unqualified modified opinion*	*qualified opinion*	*adverse opinion*
❒	❒	❒	❒

In a few words, document the reasons for your decision.

Other comments:

How did you formulate the joint judgment? Please indicate your personal opinion regarding the coordination effort.

Auditor 1:	**low**								**high**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Coordination effort	□	□	□	□	□	□	□	□	□

Auditor 2:	**low**								**high**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Coordination effort	□	□	□	□	□	□	□	□	□

PART VI: OBSERVATION FORM - FORMING A JOINT OPINION
(This form is only relevant for the study instructor.)

	low								**high**	**n/a**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**
Need for coordination and discussion effort										
• Audit Planning	□	□	□	□	□	□	□	□	□	□
• Risk Assessment	□	□	□	□	□	□	□	□	□	□
• Materiality Planning	□	□	□	□	□	□	□	□	□	□
• Accounts Receivables	□	□	□	□	□	□	□	□	□	□
• Sales Transactions	□	□	□	□	□	□	□	□	□	□
• Provisions	□	□	□	□	□	□	□	□	□	□
• Going Concern	□	□	□	□	□	□	□	□	□	□
• Management Discussion and Analysis	□	□	□	□	□	□	□	□	□	□
• Management Representations	□	□	□	□	□	□	□	□	□	□
• Company Growth	□	□	□	□	□	□	□	□	□	□
• Investment	□	□	□	□	□	□	□	□	□	□
• Operating Expenses	□	□	□	□	□	□	□	□	□	□
• Operating Income	□	□	□	□	□	□	□	□	□	□
• Earnings Before Tax	□	□	□	□	□	□	□	□	□	□
• Accumulated Profit	□	□	□	□	□	□	□	□	□	□
• Profit	□	□	□	□	□	□	□	□	□	□
• Total Assets	□	□	□	□	□	□	□	□	□	□
• Other	□	□	□	□	□	□	□	□	□	□
_____										
_____										
_____										
Exchange and discussion of findings in total	□	□	□	□	□	□	□	□	□	□

Further audit procedures would have been established in the following areas:

- Audit Planning ❒ yes ❒ no
- Risk Assessment ❒ yes ❒ no
- Materiality Planning ❒ yes ❒ no
- Accounts Receivables ❒ yes ❒ no
- Sales Transactions ❒ yes ❒ no
- Provisions ❒ yes ❒ no
- Going Concern ❒ yes ❒ no
- Management Discussion and Analysis ❒ yes ❒ no
- Management Representation ❒ yes ❒ no
- Company Growth ❒ yes ❒ no

- Investment ❒ yes ❒ no
- Operating Expenses ❒ yes ❒ no
- Operating Income ❒ yes ❒ no
- Earnings Before Tax ❒ yes ❒ no
- Accumulated Profit ❒ yes ❒ no
- Profit ❒ yes ❒ no
- Total Assets
- Other ❒ yes ❒ no

_____
_____
_____

Notes:

_____
_____
_____
_____

PART VII: QUESTIONNAIRE

Please comment on the following statements and questions:

1. A joint audit affects the audit process.
❒ never ❒ in special situations ❒ sometimes❒ frequently
If so/if not, why?

2. A joint audit affects audit opinion.
❒ never ❒ in special situations ❒ sometimes❒ frequently
If so/if not, why?

3. What do you believe is the probability of the emergence of a different audit opinion in a joint audit?
❒ not very often ❒ in given cases ❒ more often ❒ n/a

4. Do you think that you would perform further audit procedures simply because of the participation of a second auditor?
❒ no ❒ in given cases ❒ more often ❒ n/a

5. In reference to the case, what are the issues you would have discussed with a second auditor? Select the three most important issues for you.

- Audit Planning ❒
- Risk Assessment ❒
- Materiality Planning ❒
- Accounts Receivables ❒
- Sales Transactions ❒
- Provisions ❒
- Going Concern ❒
- Management Discussion and Analysis ❒
- Management Representation ❒
- Company Growth ❒
- Investment ❒
- Operating Expenses ❒
- Operating Income ❒
- Earnings Before Tax ❒
- Accumulated Profit ❒
- Profit ❒
- Total Assets ❒
- Other

_____

_____

_____

6. In reference to the case, suppose that you have audited the accounts receivables and, another auditor, the provisions. Do you think that, in practice, you would review the audit evidence gathered by the other auditor?

❒ no ❒ in given cases ❒ usually ❒ always

7. How do you assess the level of coordination effort between the two auditors in a joint audit?

❒ low ❒ medium ❒ high ❒ n/a

8. How do you assess the consequences of a joint audit for the overall review of an audit?

❒ improved ❒ neutral ❒ debased ❒ n/a

9. Is there is a danger of "free riders" in a joint audit?

❒ always ❒ in given cases ❒ not at all ❒ n/a

10. The constitution of auditors (Big 4, non-Big 4, small audit firms and so on) in a joint audit affects the audit opinion.

❒ always ❒ in given cases ❒ not at all ❒ n/a

11. An auditor's independence is higher in a joint audit.

❒ always ❒ in given cases ❒ not at all ❒ n/a

12. How relevant is the mutual review of one another's work in a joint audit?

13. Do you think that intensive discussion and communication effort exist in a joint audit?

14. In a joint audit, a multi-year audit plan with alternate audit areas should be complied with. Can you observe this requirement in practice?

15. What are your personal experiences with joint audits?

Final Judgment

16. A joint audit produces higher costs than a single audit.

❒ is not true ❒ is moderately untrue ❒ is moderately true ❒ is true ❒ cannot be estimated

17. The mutual review of the audit process in a joint audit strengthens the audit opinion.

❒ is not true ❒ is moderately untrue ❒ is moderately true ❒ is true ❒ cannot be estimated

18. The exchange of audit findings and communication between the auditors strengthen the audit opinion.

❒ is not true ❒ is moderately untrue ❒ is moderately true ❒ is true ❒ cannot be estimated

19. The complexity of audit fields has a positive influence on the effects of a joint audit.

❒ is not true ❒ is moderately untrue ❒ is moderately true ❒ is true ❒ cannot be estimated

20. A joint audit is a useful quality control measurement.

❒ is not true ❒ is moderately untrue ❒ is moderately untrue ❒ is true ❒ cannot be estimated

PART VIII: DEMOGRAPHIC DATA AND EXPERIENCE QUESTIONNAIRE

The following demographic data are collected to facilitate data sorting and statistical analysis. Participants in this study will be anonymous, and data pertinent to any specific personal or business identity will not be disclosed.

Gender

❒ male ❒ female

Nationality

❒ Austrian ❒ German ❒ Other Nationality_____

Location of audit firm headquarters

❒ Austria ❒ Germany ❒ Other Country _____

Size of audit firm

- ❒ one-man or small audit firm (1-2 auditors)
- ❒ medium-sized audit firm (3-5 auditors)
- ❒ large audit firm (more than 5 auditors, but not Deloitte Touche Tohmatsu, Ernst & Young, KPMG, PriceWaterhouseCoopers or a related company)
- ❒ Big 4 audit firm (Deloitte Touche Tohmatsu, Ernst & Young, KPMG, PriceWaterhouseCoopers or a related company)

For how many years have you been working in an audit firm? _____ years

For how many years have you been a certified public accountant? _____ years

Have you ever been a joint auditor or part of a joint audit team?

❒ yes ❒ no

If yes, how experienced are you in performing joint audits?

inexperienced						experienced
1	2	3	4	5	6	7
❒	❒	❒	❒	❒	❒	❒

Do you specialise in

a particular industry?

❒ yes _____

❒ no

a particular auditee size?

❒ yes _____

❒ no

Other comments:

Thank you for participating in this study.

Corruption and firm performance: Evidence from Greek firms

Daphne Athanasouli[1], Antoine Goujard[2], Pantelis Sklias[3]

Abstract

This article investigates the relationship between corruption and firm performance in Greece using firm level data. Corruption is overall negatively associated with firm size and growth at the firm level. We focus on the effect of 'administrative corruption', whereby firms engage in corrupt practices and bribery of government officials. We contrast the firm experience of corruption and the contextual experience of corruption at the sectoral level and find that the latter, contextual corruption is more important. The contextual effect of corruption identifies the magnitude of systemic corruption in Greece, indicating the need for reforms in an institutional environment that allows corrupt practices. Furthermore, firms of different size appear differently affected by corruption. This suggests that firm engagement in corruption is heterogeneous. Using quantile regressions, small and medium firms display a higher engagement in corrupt practices. However, their performance is less correlated with corruption than that of large firms.

Keywords: bribery, corruption, growth, firm size, Greece

JEL Classification: D73, O17, M21

1. Introduction

International organizations, policy makers and governments are increasingly interested in the effects of corruption on economic development, with anti-corruption strategies being promoted worldwide (Organization for Economic Cooperation and Development European, United Nations, World Bank, European Bank for Reconstruction and Development, Transparency International). More recently, corruption has been identified as a critical issue for the growth of the Greek economy and a major impediment for the implementation of necessary structural reforms (Christodoulakis et al., 2011). This article contributes to the empirical analysis of the impact of corruption on Greek firms. It disentangles the firm level impact of corruption from its contextual effect, and it analyses

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the heterogeneous effect of corruption on Greek firms of different size. Both firm level and contextual corruption is found to decrease firm sales and a robust negative relationship between firm corruption and growth is displayed. Furthermore, larger firms appear to suffer more from corruption than medium or small firms.

Corruption constitutes a serious impediment on economic growth at the country level (Mauro 1995; Mauro, 1997). However, at the firm level, profit maximizing firms would be expected to decide an optimal amount of corruption that would allow them to maximize their profits, while the contextual effect of corrupt practices on firm performance could be either positive or negative, depending on whether the negative spillovers of corrupt practices dominate the first potential positive effect. Hence, the effect of corruption on firm performance is ultimately an empirical question. This paper analyses the relationship between corruption, measured at the firm and industry levels, and firm performance. It is related to two main strands of literature.

The first strand of literature assesses corruption as an obstacle to economic growth. The close relation of corruption to economic growth, and the empirical findings on corruption as a serious impediment on growth and investment, have generated a higher interest in the study of corruption (Pradhan, 2000). There have been significant and consistent research findings that show that lower perceptions of corruption are highly correlated with increased economic development (La Porta et al., 1999; Ades and Di Tella, 1999; Treisman, 2003). Other studies have shown that corruption is an important obstacle to FDI inflows in the host country. Corruption in a country is related to lower levels of probable investment and it can increase the cost of negotiating with government officials for obtaining necessary licences and permits. Furthermore, it increases the risks associated with investment as it can increase costs and operational inefficiencies (Cuervo-Cazurro, 2006). Corruption can hamper growth by deterring entrepreneurship, wasting resources, hindering private investment, impeding the collection of taxes, and obstructing the implementation of necessary regulations.

The second strand of the empirical literature focuses on firm growth and demonstrates differing results. Some studies have supported the hypothesis that corruption can speed up the wheels of commerce and have a positive impact on firm development, by giving the possibility to overcome bureaucratic barriers and surpass timely processes (Wei, 1998). Kaufmann and Wei (1998) demonstrate that this can occur in very limited cases when bad regulations and harassment from officials are considered exogenous. However, they find a positive correlation in the tendency of firms to pay bribes and the time that is wasted on bureaucratic procedures. In some cases, firms engage in corrupt practices in an attempt to promote their short-term growth by facilitating transactions in the bureaucratic process. Ades and Di Tella (1999) show that higher corruption occurs in economies with trade barriers, where domestic businesses are less exposed to global competition, or where there are only few dominant businesses.

The paper builds on this existing literature and makes three main contributions. First, it examines the association between corruption and firm performance in Greece and identifies the sectors that are most affected. The main studies in this area remain at the country level, whereas firm level studies are more rare. In Greece, studies have mainly targeted political

and grand corruption at the country level, whereas firm level studies assessing corruption as a business barrier have not been realized. The data on Greece from BEEPS 2005 remain largely unexamined. More specifically there has been no research produced analyzing corruption extensively on Greece to allow for any policy considerations. Occasionally part of the survey data on Greece was used to provide information on the business climate at the country level, for the purpose of comparative analysis with the other countries of the survey. The most interesting part of the article lies on the level of precision used. The data provide information on firms at the regional level that have not been discussed and analyzed to this moment. We find particularly interesting the possibility to examine the data on approximately 550 Greek firms and be able to draw conclusions at the regional and sectoral level. At present, there are household surveys, mainly conducted by Transparency International Greece from 2005, investigating corruption in Greece, and occasional surveys simply identifying barriers in doing business. Firm level surveys that assess corruption as a business barrier in Greece, using measures based on experience and not only perception of corruption, have not been implemented, whereas the BEEPS survey on Greece remains overall unexamined. The quality of this EBRD-World Bank survey and its implementation process ensure a high level of possible accuracy and reliability.

Second, the detailed analysis of the multifaceted impact of corruption on the firm level and the contextual effect of corruption at the sectoral level allows new policy conclusions to be drawn. Firms can engage in corrupt practices in an attempt to maximize their profits and overcome timely administrative processes. However, these practices are negatively and significantly associated with firm performance. This relation becomes more negative for firm size and growth when analyzed at the sectoral level. The assessment of the level of administrative corruption and the consequent growth and operational business barriers, in different sectors across Greek-based firms, outlines the degree and spread of corruption and identifies sector specific constraints.

Finally, research on the different impact corruption has depending on the size of the business has been scarce. However, size has been proven to be a significant factor in firm growth and performance. On the one hand, there are studies on large companies, or SMEs, and their effect on growth, which produce contrasting findings. On the other hand, there have been few comparative studies that provide information about all three types of companies at the firm level. Furthermore, the heterogeneous effect of corruption on firm growth based on size remains largely unexamined. We use quantile regressions to disentangle the heterogeneous effect of corruption on firm size. Small, medium and large enterprises appear to respond differently to several business constraints.

The paper is organized as follows. Section Two discusses the specificities of corruption in Greece and the features of the sample that are relevant for this analysis. Section Three describes the data construction and identifies the level of engagement of different manufacturing sectors in corrupt practices. Section Four describes our main empirical findings on firm performance and corruption at the firm and sectoral level. Section Five examines the heterogeneity of the relationship between corruption and firm size. Section Six concludes.

2. Greek institutional features and sample

Domestic bribery underlines institutional weaknesses

It is globally recognized that business corruption hampers a country's economic development and has a negative impact on the international business environment. Recent surveys on public sector corruption and disclosures of corporate scandals in Greece have drawn attention to firm level corruption, its causes and consequences, exposing weaknesses in the institutional framework of Greece.

Administrative corruption, which affects citizens and households across Greece, is depicted in the National Study on Corruption in Greece, an initiative by the Greek Chapter of Transparency International[1]. The study monitors public perceptions of corruption and experiences of bribery (Transparency International Greece, 2011). It recently showed a drop in the amount of bribes and corrupt practices in the public and private sector in 2010, possibly suggesting that the economic downturn in Greece is also affecting the amount of administrative corruption. The public sector services that appear to be demanding the largest amount of bribes are the hospitals, followed by the tax authorities, and then the urban authorities. In the private sector the most corrupt services, as experienced by citizens, are the health and legal services (Transparency International Greece, 2010).

Apart from corruption incidents in the public sector in Greece, in the last few years cases of corruption and foreign bribery in Greece have been disclosed by foreign companies or their subsidiaries to ensure contacts, particularly in the defense, pharmaceutical and telecom and security systems sector. The cost of bribery to secure contracts was transferred to Greek taxpayers, and the price of products was often particularly high to offset the costs of the unofficial payments (Corruption Watch, 2010; European Parliament, 2011). The culprits have subsequently been brought to justice by the Greek authorities (Transparency International, 2011). These cases underline the importance of compliance and ratification of global anti-corruption conventions. Multinationals and domestic companies should adopt ethical types of conduct that are in accordance with the laws and regulations forbidding transnational and domestic bribery (Boswell and Richardson, 2003). The introduction of corporate governance systems and the adoption of global anti-corruption conventions are crucial. The recent scandals also highlighted the importance of a solid and effective institutional framework in Greece.

The institutional environment is characterized by inadequacies in the legal framework regarding the criminal liability of corporations and the limited ability to prosecute politicians because of the Greek statute of limitation. This framework obstructs transparency in doing business, as it limits the penalties associated with cases of offering or accepting bribes. The justice system is also hampered by severe delays in the application of penalties

[1] In its fight against corruption, Transparency International (TI), founded in 1993, conducts surveys and provides annual corruption perceptions indices and surveys based on the direct experience of the respondents. These surveys have been widely used in recent years in the measurement and understanding of corruption.

(Transparency International, 2011). The enforcement system is characterized by significant inefficiencies and delays in the prosecution mechanisms. The lack of independence of the judiciary is associated with an increased risk of corruption. The judicial system should be strengthened and inefficient regulations and weak contracts should be eliminated to promote transparency in the government systems (Sulliman and Shkolnikov, 2004). Furthermore, the inadequacies in the framework for complaint mechanisms for whistle-blowing protection and complaints need to be tackled (Transparency International, 2011). These measures could encourage the development of public awareness and promote greater public accountability against corruption. This paper focuses on administrative corruption, whereby firms engage in unofficial payments with public officials.

Measures of corruption and sample

Corruption is generally defined as 'the abuse of public power for private gain' (Cuervo-Cazurra, 2006), and can also be defined as 'an arrangement that involves an exchange between two parties, the "demander" and the "supplier", which has an influence on the allocation of resources either immediately or in the future, and involves the use or abuse of public or collective responsibility for private ends' (Kwok and Tadesse, 2006). The prevalence of corruption is associated with 'someone having discretionary power to allocate resources' (Jain, 2001). This power is in the possession of three different categories of agents: the political elite, the administrators, and the legislators. The monitoring ability of the principal differs in each of these cases (Jain, 2001).

Corruption levels are difficult to measure, as they are based on informal and illegal practices that tend to be concealed (Bevan et al., 2000). However, various surveys have been designed to measure corruption, and the methods used in their formation are continuously reviewed (Knack, 2006). The existing empirical literature on corruption is based on measurements of corruption either through perception-based surveys, or through surveys based on the experiences of respondents. The former use subjective indices of how corruption is perceived and attempt to decrease the measurement error by using averages from different sources. They aim to measure the perceptions of how widespread or costly corruption is in certain countries, and aggregate results from various sources, country risk ratings by business consultancies, surveys of international or domestic business people, and polls of country inhabitants. The latter are based on measures of corruption experiences and are conducted through surveys of business people and citizens in various countries. These surveys focus on the respondents' direct experience of corruption, either the experience of their family or firm, and have been widely used in recent years for the measurement and understanding of corruption. They mainly try to measure the number of incidents in which the respondents have been expected to pay bribes (Treisman, 2007).

This paper uses the survey BEEPS, which is based on the experience and perceptions of managers[2]. It is a joint initiative of the European Bank for Reconstruction and

[2] Business Environment and Enterprise Performance Survey.

Development and the World Bank. The survey is based on face-to-face interviews with firm owners and managers. It has been widely used in the research on corruption initiated from 1999, based on firm level data in transition economies, to investigate the business environment. The survey is regularly conducted on the countries of Eastern Europe and Central Asia. We use the survey conducted on Greece as part of a survey on comparator countries of Western Europe and East Asia in 2004 and 2005[3].

Information for the establishment of the sample frame was used from the National Statistical Service of Greece and ICAP Greece. The sectoral composition in terms of manufacturing and services was established by their relative contribution to GDP. The sample design based on the BEEPS sector GDP contribution was determined at 28% for industry and 72% for services in Greece. For the sample of firms to be representative for Greece additional criteria had to be met regarding the size, ownership, exporter status and location of the firms. The number of firms interviewed is 546 and cover the regions of the Capital, Central West Macedonia, East Macedonia, Thrace, East Sterea, West Sterea, Thessaly, Epirus, and Peloponnese. All the firms in the sample are privately owned, 10% are foreign owned and 11% of firms are exporters. Firms that started to operate in the years 2002, 2003 and 2004 were not included in the sample (Synovate, 2005).

We examine administrative corruption, which involves firms engaging in or being forced to engage in bribery and unofficial payments or gifts to government officials. Firms may be asked or forced to bribe to obtain rightful licenses, choose to bribe to extract profits, and speed bureaucratic processes in an institutional environment that allows these practices. We identify administrative corruption, as the percentage of total annual sales that a firm similar to the one represented by the respondent will typically pay in unofficial payments and gifts to public officials. The percentage of total annual sales that similar firms give as bribes is a direct measure of corruption, based on actual financial results; the firms are asked about corruption directly related to the amount of bribes. This measure is therefore used to estimate the relation between corruption and firm performance. As a quantitative variable, it can provide valuable information on the extent and variation of corruption, and its impact on firm size and performance.

In the descriptive analysis we use two additional measures to identify administrative corruption. The first measure estimates the frequency of bribes that similar firms 'have to pay to get things done with regards to customs, taxes, licenses, regulations and services'. The second measure identifies corruption as an operational and growth barrier for doing business, from 1 for a low level of corruption to 4 if managers assess corruption as an important barrier for the operation and growth of the respondents' business (Synovate, 2005).

[3] The description of the data is largely based on the report that was prepared for EBRD and the World Bank by Synovate (Synovate, 2005), the firm responsible for the implementation of the BEEPS and the provision of data.

3. Descriptive Analysis

Descriptive Statistics

Table 1 presents descriptive statistics for the different measures of firm size, growth and corruption. However, it is important to note that it is very difficult to compare the different measures of corruption we use, as the questions they treat are different. Therefore, even if the results are lower, the impact on the firm size and performance could be higher.

Apart from the measures of corruption at the firm level, the measures of corruption are averaged at the industry level. The averages are leave-one-out averages. For example, for a given firm in the construction sector in Greece the average includes all the firms in the construction sector apart from the firm itself. This measure captures the contextual effect of corruption and avoids endogeneity concerns, as both firm level corruption and sales may be determined jointly by the firm and could be driven by similar unobservable firm characteristics.

Table 1: Descriptive statistics, sales, growth and corruption

Variable	Obs.	Mean	Std. Dev.	Min	Max
log sales	480	6.68	1.97	3.6	13.2
log sales in t-3	463	6.60	1.91	3.6	13.0
growth	463	0.02	0.22	-1.6	0.7
corruption	546	0.49	1.41	0.0	10.0
contextual corruption	473	0.52	0.82	0.0	10.0
corruption frequency	458	2.37	1.53	1	6
corruption barrier	529	1.69	1.00	1	4

Table 2 shows the correlations between sales, growth and corruption. The measures of corruption at the firm level are all positively correlated. At the firm level, corruption appears negative for firm size and growth, whereas at the sectoral level, contextual corruption appears more negative on firm performance. This underlines the importance of the sectoral environment for firm growth and operation.

Table 2: Correlations between sales, growth and corruption

	log sales	log sales in t-3	growth	corruption	contextual corruption	corruption frequency
log sales						
log sales in t-3	0.99					
growth	0.19	0.08				
corruption	-0.07	-0.06	-0.07			
contextual corruption	-0.08	-0.09	0.03	-0.01		
corruption frequency	0.16	0.15	0.06	0.31	-0.03	
corruption barrier	0.09	0.09	0.09	0.28	-0.02	0.46

A negative association between corruption and firm sales

Among the factors that drive firms to engage in corrupt practices are market expansion and profit maximization ambitions. Firms often engage in illegal practices and bribes to ensure the success of their establishment and operations at first (e.g. securing of operation licences), and then their expansion in a country. However, a corrupt environment deprives firms of equal market opportunities and increases the cost of doing business. Time and money consumed in bribing public officials and overcoming complexity in regulations raise business costs. In cases of high and widespread administrative corruption the operational ability of firms is obstructed. Moreover, their ability to enforce contracts and business opportunities is reduced (Sullivan and Shkolnikov, 2004).

Figure 1 presents the relationship between average corruption (the direct measure of corruption we use that is, as previously explained, the percentage of total annual sales paid in bribes to public officials, hereby referred to as corruption) and the log of total annual sales at the firm level in Greece. We observe a negative relation between corruption and the sales of the firm; when the extent of corruption is lower, the firm is characterized by a higher size of sales.

Figure 2 depicts the relationship between average corruption and growth[4] at the firm level in Greece. A negative relation appears between corruption and firm growth: when corruption increases, the growth of a firm slightly decreases.

[4] Growth is defined as the (log) size of sales in 2005 minus the (log) of sales in 2002, multiplied by 100.

Figure 1: Corruption and firm sales in Greece at the firm level

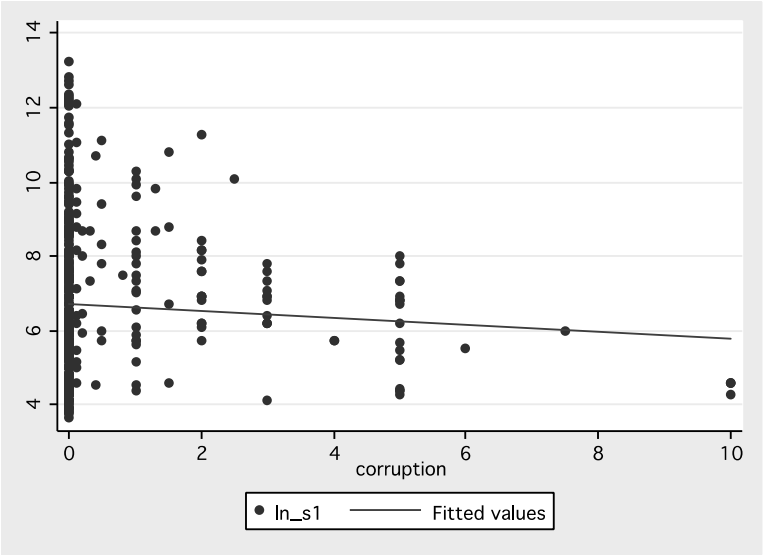
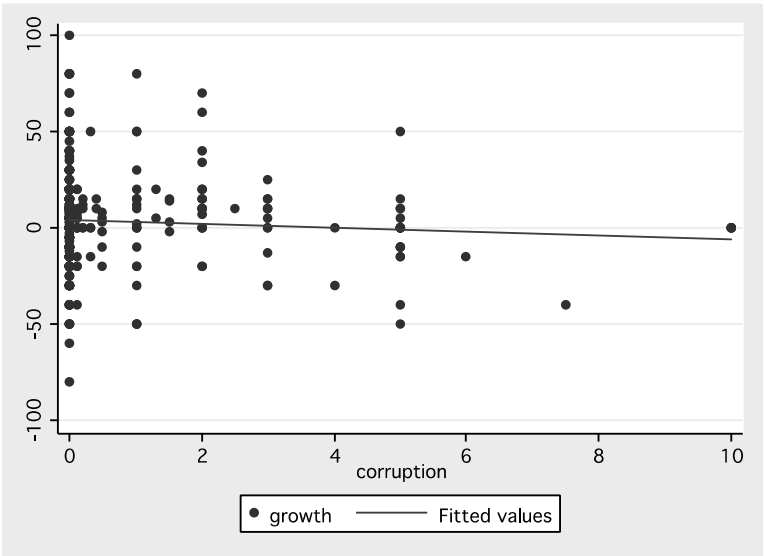


Figure 2: Corruption and firm growth in Greece at the firm level[5]



[5] Corruption in the survey is measured in 2005, whereas the growth of the firms is based on percentage change in sales in the last 3 years, during 2002–2005. It was not possible to use corruption in 2002, based on the previous BEEPS, because Greece was not surveyed. Therefore, by using the measure of corruption in 2005, the interpretation of the relation between corruption and growth of sales would be less clear, even though we would expect that the corruption levels would be similar across these years.

Figure 3 examines the different corruption patterns based on the size of the firms in Greece. Companies are divided into three main categories: those comprising 2 to 49 employees are categorized as small, medium up to 249, and large from 250 employees and above. Small and medium firms are then further divided into two subcategories, and large firms into three groups. In the case of administrative corruption (proportion of bribes), small firms, and especially the higher end of these, are the most affected. The lowest end of medium firms is also affected, whereas medium firms with 100-249 employees and large firms seem to be the least affected. Large firms with 500–999 employees seem to pay a very low, almost zero amount of bribes to public officials. The growth and associated power for large firms in the market and the increase of their experience could allow them to better position themselves and overcome possible operational barriers for their business. This finding is supported by the lower measures of corruption for large firms.

Figure 3: Average corruption and firm size in Greece

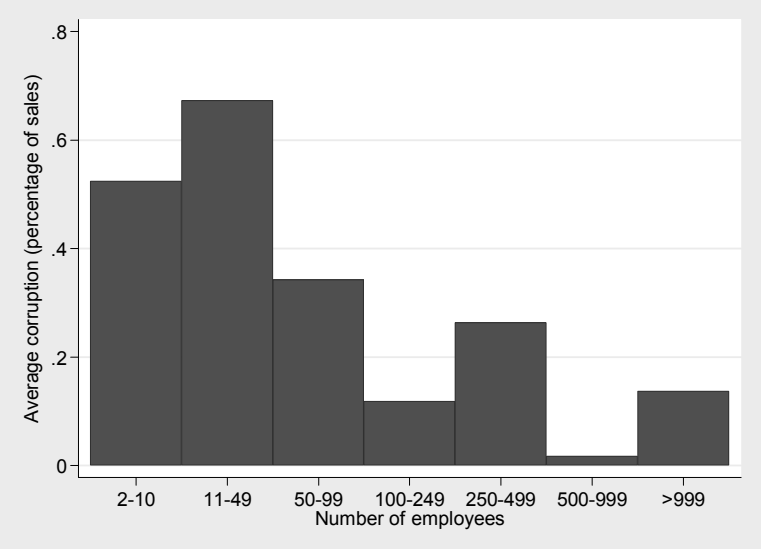


Figure 4 presents the average growth in firms of different sizes. The highest growth levels of around 15% are observed in large firms with over 999 employees, whereas the smallest levels are around 2.5% in micro firms of 2 to 10 employees. Similar, middle levels of growth, from around 5% to 8%, characterize small and medium-sized firms.

Figure 4: Average growth and firm size in Greece

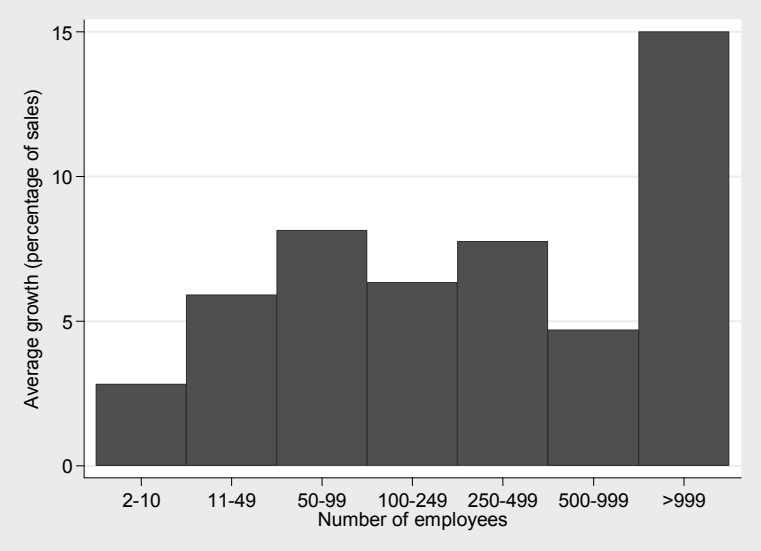
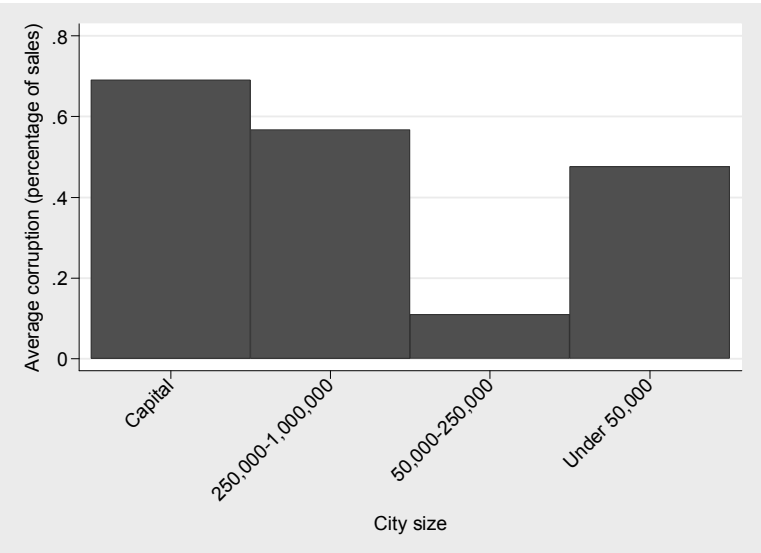


Figure 5 shows the geographical groups and our preferred measure of administrative corruption, the share of sales paid as bribes. The regional groups that altogether appear to be the most corrupt are the capital of Athens followed by cities with 250,000 to 1 million inhabitants, and finally cities with under 50,000 inhabitants. The level of engagement of cities with 50,000–250,000 inhabitants appears to be very low.

Figure 5: Average corruption across Greek cities



Administrative corruption across different sectors

Table 3 presents corruption as a barrier in doing business across manufacturing sectors. This question does not specify whether the firms or public officials initiate bribing. However, it underlines the effect of widespread corruption in the public sector that could have an impact on firm performance according to firm managers. In mining and quarrying, 40% of the firms identify corruption as a major obstacle. Firms in wholesale and retail trade identify corruption as a major barrier for the growth and operation of their business, 21% of the firms evaluate it as a minor obstacle, and 24% as a moderate or major obstacle. In manufacturing, corruption is also found as a very important obstacle in doing business; 24% judge it is a moderate or major obstacle, and 19% a minor obstacle. In transport, storage and communication, 19% of firms also perceive corruption as a major or moderate obstacle, and 19% as a minor one, while real estate, renting and business services present similar results. In construction, 15% of the firms recognize corruption as a moderate or major barrier, whereas 21% consider it a minor barrier. We observe similar results in the hotel and restaurants sector, where 17% of the firms consider it a moderate or major barrier, while 27% view it as a minor barrier.

Table 3: Corruption as a barrier to growth by sector

		Corruption barrier		
	Obs.	Minor	Moderate	Major
Mining and quarrying	5	0%	0%	40%
Construction	61	21%	5%	10%
Manufacturing	98	19%	10%	14%
Transport storage and communication	43	19%	7%	12%
Wholesale and retail trade	178	21%	11%	13%
Real estate, renting and business services	54	17%	6%	11%
Hotels and restaurants	89	27%	7%	10%
Other services	18	17%	11%	22%
All sectors	546	21%	8%	13%

Table 4 observes the assessment of corruption frequency across sectors in Greece. It therefore depicts the frequency of cases in which firms are forced to bribe and cases of institutionalized corruption, in which firms are forced to bribe in order to secure access to rightful processes. In mining and quarrying, 40% of the firms state that corruption is always occurring. In construction, 30% of firms estimate that corruption is frequently, usually or always taking place, and 50% that it seldom or sometimes occurs. In the hotels and

restaurants sector, 25% of firms estimate that corruption is a practice that occurs frequently, usually or always, whereas 34% of them consider it occurs seldom or sometimes. Managers in wholesale and retail trade evaluate corruption as a frequent, usual or standard practice in 22% of the firms, and as a seldom or occasional practice in 42% of them. In real estate, renting and business services, 21% of firms assess that corruption occurs frequently, usually or always, and 33% consider it to occur seldom or sometimes. In transport, storage and communication, 20% of firms evaluate corruption as a frequent, usual or standard practice, and 25% of them as a seldom or occasional practice. In manufacturing, 18% of firms find that corruption occurs frequently, usually or always, while 35% estimate that corrupt practices seldom or sometimes occur.

Table 4: Frequency of corruption by sector

		Frequency of corruption					
	Obs.	Never	Seldom	Sometimes	Frequently	Usually	Always
Mining and quarrying	5	0%	0%	40%	20%	0%	40%
Construction	48	21%	27%	23%	13%	15%	2%
Manufacturing	77	47%	23%	12%	5%	9%	4%
Transport, storage and communication	40	55%	15%	10%	5%	5%	10%
Wholesale and retail trade	154	37%	29%	13%	7%	10%	5%
Real estate, renting and business services	46	46%	11%	22%	15%	2%	4%
Hotels and restaurants	72	42%	28%	6%	8%	13%	4%
Other services	16	44%	25%	13%	19%	0%	0%
All sectors	458	40%	24%	14%	9%	9%	5%

Table 5 displays unofficial payments and bribes paid as a share of sales by sector. The sensitivity of this question, linked to the disclosure of financial results, increases the possibility of underreporting (Synovate, 2005). Mining and quarrying emerges as the most corrupt sector, with an average of 1.28%, which supports the previous findings on the high frequency of corruption and evaluation of corruption as a major business barrier. Firms in transport and storage and firms in construction also report that unofficial payments and bribes are a significant part of their sales, at 0.8% and 0.7% respectively. The bribes in the hotels and restaurant sector and the wholesale and trade are estimated at around 0.5%. The lowest amount of bribes as a percentage of sectoral sales is observed in real estate and renting at around 0.32%, and in manufacturing at 0.26% of sales.

Table 5: Unofficial payments and bribes as share of sales by sector

Variable	Obs.	Mean	Std. Dev.	Min	Max
Mining and quarrying	5	1.28	1.00	0	2
Construction	61	0.70	1.46	0	5
Manufacturing	98	0.26	1.09	0	7.5
Transport, storage and communications	43	0.80	1.98	0	10
Wholesale and retail	178	0.45	1.40	0	10
Real estate, renting	54	0.32	1.06	0	5
Hotels and restaurant	89	0.47	1.21	0	5
Other services	18	1.12	2.61	0	10
Total	546	0.49	1.41	0	10

The level of corruption across sectors in Greece appears varied. The mining and quarrying sector and the construction sector display a pattern of regular engagement in bribing: an alarming 80% of the firms in these sectors respond that unofficial payments and bribes are taking place, while the average bribes amount to 1.28% and 0.7% of annual sales. Furthermore, corruption is particularly apparent in the wholesale and retail trade and the hotels and restaurant sector, where 64% and 59% of firms respond positively on corrupt payments. Firms in the transport, storage and communications sector display differing results. While the highest number of firms in the sector, 55%, responds that corruption never occurs, the level of corrupt payments is the second highest, at 0.8% of total annual sales. Based on the frequency of payments and bribes given as percentage of sales, less unofficial payments seem to occur in real estate, renting and business services sector, and the manufacturing sector. Nevertheless, around half of these firms respond positively on corrupt payments taking place.

The sectors that overall appear to be the most constrained by corruption are the wholesale and retail trade, the hotels and restaurants, and the manufacturing sector. Around half of the firms in the wholesale and retail trade (45%) consider corruption a barrier in doing business, and similarly the hotels and restaurants sector and the manufacturing sector appear severely hampered by corruption (44% and 43% respectively evaluated corruption as a barrier). Overall, firms in mining and quarrying display concerning results: 40% respond that corruption is a major obstacle in their operation, and 40% of firms that bribing is always occurring. In the sectors of transport storage and communication, construction and real estate, renting and business services, corruption is also considered an important constraint in business by 38%, 37% and 34% of firms respectively. The analysis on the sectoral level provides a detailed overview of the business constraints generated by corruption across different sectors in Greece. Overall, we observe that corruption, irrespective of the sectoral engagement in bribing, is considered a significant barrier in doing business across all sectors in Greece.

4. Firm and contextual corruption in Greece

Firm level corruption and firm performance

In recent years, it has been widely recognized that corruption is a significant barrier to the operation and growth of firms. Dal Bo and Rossi (2007) find evidence in Latin America that corruption is harmful for firm productivity. Using data on Mexican states, Laeven and Woodruff (2007) also find that Mexican states with more effective legal systems have larger firms. The harmful effect of corruption on firm performance is confirmed on a wide cross-section of countries by Beck et al. (2003). However, there have been findings in the literature on the possible positive effect of corruption for some firms (Wei, 1998). It has been supported that corruption could increase economic development, mainly because illegal practices and payments as 'speed money' could surpass bureaucratic delays; the acceptance of bribes in government employees could work as an incentive and increase their efficiency (Leff, 1964; Huntington, 1968); and because corruption is possibly the price people are forced to pay as a result of market failures (Acemoglu and Verdier, 2000).

Table 6 presents the estimates of a simple Ordinary Least Squares (OLS) regression of the log of firm sales and growth on corruption, and includes controls for city and sector. Corruption, measured as the share of sales paid for bribes, is significantly and negatively correlated with the level of sales and growth at the 5% and 10% significance level. When we control for city, the relationship between corruption and growth is similar, whereas the association between corruption and firm size becomes more negative and significant at the 1% significance level. When controlling for sector, the association between corruption and growth becomes more negative and significant at the 5% significance level, whereas the association between corruption and firm size remains negative but insignificant.

Table 6: Firm Size, Growth and Corruption[6]

	No controls	Control city	Control sector	No controls	Control city	Control sector
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Log Sales	Log sales	Log sales	Growth	Growth	Growth
Corruption	-0.093**	-0.126***	-0.061	-1.189*	-1.133*	-1.315**
	(0.041)	(0.045)	(0.039)	(0.645)	(0.645)	(0.666)
Observations	480	480	480	463	463	463
R-squared	0.005	0.078	0.197	0.007	0.023	0.080

Standard errors robust to heteroskedasticity in parentheses. ***, **, * indicate estimates significant at the 1%, 5% and 10% significance level, respectively. The dependent variable is the natural logarithm of total sales.

[6] The log of sales distribution is approximately normally distributed.

Contextual corruption and firm performance

We shall now focus on the association between contextual corruption, measured among the peers of the firms at sectoral level, and firm performance. At the sectoral level, we expect that the relationship between corruption, firm size and growth will be clearly negative. Firms that are not involved in corruption may have less access to resources and increased costs, and their sales could be hampered by the discrimination and misallocation of resources induced by the bribing firms.

Table 7 describes how contextual corruption at the sectoral level relates with firm sales and firm growth. The relationship between contextual corruption and firm growth, in specifications without any controls or controls for city, appears insignificant. However, the relationship between contextual corruption and firm size appears negative and significant once we control for the size of the city where the firms are located. The coefficient of contextual corruption on firm size without any controls is -0.18, and insignificant at the 10% significance level. When controlling for city, the effect of contextual corruption becomes more negative, with a coefficient of -0.21, and strongly significant at the 10% significance level.

These regressions do not include controls for industrial sectors, as the contextual corruption is computed at the sector level and would be highly collinear with the sectoral dummy variables. The identified association between contextual corruption at the sectoral level and firm sales indicates the systemic character of corruption. The association between administrative corruption at the firm level and firm size and growth appears negative (Table 6). However, we find that the extent of the administrative corruption among the firm peers displays a larger negative magnitude than the estimates based on firm-specific measures of corruption (Table 7). Overall, the contextual effect of corruption suggests that the corrupt behaviour at the firm level could have important spillovers on their peers and competitors. Firms do not appear to internalize the costs of their own corruption for other firms. Hence, the contextual corruption generated from a corrupt sectoral environment could be much more detrimental for firm sales and growth than firm level corruption.

Table 7: Firm size, growth and contextual corruption

	No controls	Control city	No control	Control city
	(1)	(2)	(3)	(4)
Variables	Log sales	Log sales	Growth	Growth
Contextual Corruption	-0.180	-0.212*	0.558	0.475
	(0.132)	(0.125)	(1.028)	(0.986)
Observations	417	417	404	404
R-squared	0.007	0.065	0.000	0.018

Standard errors in parentheses are clustered at the sectoral level. ***, **, * indicate estimates significant at the 1%, 5% and 10% significance level, respectively. The dependent variable is the natural logarithm of total sales.

5. The heterogeneity of the relationship between corruption and firm sales

We shall now focus on the heterogeneity of the relationship between corruption and the sales of different types of firms. The size of the firm has been related to firm size and performance. However, the different effect that corruption may have on firms depending on their size and the level of business constraints it imposes on them has not been analysed in firms across Greece. According to recent research from the World Bank and the EBRD, the firms that are the most influenced overall by business constraints are small rather than medium or large firms, and generally those firms that can achieve more growth and create more jobs (Transition Report 2005). However, the question as to whether SMEs can actually generate more growth has initiated a lot of debate.

A causal relationship between the share of SME and growth has not been established. Large firms are able to take advantage of economies of scale and can afford fixed R&D costs, therefore, they may be able to promote innovation and productivity more than SMEs (Beck et al., 2005). There is evidence that increased levels of innovation are related to larger firm size (Pagano and Schivardi, 2003). In terms of employment creation and quality, large firms can provide greater stability and quality in employment and they appear to be equally labour intensive as SMEs (Little et al., 1987; Rosenzweig, 1988).

However, SMEs are particularly important in an economy, and countries with faster rates of development are characterized by an increased share of SMEs and an increased SME growth rate (Beck et al., 2005). Empirical research finds that the SMEs[7] contribute more than 55% of GDP and 65% of employment in countries of high GDP per capital, and 70% of GDP and 95% of employment in countries of low GDP per capital (Ayyagari, 2007). Consequently, the protection of their operation is crucial for the economy.

Corruption and the distribution of firm size

In order to assess the relationship between corruption and the distribution of firm size, we use quantile regressions (Koenker and Basset, 1978). Ordinary least squares (OLS) regression is based on the mean of the conditional distribution of the regression's dependent variable. This approach is used for two main reasons. First, the average effect of corruption on firm sales is generally the main parameter of interest. Second, it can often be implicitly assumed that corruption has the same effect on large and small firms. However, corruption may distort the distribution of firm sales. The analysis is mainly descriptive and aims to offer an understanding of the extent of corruption in Greece and provide for the first time an indication of its possible impact on the business environment. Based on the absence of panel data, as the survey was solely implemented in Greece in 2005, and given the sample size, it is not possible to address all the omitted variable biases. Even though it is

[7] There have been various definitions of small, medium and large enterprises, and small and medium enterprises are often analysed together. According to the current definition of the European Union, small companies have less than 50 employees, medium more than 50 and less than 250, and large more than 250 employees.

not possible to ascertain direct causality, the correlations present some interesting patterns to identify which firms are likely to be most affected by corruption. Quantile regression models allow for a full characterization of the conditional distribution of firm sales with respect to the extent of corruption.[8]

Table 8 presents the estimates for the association between corruption and sales on the quantiles of the firm size distribution. The models used to construct these estimates control for city size[9] and we focus on the 0.1, 0.25, 0.5, 0.75 and 0.9 percentiles. Estimates at different quantiles can be interpreted as showing the response of the log of sales to the extent of corruption at different points in the conditional sales distribution. For example, the point estimate for corruption on the quantile 0.5, the median, indicates that the median of the distribution decreases by 3 percentage points (0.03 log point) when the share of sales paid as bribes increases by one percentage point. By comparison, the point estimate for the upper decile (quantile 0.9) indicates that the same increase of bribes would decrease the upper decile of firm size by nearly 25% (0.22 log points).

It is noteworthy that the quantile coefficients increase with the considered quantiles. The largest effect of corruption is on the top of the firm size distribution, the coefficients of the third quartile (percentile 0.75) and the upper decile (percentile 0.9) are roughly similar, around -0.22, while the other quantile coefficients are approximately 0.03 or close to zero for the lowest decile. This is justified as the average point estimates (Table 6) was around -0.1. This shows that the negative association between corruption and firm sales is larger for the firms belonging to the upper quantiles than for the smaller firms. Hence, corruption appears to have an important impact on the heterogeneity of firm size. Higher corruption tends to lower the average firm sales through the effect on the largest firms while the lower part of the firm size distribution is relatively unaffected.

Table 8: Corruption and the distribution of firm size, quantile regression estimates

	Quantile regression for log sales				
Quantile	0.1	0.25	0.5	0.75	0.9
	(1)	(2)	(3)	(4)	(5)
Corruption	0.000	-0.041	-0.030	-0.230**	-0.220
	(0.036)	(0.056)	(0.094)	(0.090)	(0.152)
Control for city size	Yes	Yes	Yes	Yes	Yes
Observations	480	480	480	480	480

Standard errors are bootstrapped using 100 replications. *** Denote estimates significant at the 1% level, ** at 5%, * at 1%.

[8] See Angrist and Pischke (2009) for a recent review of the benefits of quantile regressions.

[9] Other estimates not controlling for city size present a similar pattern.

These results are partly in line with previous results on less developed countries. Gallipoli and Goyette (2009) propose to explain the fact that the size heterogeneity across firms is greater for less developed countries than for developed countries by their larger degree of corruption. Using a sample of firms in Uganda, they suggest that small firms and entrepreneurs who would benefit from scaling-up sales and employment may refrain from doing so in order to remain informal and avoid tax liabilities and bribes. However, Emerson (2001) using a panel of countries finds that this mechanism ultimately leads to a lower share of large firms in the more corrupt economies. More recently, Dusha (2011) proposes a political economy model to rationalize these findings. In his model, corruption promotes entry at the low end of the productivity distribution and obstructs entry at the high-end, which has adverse effects on aggregate Total Factor Productivity.

Large firms face more impediments on their growth because of corruption than small and medium firms, while large firms engage in less corruption than smaller firms. Administrative corruption is found to be negatively and highly significantly related to business growth (Beck et al., 2002). Corruption is, according to much research, generally evaluated as an important barrier in doing business. Aidis and Mickiewicz (2006) in their research on firm perceptions of business barriers and growth expectancy in Lithuania find that finance issues, reduced purchasing power of customers, and the inefficiency of investment funds are the most important business barriers after high tax rates. Even though corruption is ranked as an important but not the most critical business barrier, it appears to have the most negative effect on growth expectancy, indicating it constitutes a major impediment on growth.

In Greece the growth and performance of SMEs are severely hampered by limited access to finance, limited access to the international market, and legal and administrative burdens. In economic downturns the growth prospect of SMEs is affected by limited access to finance, limited demand for their products and limited liquidity in the market. In order to support SMEs to overcome the economic crisis, the Greek government is prioritizing the implementation of concrete measures and necessary reforms, aiming to foster competition, productivity and innovation in the market, according to the priorities of the European Union (National Observatory for Small and Medium Enterprises, 2008). Large firms usually have more opportunities to avoid business constraints, as they can internalize much of their capital via the financial markets and financial intermediaries and are less affected by the situation in the public markets.

However, SMEs often have some advantages in comparison to large enterprises because they are characterized by greater flexibility and an ability to adapt in different market conditions (National Observatory for Small and Medium Enterprises, 2008). This ability to adapt could support the finding of the paper on SMEs being less hindered by corruption. Ayyagari et al., (2007) investigate the effect of financial and institutional barriers for SMEs and find robust evidence that financing constraints constitute a serious impediment to their growth and operation, and these constraints appear more significant than corruption. However, corrupt practices in doing business might be proven more inefficient and costly for large firms that compete at an international level. Such firms need

to comply with international standards, adopt global business practices, and obtain the approval of the international business community through following legitimate policies. Another explanation why corruption can constitute a stronger barrier for the size and development of large firms is attributed to the fact that smaller firms are less noticeable and therefore they would be less approached for extracting rents, since their actual capacity to make unofficial payments would be limited. Additionally, smaller firms may be more financially constrained and therefore less likely targeted for bribes by public officials. However, as firms grow they would be more likely pressed for bribes. Consequently, the lack of business efficiency caused by widespread corruption could be more costly and difficult to circumvent for large firms.

The asymmetric relationship between corruption and firm sales

The relationship between corruption and sales is heterogeneous among firms of different size. However, there is a systemic impact of corruption, and small and medium firms are also affected indirectly, on the sectoral level, from contextual corruption as discussed in the previous section. Business corruption decreases competition and efficiency and develops a 'rent-seeking' environment. The demand of bribes by public officials for the acquisition of licences and permits could reduce the amount of firms that can enter the market and the growth of the existing ones (Sullivan and Shkolnikov, 2004).

The asymmetric effect of corruption on firm sales is confirmed when we look at the contextual effect of corruption. As before, contextual corruption is computed at the leave-one-out average of the firms of the same manufacturing sector. In Table 9 the effect of contextual corruption appears much more clearly in the upper tail of the firm sales distribution. Small firms appear again the least affected by corruption, the point estimate for the lowest decile being negative (-0.061) but insignificant at the 10% level. However there are substantial differences with the previous estimates at the firm level. The impact of contextual corruption appears more consistent and negative across quantiles. The quantile estimate of the first quartile (-0.131) is already significant at the 10% level and the median effect (-0.266) is only marginally smaller than the effect on the upper quartile and the top decile (-0.332 and -0.334). This means that contextual corruption, contrary to firm level corruption, tends to shift downward the whole distribution of firm sales, even if the largest firms are still the most affected.

This systemic and contextual risk of corruption could be limited by improving the institutions that shape the business environment in Greece, thereby supporting the operation of large firms and SMEs. There have been policies addressed directly to the growth of SMEs, however, the results of the study show that large firms may be more hampered by administrative corruption. The overall improvement on the institutional environment could be beneficial for firms of different size and could promote entrepreneurship.

Table 9: Contextual corruption and the distribution of firm size, quantile regression estimates

	Quantile regression for log sales				
Quantile	0.1	0.25	0.5	0.75	0.9
	(1)	(2)	(3)	(4)	(5)
Contextual corruption	-0.061	-0.131	-0.266*	-0.332	-0.334
	(0.099)	(0.118)	(0.149)	(0.247)	(0.375)
Control for city size	Yes	Yes	Yes	Yes	Yes
Observations	417	417	417	417	417

Standard errors are block-bootstrapped using 100 replications at the sectoral level. *** Denote estimates significant at the 1% level, ** at 5%, and * at 1%, respectively. The contextual corruption is computed at the leave-one-out average of the firms of the same manufacturing sector.

In a study by the Athens Chamber of Commerce and Industry, more than 1,100 respondents evaluated the main business constraints in firms across Greece. Corruption between firms and the public sector was identified as a major obstacle in doing business, as was bureaucracy in the public services, the large size of the public sector in Greece, and the inability to combat the unofficial economy and trade. The main factor identified to hinder entrepreneurship is the lack of stability and predictability of changes in the tax, employment and insurance regulations. Access to finance was also identified as a significant barrier in doing business (Athens Chamber of Commerce and Industry, 2011).

Measures that could boost the overall business environment in Greece include a reduction of the operational cost of enterprises and administrative burdens and a simplification of the business environment through changes in public administration. Overall, the obstacles for starting a business should be decreased (Ioannidis, 2004). Business barriers in the entry and operation of a firm create an ideal environment for corruption to occur. In the cases where, in order to acquire a licence for the start-up of a company, bribery is required, many companies are driven to the informal economy (Sullivan and Shkolnikov, 2004). The procedures for business licences and business registrations should be decreased and simplified. The upgrade of public sector services through e-government could simplify procedures for setting up and operating a business, decrease time spent with public officials and improve effectiveness and transparency in the system. Reducing the discretion public officials have to interpret the regulations and raising tax compliance could also have a positive result in combating corruption (Sullivan and Shkolnikov, 2004). The modernization of the public administration and the implementation of reforms to simplify the regulatory environment could support business, decrease corruption and reinforce the international competitiveness of Greek firms (Ioannidis, 2004).

6. Conclusion

The study analyses administrative corruption as a business barrier to firm size and performance in Greece, and identifies the sectors that are most hampered by corruption and the sectors most prone to corrupt behaviour. The contextual effect of corruption, measured by the extent of corrupt practices in the firm sector, appears to be more detrimental to firm performance than the firm experience of corruption. Hence, both the sector and the firm environment determine the overall, negative, and systemic effect of corruption on firms in Greece. However, firms respond differently to business barriers and the relationship between corruption and firm growth appears to be significantly affected by the size of the company. Firm performance may be affected by corruption irrespective of the degree of actual firm engagement. Small, medium and large firms are affected differently by administrative corruption, and the degree of their engagement in corrupt practices varies. We found that corruption appears more detrimental for the sales in large firms. As large firms represent the major part of employment, this underlines the importance of institutional reforms that will improve the overall framework for doing business in Greece and target the most vulnerable sectors and firms.

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Finance-Growth-Crisis Nexus in Asian Emerging Economies: Evidence from VECM and ARDL Assessment

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Abstract

This paper examines the causal relationship between financial development, economic growth and financial crisis in the five Asian emerging economies (India, Indonesia, South Korea, Malaysia and Thailand) during the period 1982 to 2007. All of these countries are known as emerging economies with well known financial crisis episodes (i.e., India's 1991 crisis and the Asian 1997 crisis). The summary indicators of financial development, financial crisis and financial repression are constructed through the principal component approach. The cointegration and Granger causality analysis are conducted by using two techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). The main findings are: (1) the direction of the finance-growth nexus is country-specific; (2) deeper financial development can lead to financial crisis; and (3) financial crisis has a negative impact on economic growth (except Korea for the last two). On policy implication, we ascertain that the growth effect of financial deepening should be appraised with the view that financial deepening could gravitate toward financial crisis.

Keywords: Finance-growth nexus, financial crisis, Asia, VECM, ARDL

JEL Classification: E44, O16, O53

1. Introduction

Since the seminal works of McKinnon (1973) and Shaw (1973) were published, the finance-growth nexus—how financial development and economic growth interact with each other—has been extensively assessed but the results are inconclusive and the issue remains debatable. On the other hand, as more economies—in particularthose known as emerging economies—have been increasingly exposed to severe financial disturbances over the last few decades, financial crisis has emerged as one of the hottest topics in the literature,

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highlighting crucial damages on crisis-hit economies. This paper attempts to integrate these two subjects or to examine the "finance-growth-crisis" nexus in five Asian emerging economies (India, Indonesia, South Korea (hereafter Korea), Malaysia and Thailand). All countries of our sample are known as emerging economies with rapid financial deepening, high economic growth and financial crisis episodes. Since the Chakravarty Committee Report (Report of the Committee to Review the Working of the Monetary System) (Reserve Bank of India, 1985) was announced in April 1985, India was in the process of (partial) financial liberalisation and experiencing credit boom and high GDP growth over the late 1980s. Then, the severe crisis hit that country in early 1991. As described by the term "East Asian miracle" (World Bank, 1993), the high economic achievements of Indonesia, Korea, Malaysia and Thailand has been praised. Their success stories, however, were suddenly terminated by the Asian 1997 crisis[1]. These profiles prompt us to examine the finance-growth-crisis nexus in the five countries.

The motivation of this study is to address the following inherent problems observedin the literature. First, although the relationship between financial deepening and economic growth potentially relates to the incidence of financial crisis, the trivariate linkage of financial development, economic growth and financial crisis has not been deliberated yet, especially in the framework of cointegration and Granger causality. Second, in the empirical literature of finance-growth nexus, the leading evidence—finance exhibits a positive impact on growth—has been drawn from cross-country and panel data models. These models, however, implicitly presume homogeneity in different countries' growth patterns and thus mask country-specific factors in estimation (Demetriades and Hussein, 1996; Luintel and Khan, 1999).

The goal of this paper is to shed light on the "finance-growth-crisis" nexus in the five Asian emerging economies. Our contributions to the literature are given as follows. First, we provide country-by-country estimates of the five Asian countries by using the techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). Evidence from our study that takes into account country-specific conditions will be more plausible than that from a cross-country and panel data study that looks for a single generalized result by averaging and pooling sample countries' data.Both VECM and ARDL, which are based on different concepts of cointegration (i.e., Johansen, 1988; Pesaran et al., 2001), is an inventionthat helps attach robustness to our analysis[2]. Second, and more importantly, we extend the finance-growth nexus—the empirical results on this topic have not been reconciled yet—to the finance-growth-crisis nexus. By doing so, more accurate estimates on finance-growth nexus will be detected because the interaction between finance, growth and crisis must be crucial to determine the effect of finance or growth on each of them. Additionally, we are also concerned with how both finance and

[1] See, Joshi and Little (1996) for India's 1991 crisis and the World Bank (1998) for the Asian 1997 crisis.

[2] Using both VECM and ARDL techniques, Enisan and Olufisayo (2009) examined the causal link between stock market development and economic growth in African countries.

growth influence crisis (finance→crisis and growth→crisis). In particular, assuming that financial boom typically precedes crisis, we predict that the increasing level of financial development crucially causes financial crisis.

The remainder of the present paper is structured as follows. In Section 2, the relevant literature is outlined. In Section 3, those underlying variables of the economic indicator (EG) and three summary indicators are described. Econometric models and procedures are provided in Section 4. The empirical findings are reported and discussed in Section 5, and concluding remarks are given together with policy implications in Section 6. For this study, we used the data from the IMF's International Financial Statistics (IFS), the World Bank's Financial Structure Dataset (FSD) and World Development Indicators (WDI), and the publication of the Reserve Bank of India (in case of India).

2. Literature Review

Advanced by theoretical achievements of McKinnon (1973) and Shaw (1973) and the endogenous growth literature (e.g., Greenwood and Jovanovic 1990; Bencivenga and Smith, 1991), it has been a general concept that financial development is vital to attain higher economic growth. That is, financial institutions utilize productive resources to facilitate capital formation and thus play a crucial role in mobilizing saving and in allocating thus collected resources efficiently to productive sectors. On the other hand, there is a sceptical view on the role of financial development in economic growth, as given by Robinson's (1952) argument that ''where enterprise leads, finance follows''. Since the increasing demand for financial services is brought by economic growth, it is economic growth that is the chief driving force behind financial deepening and the growth effect of finance is overstressed (Lucas, 1988). Thus, the assertion that financial development promotes economic growth is a persuasive but unqualified assumption yet, so that there is a need for empirical confirmation. One way of performing empirical analysis is based on the following regressions:

$$Y_{it} = f\left(FD_{it}, X_{it}\right) \tag{1}$$

$$FD_{it} = f\left(Y_{it}, X_{it}\right) \tag{2}$$

where Y_{it} is the growth rate of country i, FD_{it} is an indicator of financial depth, and X_{it} is a set of controlled variable. In the multi-country assessment of finance-growth nexus, there has been a methodological controversy between cross-country and panel data studies and time series studies. Indeed, there is a conceptual difference in these two. The school of cross-country and panel data analysis was pioneered by King and Levine (1993)[3]. Initially, due to the lack of sufficient time series data for developing countries, empirical research on the finance-growth nexus was dominated by cross-country and panel data models. These studies consistently show a positive relationship of finance→growth while seeking a

[3] Recently, the generalized method of moments (GMM) panel data analysis has been common.

single generalized estimate by averaging and pooling the data of multiple countries. Such a procedure, which is implicitly based on the assumption of a homogenous, balanced growth path across countries, not only provides a clear single result but also does not allow different countries to exhibit different patterns of causality[4].One feature of cross-country and panel data analysis is that, it addresses Equation 1 only with economic growth is the dependent variable. The school of time series analysis was pioneered by Demetriades and Hussein (1996). In contrast, the time series approach estimates both Equations 1 and 2, and tests for the Granger causality between finance and growth. Thus, it enables us to carry out a country-by-country assessment in which different countries can exhibit different estimates, reflecting country-specific conditions in the results. Nonetheless, the time series evidence of finance-growth nexus in each country, particularly for causal direction, has been mixed, that is, either finance→growth or growth→finance or finance↔growth (bilateral) (see, Demetriades and Hussein, 1996; Luintel and Khan, 1999; Fase and Abma, 2003; Rousseau and Vuthipadadorn, 2005).

Finally, among several topics in the vast financial crisis literature, we highlight the emergence of the New Financial Architecture (NFA) which relates most to this study. The NFA refers to:

"the global integration of modern financial markets that is based on light government regulation of financial intermediaries" (Crotty, 2009, p. 564).

Under such a global environment, financial liberalisation was initiated, or the extent of financial repression was lessened by deregulating or removing interest rate ceilings, lowering reserve requirements and reducing the volume of directed credit, especially in those called emerging economies over the last two decades. In addition, some countries also promoted stock market development byallowing foreign financial intermediaries into their financial (both credit and stock) markets. The financial profiles of our sample countries typically follow this NFA argument. Although financial development contributes to higher economic growth in these countries, its favourable effects have been questioned due to increasing financial fragility and resultant financial crisis (i.e., India's 1991 crisis and the Asian 1997 crisis) that severely affected emerging economies.

3. Data

3.1 Use of Quarterly Data

An important aspect of this study is the use of quarterly data[5].In performing time series analysis, more observations provide better statistically acceptable estimates. However, data for developing countries like in our sample is very limited. Their annual data series cover only a limited span and thus provide fewer observations. As discussed below in *Financial*

[4] Quah (1993) discusses these procedures of the cross-country analysis.

[5] It has been pointed out that quarterly frequency data are usually associated with short-run cyclical fluctuations of the economy. Hence, if a series exhibits a prominent seasonality, it is removed from that series through proper statistical procedures.

C*risis* I*ndicator*, the quarterly volatility in each elementary variable is calculated to produce the financial crisis indicator (FC). We contend that quarterly frequency observations are better in handling volatility in estimation. The weakness of monthly volatility is that it is too constantly fluctuating. Likewise, if annual volatility is computed, it is less fluctuating, or it is actually a pulse dummy highlighting the year of a crisis.

3.2 Disaggregation Procedure for GDP Series

Except for Korea, other countries in our sample countries do not provide the quarterly data on GDP for the intended period of study, i.e., 1982 to 2007. Korea's quarterly GDP series, however, exhibited a strong seasonality that is not properly erased through the seasonal decomposition procedure. Hence, we disaggregate the five countries' annual nominal- and real per capita GDP (nominal GDP deflated by the GDP deflator and the population) series to quarterly ones through the method developed by Chow and Lin (1971), and use this estimated quarterly figures for our estimation. The nominal GDP series are used as a deflator in calculating several elementary variables of financial development and financial repression, and the volatility in nominal GDP is measured as one of the elementary variables of financial crisis (see, Table A1, A2, A4, in Appendix). Likewise, we compute quarterly real per capita GDP and take its logarithm as the economic growth indicator (EG).

In conducting the disaggregation through the Chow and Lin method, we need to take actually measured quarterly data series—as the indicator(s)—into calculation; those indicators are necessary to give proper fluctuations to quarterly GDP series. For this end, we choose and use such related series as: export volume (IFS line 70) for Indonesia, Malaysia and Thailand; and both industrial production (IFS line 66) and export volume for India and Korea[6]. Through such procedures, we calculated the five countries' nominal GDP and EG series, and present their EG plots in Figure A1 to A5, in Appendix. As illustrated, India's EG shows prominent fluctuations around the crisis year 1991, whereas those of four countries show a clear change around the period 1997 to 1998.

3.3 Summary Indicators

In subsequent discussion, we sketch three summary indicators of the financial development indicator (FD), financial crisis indicator (FC) and financial repression indicator (FR), respectively, through the principal component approach. The use of the principal component approach in the construction of summary indicators was pioneered by Demetriades and Luintel (1997) and followed by Ang and McKibbin (2007)[7]. The plots of the five countries' summary indicators are provided in Figure A1 to A5, in Appendix.

[6] The combinations of indicators (industrial production and export volume) are different among the sample countries. Here, we empirically confirm that each of those combinations is important to avoid autocorrelation in each country's estimation.

[7] To conserve space, the description on the construction of the summary indicators is not presented but is available upon request.

3.3.1 Financial Development Indicator

One issue in the empirical literature is that there is no single indicator that sufficiently captures all aspects of financial deepening. As a result, most studies—including pioneering works of King and Levine (1993) and Demetriades and Hussein (1996) and recent ones—separately examine the relationship between economic growth (mostly real per capita GDP) and each of several financial development variables (e.g., liquidity liabilities (M3) and domestic credit provided to the private sector). Another issue is that banking and stock market—two major components of financial development—have been independently assessed in the literature. Such studies as Levine and Zervos (1998) and Arestis et al. (2001) investigated the effect of stock market development on economic growth. Meanwhile, there are few studies that consider financial development as an integrated phenomenon consisting of banking and stock market, despite the increasing proportion of the latter in a financial system. Taking into account these issues, we argue that financial development—as a single phenomenon—should be measured by combining several elements. And five elementary variables of financial development, which are commonly used in the empirical literature, are combined to make the financial development indicator (FD) (see, Table A1 in Appendix)[8]. The ratio of money supply to GDP (MTG) is picked up to estimate the degree of financial depth in the simplest manner. We are also concerned with the financial size and activity (liquidity) measures (BATG, PCTG, SKTG and SVTG) as suggested by Beck et al. (1999). With these measures, the impact of two financial channels (banking sector and stock market) and their two aspects (size and activity) are approximated.

3.3.2 Financial Crisis Indicator

In creating the financial crisis indicator (FC), we contend the following two points. First, financial crisis should be measured by a rich set of macroeconomic indicators. The rationale is that although financial crises are generally classified into currency and banking crises, we consider financial crisis as a combined macroeconomic phenomenon consisting of both currency and banking crises (Kaminsky and Reinhart, 1999). Indeed, each type of crisis is influenced by several macroeconomic factors[9]. Second, obtaining a hint from the ongoing debate in the macroeconomic volatility literature, we consider that, while financial fragility—as a continuous phenomenon—can be measured as changing volatility in an economy, financial crisis is identified as an extreme volatility in that process[10,11].

[8] In this article, a summary "indicator" is made of severalelementary variables.

[9] For selecting the elementary variables of financial crisis, we reviewed the "leading indicators of crisis" or early warning system (EWS) literature pioneered by Kaminsky et al. (1998).

[10] The macroeconomic volatility literature initially concerns the link between economic growth and volatility (e.g., Ramey and Ramey, 1995) and recently was extended to studying that linkage in terms of globalization, that is, growing international trade and financial integration (e.g., Kose et al., 2006).

[11] "Many of these (emerging) economies have experienced rapid growth but have also been subject to high volatility, most prominently in the form of severe financial crises that befell many of them during the last decade and a half" (Kose et al., 2006, p. 177).

Based on these arguments, we calculate the volatility in each of 16 elementary variables of financial crisis (see, Table A2 in Appendix) by the squared returns. In case of real exchange rate (ER), for example, its volatility is computed as: $X_t^2 = \left[\log\left(ER_t / ER_{t-1}\right)\right]^2$ .Next, we compute a 4-quarter rolling average of X_t^2 because the volatility values in level are too uneven, to search for more correlations among the financial crisis variables in constructing the FC. Since the availability of financial crisis variables and the results of the principal component analysis differ for each of the five countries, we have created the FCs that consist of different numbers and combinations of financial crisis variables (see, Table A3 in Appendix). Finally, as described in Figure A1 to A5 in Appendix, the plots of the five countries' FCs exhibit the peak or extreme volatility over the crisis periods (i.e., the period 1990 to 1991 for India and the period 1997 to 1998 for the other four countries).

3.3.3 Financial Repression Indicator

Inspired by the fact that financial systems in our sample countries are controlled and regulated to various extents, we are also concerned with financial repression. Financial repression takes the form of such financial distortions as interest rates controls (ceilings), reserve requirements and directed credit. McKinnon (1993, p. 11) defines financial repression as:

> "When governments tax (through reserve requirements) and otherwise distort their domestic capital markets (through interest controls and directed credit), the economy is said to be financially repressed".

Another argument is that a high degree of financial repression is associated with high inflation or seigniorage (Bencivenga and Smith, 1992). Moreover, we assume that, as the volume of credit provided to the government increases crowding out the credit provided to the private sector, the extent of financial repression is intensified. Based on these arguments, we select eightelementary variables of financial repression (see, Table A4 in Appendix).

4. Methodology

4.1 Hypothesis Testing

The basic models of this study are given as follows:

$$EG_i = f(FD_i, FC_i, FR_i) \tag{3}$$

$$FD_i = f(EG_i, FC_i, FR_i) \tag{4}$$

$$FC_i = f(EG_i, FD_i, FR_i) \tag{5}$$

where *EG* is the economic growth indicator as measured by the logarithm of real per capita GDP, and *FD*, *FC* and *FR* are the financial development, financial crisis and financial repression indicators, respectively. Through Equations 3 and 4, the issue on the finance-

growth nexus is addressed, that is, whether the causation runs from finance to growth or growth to finance or bilaterally. Likewise, we are also concerned with the impact of financial crisis and financial repression on economic growth and financial development. Another vital issue is represented by Equation 5, through which the linkage between financial crisis and other variables is investigated. Importantly, these hypotheses are investigated through two different concepts of cointegration: VECM requesting all underlying variables to be $I(1)$ and ARDL accepting either $I(0)$ or $I(1)$.

4.2 Vector Error Correction Models

We formulate the following VECMs for EG, FD and FC as the dependent variables, respectively:

$$\Delta EG_t = \alpha_1 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{11} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{12} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{13} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{14} \Delta FR_{t-j} + \theta_{15} SGD_t + \theta_{16} PCD_t + \theta_{17} SBGD_t + inpt + u_{1t} \quad (6)$$

$$\Delta FD_t = \alpha_2 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{21} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{22} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{23} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{24} \Delta FR_{t-j} + \theta_{25} SGD_t + \theta_{26} PCD_t + \theta_{27} SBGD_t + inpt + u_{2t} \quad (7)$$

$$\Delta FC_t = \alpha_3 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{31} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{32} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{33} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{34} \Delta FR_{t-j} + \theta_{35} SGD_t + \theta_{36} PCD_t + \theta_{37} SBGD_t + inpt + u_{3t} \quad (8)$$

where ECT is the error-correction term—for example, in Equation 6, $ECT = \beta_{11} EG_{t-1} + \beta_{12} FD_{t-1} + \beta_{13} FC_{t-1} + \beta_{14} FR_{t-1}$ in which β_{ij}'s are the elements of the cointegrating vector —whose coefficient (α) is expected to have a negative sign[12]. Here, dummy variables included are briefly elucidated. First of all, to avoid autocorrelation, we allocate SGD (the shock in economic growth dummy), which takes the value of one for negative EG growth periods otherwise zero. Although SGD is initially allocated, if SGD alone does not circumvent autocorrelation, we properly add such dummies as: SFD (the shock in financial development dummy), which is one for negative FD growth periods, otherwise zero; and SFCD (the shock in financial crisis dummy), which takes the value of one for positive FC growth periods otherwise zero. Unless SGD is needed, we exclude it and instead take either/both of SFD or/and SFCD only. Moreover, PCD is the pre-crisis dummy that takes the value of one for 1990Q1 to 1990Q4 and zero for other periods in India's analysis. For the other four countries, PCD is not included. Finally, the allocation of SBGD (the structural break in economic growth dummy) is discussedbelow in *Bai and Perron test*. For

[12] Since the dummy variables included are different across the countries (see Table 2), Equations 6 to 11 are India's VECM and ARDL models.

giving interference, two types of the causality test are conducted. The first test is the weak exogeneity test in which the null of H_0: $\alpha_j = 0$. Indeed, the weak exogeneity test presents the evidence of long-run causality. The second test is the strong exogeneity test that imposes the strongest restriction of H_0: all θ_{ij}'s = $\alpha_j = 0$ in each VECM and thus indicates the overall causality in the system (see, Charemza and Deadman, 1997). These two tests are based on chi-square statistics from the Wald test.

4.3 Autoregressive Distributed Lag Models

Subsequently, the ADRL frameworks are presented by the following error correction models (ECMs):

$$\Delta EG_t = \alpha_4 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{41} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{42} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{43} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{44} \Delta FR_{t-j} + \theta_{45} \Delta SGD_t + \theta_{46} \Delta PCD_t + \theta_{47} \Delta SBGD_t + inpt + u_{4t} \quad (9)$$

$$\Delta FD_t = \alpha_5 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{51} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{52} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{53} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{54} \Delta FR_{t-j} + \theta_{55} \Delta SGD_t + \theta_{56} \Delta PCD_t + \theta_{57} \Delta SBGD_t + inpt + u_{5t} \quad (10)$$

$$\Delta FC_t = \alpha_6 ECT_{t-1} + \sum_{j=1}^{p-1} \theta_{61} \Delta EG_{t-j} + \sum_{j=1}^{p-1} \theta_{62} \Delta FD_{t-j} + \sum_{j=1}^{p-1} \theta_{63} \Delta FC_{t-j} + \sum_{j=1}^{p-1} \theta_{64} \Delta FR_{t-j} + \theta_{65} \Delta SGD_t + \theta_{66} \Delta PCD_t + \theta_{67} \Delta SBGD_t + inpt + u_{6t} \quad (11)$$

The ECT in Equation 9, for example, takes the form of: $ECT = \beta_{41} EG_t + \beta_{42} FD_t + \beta_{43} FC_t + \beta_{44} FR_t + \beta_{45} SGD_t + \beta_{46} PCD_t + \beta_{47} SBGD_t + inpt$. The ARDL estimation provides $(p+1)^k$ number of regressions, where p is the maximum number of lags to be used and k is the number of variables in the ARDL equation. Since this study uses quarterly series, the maximum lag is initially set at $p = 4$. At the first stage, we need to conduct the bounds test that computes F-statistics to confirm the existence of long-run cointegrating relationships between the underlying variables irrespective of whether those variables are $I(0)$ or $I(1)$ (Pesaran and Pesaran, 2009). At the second stage, the optimal lag order for each variable is set. We look for the optimal lags by referring either to the Akaike information criteria (AIC) or to the Schwartz–Bayesian criteria (SBC). Finally, two types of the causality test, which are suggested in the VECM analysis, are carried out for each ARDL model.

4.4 Bai and Perron Test

Since the structural break literature emerged, it has been generally agreed that a structural break exists in time series data[13]. In fact, visually checking the EG (real per capita

[13] For a comprehensive review of the structural break literature, see Perron (2006).

GDP) plots in Figure A1 to A5 in Appendix, India seems to have a break around 1991, whereas the other four countries have a prominent break over the period 1997 to 1998. We therefore consider it important to take the element of structural break into our analysis for obtaining more plausible estimates. For this end, the structural break in economic growth dummy (SBGD) is allocated by estimating structural break(s) in each country's EG series through the test developed by Bai and Perron (1998; 2003) (hereafter the BP test)[14]. The BP test specifies multiple structural changes in a linear regression model estimated by least squares, treating the dates of structural breaks as unknown and endogenous events. Thus, the rationale for performing the BP test is that it allows us to determine break points statistically and objectively not setting the break dates based on *a priori* information. We conduct the BP test through the following unrestricted vector autoregression model (EG-VAR) where EG is the dependent variable:

$$EG_t = \sum_{j=1}^{p} \alpha_{11} EG_{t-j} + \sum_{j=1}^{p} \alpha_{12} FD_{t-j} + \sum_{j=1}^{p} \alpha_{13} FC_{t-j} + \sum_{j=1}^{p} \alpha_{14} FR_{t-j} + \alpha_{15} SGD_t + \alpha_{16} PCD_t + inpt + u_{11t} \quad (12)$$

To eliminate autocorrelation in our estimation, we include dummies in each EG-VAR as follows: SGD and PCD for India; SGD and SFD for Indonesia; SFD and SFCD for Korea; SGD and SFCD for Malaysia; and SGD, SFD and SFCD for Thailand[15]. As reported in Table 2, the sample periods differ across the five countries due to data availability or data truncation in the process of constructing the summary indicators. Subsequently, we check the lag order selection statistics of each EG-VAR, and set three lags for Korea, Malaysia and Thailand and four lags for India and Indonesia[16].

Based on the break dates reported in Table 1, different SBGDs are formed and included ineach country's estimation. The results show that for both India and Indonesia, the one break result is the best (1990Q1 for India and 1997Q4 for Indonesia), whereas for Thailand, the two-break result (1997Q2 and 2003Q1). Here, the selection mainly depends on whether the SBGD allocation provides a single cointegration (r = 1) and/or no autocorrelation in estimation. Nonetheless, SBGDs are not essential for both Korea and Malaysia. For Korea, instead of the BP test, we perform the Zivot and Andrew (1992) test and detect a single structural break in 1997Q4[17]. With this single break result, we allocate a zero-one dummy, which is named the Zivot and Andrew dummy (ZAD), in Korea'sestimation. On the other hand, for Malaysia, any dummy allocations — specified either by the BP test or by the ZA test — do not produce better estimates so that no SBGD is contained in Malaysia's analysis.

[14] We refer to Verma and Wilson (2005) who detected a structural break in India's annual GDP series around 1989 with the test suggested by Perron and Vogelsang (1992) and allocate zero and one dummies assuming the year 1989 as the break point.

[15] Equation 12 is for India's estimation.

[16] Since the space is limited, all the results of the BP test are not reported but are given on request.

[17] The Zivot and Andrew test is an autoregressive structural break test that specifies a single unknown break as an endogenousevent.

Finally, Table 2 shows the combinations of dummy variables that are included in the five countries' assessments.

Table 1: Bai and Perron Test Results

Country	Number of Break(s)			
	1	2	3	4
India	1990Q3	1990Q3 1997Q1	1998Q3; 1994Q2 1999Q3	—
Indonesia	1997Q4	1997Q1 2002Q2	1987Q1; 1997Q1 2002Q1	—
Korea	1998Q3	1996Q4 2001Q4	1988Q3; 1996Q4 2001Q4	1987Q4; 1992Q4 1997Q4; 2002Q4
Malaysia	1997Q1	1993Q2 2000Q2	1988Q1; 1995Q1 2000Q2	—
Thailand	1997Q3	1997Q2 2003Q1	1994Q1; 1998Q3 2003Q1	—

Source: Authors' own estimation.

Table 2: Sample Periods and Dummy Variables Included

Country	Sample period	Dummy variables
India	1982Q1 to 2007Q4	SGD; SBGD (one break: 1990Q3); PCD
Indonesia	1982Q1 to 2007Q4	SGD; SFD; SBGD (one break: 1997Q4)
Korea	1983Q1to 2007Q4	SFD; SFCD; ZAD (1997Q4)
Malaysia	1982Q1 to 2007Q4	SGD; SFCD
Thailand	1986Q1 to 2007Q4	SGD; SFD; SFCD; SBGD (two breaks: 1997Q2 & 2003Q1)

Source: Authors' own estimation.

5. Empirical Results

The total of 24 models is estimated for the five Asian countries, and the sample periods of these countries are the same as those in the BP test (see, Table 2). The number of observations ranges from 89 to 104 among the sample countries. While some models indicate the evidence of heteroscedasticity, non-normality and functional form problem, all models are free from autocorrelation at the 10% significance level or better (see, Table A5 in Appendix).

5.1 Unit Root and Cointegration Tests

The order of integration of variables in this study is determined by the ADF and PP unit root tests. To keep the accuracy in unit root statistics, both the two tests are exposed to (exogenous) structural break(s) whose dates are given in Table 2[18]. The results in Table 3 fairlyidentify that all the five countries' EG, FD, FC and FR are non-stationary in their levels (except the PP result of Indonesia's FR) but become stationary after taking the first difference[19]. Thus, all the underlying variables are confirmed as $I(1)$ even with the presence of structural break[20].Next, the Johansen (1988) cointegration test (with unrestricted intercepts and no trends) is conducted treating FR as an exogenous $I(1)$ variable in the cointegrating vector[21]. It is important to determine the lag order prior to the cointegration test, as the Johansen test is highly depended on the choice of lag length. The appropriate lag length chosen is three for Korea, Malaysia and Thailand and four for India and Indonesia. Based on trace statistics, the results in Table 4 indicate a single cointegration relationship ($r = 1$) among EG, FD and FC at the 10% level or better in all the countries.

Table 3: Results of Unit Root Test with Structural Break(s) ($k = 4$)

Panel A	India		Indonesia		Korea	
	One break (1990Q3)		One break (1997Q4)		One break (1997Q4)	
	ADF	PP	ADF	PP	ADF	PP
EG	-0.395	-0.122	-1.934	-1.490	-2.129	-2.057
ΔEG	-3.639*	-11.692*	-3.757*	-3.517*	-4.948*	-9.141*
FD	0.192	-0.137	-2.045	-2.411	-2.340	-2.156
ΔFD	-3.680*	-15.584*	-5.315*	-16.019*	-3.528*	-11.081*
FC	-2.052	-1.835	-2.914	-2.379	-2.135	-1.756
ΔFC	-5.780*	-7.086*	-4.939*	-7.653*	-4.580*	-6.046*
FR	-0.708	-1.649	-2.943	-4.386*	-2.881	-2.676
ΔFR	-4.579*	-14.758*	-5.752*	-17.343*	-3.519*	-13.403*

[18] For the ADF and PP unit root tests with exogenousstructural break, see Pesaran and Pesaran (2009).

[19] As mentioned in Section 4.4, although SBGD is not taken into estimation, Malaysia's unit root tests are exposed to one break (1997Q1).

[20] The standard ADF and PP tests either of intercept and no trend or of intercept and liner trend also confirm that all the underlying variables are I(1). The results are given on request.

[21] For details, see, Pesaran et al. (2000).

Panel B	Malaysia		Thailand	
	One break (1997Q1)		Two breaks (1997Q2 & 2003Q1)	
	ADF	PP	ADF	PP
EG	-1.947	-1.687	-2.354	-2.159
ΔEG	-4.515*	-7.029*	-2.931	-5.917*
FD	-2.208	-2.077	-1.596	-1.660
ΔFD	-4.285*	-10.568*	-3.064	-8.479*
FC	-2.603	-2.486	-2.405	-2.485
ΔFC	-4.828*	-9.263*	-5.958*	-5.725*
FR	-2.258	-1.843	-1.940	-2.582
ΔFR	-4.339*	-9.728*	-4.654*	-10.084*

Source: Authors' own estimation.
Notes: *denotes statistical significance at the 5% level.

Table 4: Johansen Cointegration Test Results (Trace Statistics)

Null	Alternative	India	Indonesia	Korea	Malaysia	Thailand
r = 0	r = 1	47.57*	61.36*	59.20*	37.86**	56.72*
r <= 1	r = 2	17.12	20.12	16.21	12.5	13.8
r <= 2	r = 3	2.92	0.93	0.97	2.48	4.43

Source: Authors' own estimation.
Notes: * and ** denote statistical significance at the 5 and 10% levels, respectively.

5.2 ARDL Procedures

The bounds test is implemented with maximum lag order of four for India and Indonesia, and three for Korea, Malaysia and Thailand. The test statistics in Table 5 reveal that, there is cointegration relationship in: all EG, FD and FC for Korea; FD and FC for India and Malaysia; and only FC for Indonesia and Thailand. Although several *F*-statistics in Table 5 are judged as inconclusive in the bounds test, the presence of cointegration has been detected through the conventional unit root tests (i.e., the ADF and PP tests)[22]. Next, while we seek the lag length of each underlying variable, both AIC and SBC give us only the lag selections that seem to cause autocorrelation in both India and Indonesia's models. Hence, the orders of the two countries are manually set as presented in Table 5. For the rest of three countries, Korea's models are selected by SBC and Malaysia and Thailand's models by AIC, respectively.

[22] For the bounds test procedures, see Pesaran and Pesaran (2009).

Table 5: Bounds Test Results and Selected Orders

	EG	FD	FC
India	0.899	3.526; (2, 4, 2, 2)	3.225; (4, 1, 4, 0)
Indonesia	2.395	1.451	5.362; (4, 2, 2, 0)
Korea	5.427; (1, 3, 1, 0)	2.880; (3, 1, 0, 0)	6.323; (2, 0, 0, 0)
Malaysia	2.552	3.936; (1, 0, 0, 3)	2.836; (3, 0, 0, 0)
Thailand	0.627	1.180	8.342; (3, 3, 1, 3)

Source: Authors' own estimation.

Notes: 5% bounds 3.23 to 4.35 and 10% bounds 2.72 to 3.77. In parentheses, the sequence is (EG, FD, FC, FR) for EG model, (FD, EG, FC, FR) for FD model and (FC, EG, FD, FR) for FC model. The sequence is given to the results statistical significant at the 10% level or better.

5.3 Finance-Growth Nexus

Table 6 contains the relevant findings on the finance-growth nexusin the five Asian countries. Both "Yes" and "No" results are based on the strong exogeneity statistics from both VECM and ARDL. The "Yes" means significant at the 10% level or better, and the weak exogeneity is significant at the 10% level or better and marked by "§". We observe that the finance and growth are positively related to each other in all countries irrespective of the level of significance. In case of India and Malaysia, their finance-growth causality is identified as bilateral within the VECM framework, whereas their ARDL estimates reject the cointegrating relationship in EG-ARDL, suggesting the causal link of growth→finance. This leads us to conclude that the finance-growth nexus is primarily bidirectional but tipping more towards growth→finance. For Korea's finance-growth nexus, while the VECM results support the causal link of growth→finance, the ARDL results demonstrate the bilateral causality. Although the weak exogeneity test results are insignificant in Korea's EG-ARDL and FD-ARDL, we detect stronger evidence of finance→growth causal link from Korean's VECM outcomes. In cases of Indonesia and Thailand, their finance-growth nexus cannot be investigated through ARDL as the bounds test results reject their long-run causality between finance and growth. Nonetheless, the VECM estimates clearly show that the causality runsfinance→growth in Indonesian and growth→finance in Thailand.

The conclusions of the five Asian countries' finance-growth nexus are summarized in Table 7. As we can see, a variation across countries is observed even though the same variables and approach are used. The demand-leading hypothesis — economic growth leads to higher financial development but not vice versa — is supported by Thailand's results. Although their finance-growth nexus is concluded as bilateral, both India and Malaysia's estimates are partially supported the demand-leading hypothesis. On the other hand, the supply-leading hypothesis (finance→growth) is validated by the results for Indonesia and

Korea. Finally, Table 8 shows time series evidence from several empirical studies that assessed the finance-growth nexus in India, Indonesia, Korea, Malaysia and Thailand using standard techniques (mainly VECM). As we can see, the results are mixed within each country.

Table 6: Finance-Growth Nexus (1)

Country	Finance→Growth		Growth→Finance	
	VECM	ARDL	VECM	ARDL
India	Yes**	—	Yes* §	Yes* §
Indonesia	Yes**§	—	—	—
Korea	Yes*§	Yes*	No	Yes*
Malaysia	Yes** §	—	Yes* §	Yes* §
Thailand	—	—	Yes*** §	—

Source: Authors' own estimation.

Notes: *, ** and *** denote statistical significance at the 1, 5 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. In all the five countries, both finance and growth positively relate to each other.

Table 7: Finance-Growth Nexus (2)

Country	Result
India	Finance↔Growth but more inclining toward Growth→Finance
Indonesia	Finance→Growth
Korea	Finance→Growth
Malaysia	Finance↔Growth but more inclining toward Growth→Finance
Thailand	Growth→Finance

Source: Authors' own estimation.

Table 8: Time Series Evidence on Finance-Growth Nexus

(a) India	
Finance→Growth	Bhattacharya & Sivasubramanian (2003); Rousseau & Vuthipadadorn (2005)
Growth→Finance	Our ARDL; Kassimatis and Spyrou (2001) Arestis et al. (2002); Fase & Abma (2003)
Finance↔Growth	Our VECM; Demetriades & Hussein (1996); Demetriades & Luintel (1997) Luintel & Khan (1999); Singh (2008); Fukuda & Dahalan (2011)
(b) Indonesia	
Finance→Growth	Our VECM; Fukuda & Dahalan (2011)
Growth→Finance	—
Finance↔Growth	Rousseau & Vuthipadadorn (2005)
No causality	Majid&Musnadi (2010)
(c) Korea	
Finance→Growth	Our VECM; Kassimatis and Spyrou (2001); Fase & Abma (2003) Rousseau & Vuthipadadorn (2005); Yang & Yi (2008)
Growth→Finance	Arestis et al. (2002)
Finance↔Growth	Our ARDL; Demetriades & Hussein (1996); Luintel & Khan (1999)
(d) Malaysia	
Finance→Growth	Ansari (2002); Fase & Abma (2003); Rousseau & Vuthipadadorn (2005) Majid&Musnadi (2010)
Growth→Finance	Our ARDL; Ang & McKibbin (2007)
Finance↔Growth	Our VECM; Luintel & Khan (1999)
(e) Thailand	
Finance→Growth	Fase & Abma (2003) (1 lag); Rousseau & Vuthipadadorn (2005)
Growth→Finance	Our VECM; Demetriades & Hussein (1996) (LD) Arestis et al. (2002); Fase & Abma (2003) (2 lags)
Finance↔Growth	Demetriades & Hussein (1996) (LM); Luintel & Khan (1999)

Source: Authors' own estimation.

Notes: Demetriades and Hussein (1996) used two financial development indicators: the ratio of bank deposit liabilities to GDP (LM) and the ratio of bank claims on the private sector to GDP (LD), both of which take the form of the logarithm.

5.4 Financial Repression

As described in Table 9, the impact of financial repression either on finance or on growth are different among the five Asian countries. The causal direction of financial repression is confirmed by the sign of FR coefficient in the cointegrating space of each ECM. In India, financial repression is positive to growth and negative to finance. All the Korean models uniformly suggest the negative causality of repression→growth rejecting a significant causal link of repression→finance. Interesting is Malaysia, where financial repression exhibits a negative influence on growth and a positive one on finance as demonstrated by both VECM and ARDL. For Indonesia and Thailand, any significant results are not detected. Thus, diverse effect of financial repression on financial development and economic growth are revealed. This variation can be attributed to the institutional factors (e.g., the quality of prudential regulation) that differ considerably across the five countries. One interesting argument given by Arestis et al. (2002) is that, financial restraints (repression) can play a prudential role in preventing moral hazard behaviours in financial transactions so that financial repression exhibits a positive impact on financial development. In this context, the positive causality of repression→finance, which is found to be significant in Malaysia, is evidence of increased confidence in the financial system. In India, on the other hand, the link is negative and significant; and the causality of repression→growth is positive but insignificant. Hence, in promoting economic growth and establishing confidence in the financial system, financial policies in India are viewed as still inefficient and retarded.

Table 9: Financial Repression

Country	Repression→Growth		Repression→Finance	
	VECM	ARDL	VECM	ARDL
India	Yes(+)***	—	Yes(-)*§	Yes(-)*§
Indonesia	No(+)§	—	—	—
Korea	Yes(-)*§	Yes(-)*	No(+)	No(+)
Malaysia	Yes(-)**§	—	Yes(+)*§	Yes(+)*
Thailand	—	—	No(+)§	—

Source: Authors' own estimation.

Notes: *, ** and *** denote statistical significance at the 1, 5 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. + and - indicate positive and negative links (the direction of financial repression is confirmed by its sign in the cointegrating vector).

5.4 Finance-Growth-Crisis Nexus

Table 10 documents the effect of financial crisis either on growth or on finance. The results are summarized as: (1) crisis→finance(+) in India; (2) no significant estimate for Indonesia; (3) different estimates are detected through VECM and ARDL in Korea; (4) crisis→finance(+) and crisis→growth(-) in Malaysia; and (5) crisis→finance(+) in Thailand. Likewise, Table 11 reports how financial crisis is caused by finance, growth and repression. We identify growth→crisis(-) and finance→crisis(+) in all the countries except for Korea where growth→crisis(+) and finance→crisis(-). As far as the impact of repression on crisis is concerned, it is repression→crisis(+) in all the countries except for Thailand where repression→crisis(-).

Looking at the results in Tables 10 and 11, we infer a positive bilateral causality of finance↔crisis in India, Malaysia and Thailand. This causation might be due to financial boom that can remarkably increase the volume of credit and/or encourage stock market activities in an economy irrespective of real sector condition. Therefore, the causality of finance↔crisis(+) implies that if the government or monetary authority adopts a policy that simply increases volatility in an economy, the extent of financial deepening rises further. However, such volatility-led policy implication is obviously adverse and dangerous, leading to financial fragility and ultimately to financial crisis. This process coincides with our initial prediction that financial boom ends up with financial crisis. For Korea, a positive bilateral causality of growth↔crisis is observed, though a uniformed result is not found for the causality between finance and crisis. Thus, our analysis indicates that Korea's transmission mechanism to financial crisis differs from those in the other countries. As we can see, a bilateral link of growth↔crisis is reported to be negative in India, Indonesia and Malaysia. While the evidence of crisis→growth is relatively weak, that of growth→crisis is strongly confirmed by both the VECM and ARDL assessments (including Thailand). It thus might be argued that higher economic growth can reduce the risk of financial crisis.

Table 10: Finance-Growth-Crisis Nexus (1)

Country	Crisis→Growth		Crisis→Finance	
	VECM	ARDL	VECM	ARDL
India	No(-)	—	Yes(+)*	No(+)§
Indonesia	No(-)§	—	—	—
Korea	Yes(+)*§	No(+)	No(-)	Yes(+)*
Malaysia	Yes(-)*§	—	Yes(+)*§	Yes(+)*
Thailand	—	—	Yes(+)***§	—

Source: Authors' own estimation.

Notes: * and *** denote statistical significance at the 1 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. + and - indicate positive and negative links (the causal direction of financial repression is confirmed by its sign in the cointegrating vector).

Table 11: Finance-Growth-Crisis Nexus (2)

Country	Growth→Crisis		Finance→Crisis		Repression→Crisis	
	VECM	ARDL	VECM	ARDL	VECM	ARDL
India	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(+)*	Yes(+)*
Indonesia	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(+)*	Yes(+)*
Korea	Yes(+)*	Yes(+)*	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*
Malaysia	No(-)	Yes(-)*	No(+)	Yes(+)*	No(-)^{Ŧ}	Yes(+)*
Thailand	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(-)*	Yes(-)*

Source: Authors' own estimation.

Notes: * denotes statistical significance at the 1% level. Ŧ shows that the weak exogeneity test result of Malaysia's VECM is insignificant, whereas those of all others are significant at the 10% level or better. + and - indicate positive and negative links. The causal direction of financial repression is confirmed by its sign in the cointegrating vector.

Subsequently, the casual link between crisis and repression is discussed. As given in Table 11, it is repression→crisis(+) in India, Indonesia, Korea and Malaysia; and repression→crisis(-) in Thailand. While a high degree of financial repression seems to cause financial crisis in four countries, it is reversed in Thailand where the low degree of financial repression is observed immediately before the Asian crisis (see, Figure A5 in Appendix) hits the country. For other countries except Thailand, we argue that an extremely high degree of financial repression in a boom period attracted more speculative funds (rather than contained a credit boom). This further increases the volatility in those economies where the financial market is progressively liberalized but not well-regulated and controlled. Such a mechanism might have worked in India, Indonesia, Korea and Malaysia before these countries are severely hit by financial crisis. For Thailand, on the other hand, an expansionary financial trend—as approximated by the low degree of FR—might have typically created a financial boom led by investment opportunities that are rapidly increasing but are not properly hedged.

6. Conclusion and Policy Implications

This paper examines the cointegration and Granger causality between financial development, economic growth and financial crisis in the five Asian countries (India, Indonesia, Korea, Malaysia and Thailand) through the techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). As far as the estimates of the finance-growth nexus are concerned, although the same variables and methodology are employed, different causal directions (i.e., either finance→growth or growth→finance or finance↔growth) have been detected across the five Asian countries. The findings support the validity of country-by-country analysis employing time series techniques over the cross-country and panel data analysis that seeks a single generalized result by pooling

and averaging several countries' data. Besides, our findings are more plausible than those from a simple bivariate model because financial crisis, financial repression and structural break—which exhibit vital background effects on the finance-growth nexus—are taken into our estimation. Moreover, the use of both VECM and ARDL add more robustness to the analysis, as the long-run relationship has been confirmed through two different concepts of cointegration test.

Extending the topic of "finance-growth nexus" to a new dimension of "finance-growth-crisis nexus", we present the following policy implications. First, the positive impact of finance on growth should be evaluated with the view that deeper financial development can lead to financial crisis. Although the positive impact of finance→growth is confirmed, we must be aware of the adverse effect due to the positive bilateral causality of finance↔crisis — as the substantial cost of financial deepening — would lead to a crisis. To plan and develop a financial system for higher economic growth, policy makers need to be vigilant of the two conflicting causalities and thus thenet effect of financial deepening. Second, based on the findings of the linkage between financial crisis and financial repression, we argue that the priority in implementing the financial policy measures by the monetary authority is to reduce the threat of financial crisis whose impact is economically and socially enormous. Considering the complexity of the issue, efforts must be made to build a more robust financial system through regulatory reform. In this context, introducing some preventive measures will strengthen the resilience of the financial system that could help reduce the probability of systemic crisis at some point in the future. While this paper assumes that financial crisis in each sample country is caused by domestic factors, it is also observed that a financial crisis occurring in one country can bring about those in other countries as seen in the Asian 1997 crisis and the recent Euro crisis. Future studies should address the issue ofcris is contagion while looking at whether/how financial crisis can spill over across several countries.

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Appendix

Table A1: Elementary Variables of Financial Development

Definition (Name)	Source
Money supply/GDP (MTG)	Line 35L (for money supply) and 99B (for GDP)
Deposit money bank assets/GDP (BATG)	All categories of line 22 (for deposit money bank assets) and line 99B
Private credit by deposit money banks/ GDP (PCTG)	Line 32D (for private credit) and 99B
Stock market capitalization/GDP (SKTG)	FSD
Stock market total value/GDP (SVTG)	FSD

Notes: All the "lines" refer to those of the International Financial Statistics (IFS). Annual series of SKTG and SVTG are disaggregated to quarterly ones by the Boot et al. (1967) method.FSD = Financial Structure Dataset.

Table A2: Elementary Variables of Financial Crisis

Definition (Name)	Source
Exchange rate (ER)	ER = NER * (USCPI / SCPI) where NER is nominal exchange rate (line RF), and USCPI and SCPI are US and sample country's consumer price indexes, respectively.
Money supply / foreign exchange reserve (MTF)	MTF = NM / (FER * NER) where NM is nominal money supply (line 35L), and FER is foreign exchange reserve (line 1D).
External debt (ED)§	ED = (NED * NER) / CPI where NED is nominal external debt (WDI).
Trade volume (TV)	TV = [(X + I) * NER] / CPI where X + I is exports + imports (lines 70 and 71).
Oil price (OP)	OP = (NOP * NER) / CPI where NOP is nominal oil price (line 76AA).
Fiscal deficit (FCD)§	FCD = NFCD / CPI where NFCD is nominal fiscal deficit (Reserve Bank of India) (for India).
Gov. consumption expenditure (GCE)§	GCE = NGCE / CPI where NGCE is nominal government consumption expenditure (line 91) (for Indonesia, Korea, Malaysia and Thailand).
Share price (SP)	SP = NS / CPI where NSP is nominal share price (line 62).
Inflation rate (IR)	IR = [(CPI – CPI(-1)) / CPI(-1)] * 100
Real interest rate (RR)	RR = NR – IR where NR is nominal interest rate (discount rate) (line 60).

GDP (GDP)§	GDP = NGDP / CPI where NGDP is nominal GDP (line 98B).
Money supply (MS)	MS = NM / CPI
Total domestic deposit (TD)	TD = NTD / CPI where NTD is the sum of demand- and time deposits (lines 24 and 25).
Deposit money bank assets (BA)	BA = NBA / CPI where NBA is nominal bank assets (all categories of line 22).
Private credit by deposit money banks (PC)	PC = NPC / CPI where NPC is nominal private credit (line 32D).
Stock market capitalization / GDP (SKTGV)§	FSD
Stock market total value / GDP (SVTGV)§	FSD

Notes: All the "lines" refer to those of the International Financial Statistics (IFS). § indicates that annual series are disaggregated to quarterly ones by the Boot et al. (1967) method except GDP that is by the Chow and Lin (1971) method. WDI = World Development Indicators. FSD = Financial Structure Dataset.

Table A3: Asian Countries' Selected Elementary Variables of Financial Crisis

Country	Financial Crisis Variables
India	ER; MTF; ED; TV; OP; FCD; SP; IR; GDP; MS; TD; SKTGV
Indonesia	ER; MTF; ED; TV; OP;GCE; IR; MS; TD; BA; PC
Korea	ER; MTF; TV;SP; IR; GDP; MS; TD; SKTGV; SVTGV
Malaysia	ER; ED; TV; GCE; SP; IR; SKTGV
Thailand	ER; MTF; ED; TV; GCE; IR; GDP; MS; TD; SKTGV

Source: Authors' own estimation.

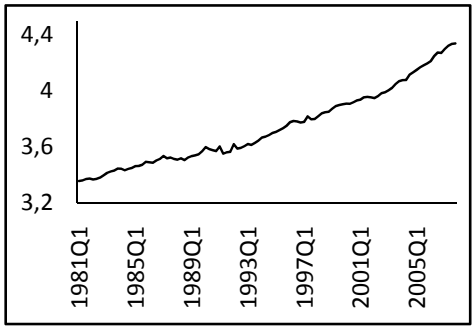
Table A4: Elementary Variables of Financial Repression

Definition (Name)	Source
Nominal interest rate (NR)	Line 60 (for bank rate)
Com. bank reserve / m. supply (CRTM)	Lines 20 (for CB reserves) and 35L (for m. supply)
Com. bank reserve / GDP (CRTG)	Lines 20 and 99B (for GDP)
Com. bank reserve / total deposit (CRTD)	Lines 20 and 24 and 25 (for total deposit)
Claims on the gov. / m. supply (GTM)	Lines 32AN (for claim on the government) and 35L
Claims on the gov. / GDP (GTG)	Lines 32AN and 99B
Claims on the gov. / total domestic credit (GTD)	Lines 32AN and 32 (for total domestic credit)
Inflation tax (Seigniorage) (IT)	Change in reserve money (line 14) / GDP (line 99B)

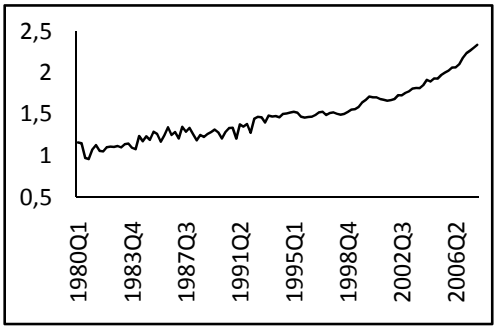
Notes: All the "lines" refer to those of the International Financial Statistics (IFS).

Figure A1: India's EG and Summary Indicators

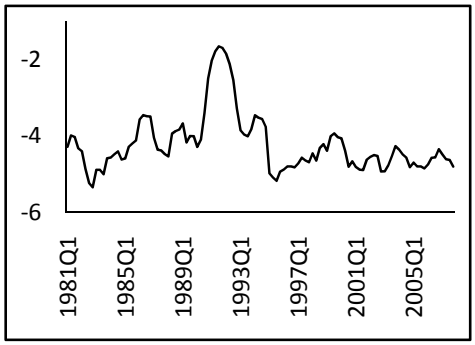
(a) EG



(b) FD



(c) FC

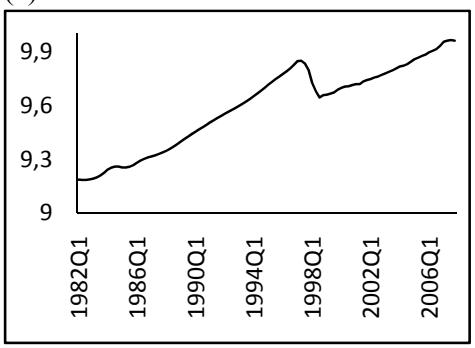


(d) FR

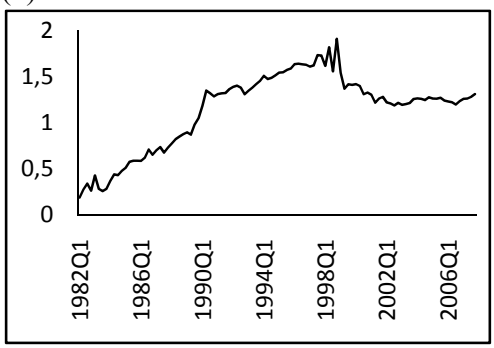
Source: Authors' own estimation.

Figure A2: Indonesia's EG and Summary Indicators

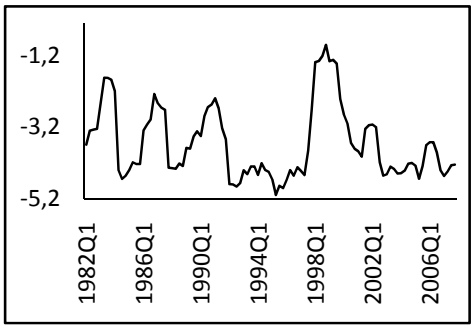
(a) EG



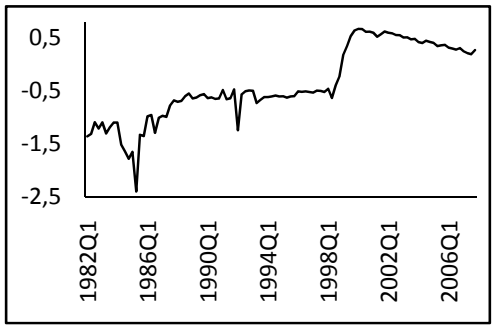
(b) FD



(c) FC



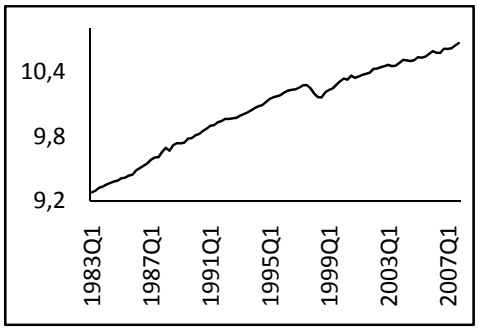
(d) FR



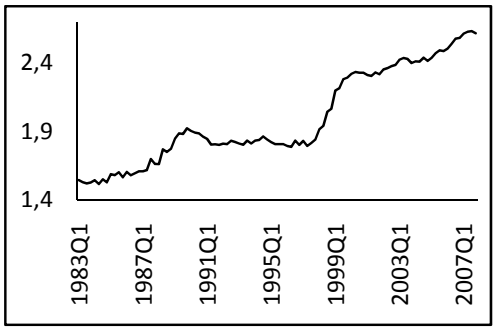
Source: Authors' own estimation.

Figure A3: Korea's EG and Summary Indicators

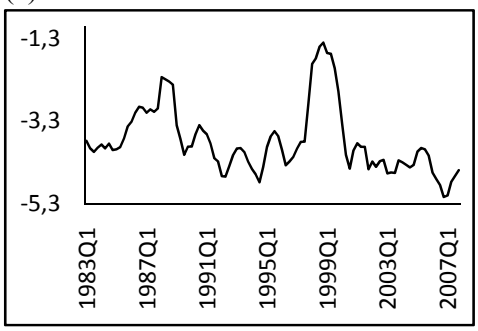
(a) EG



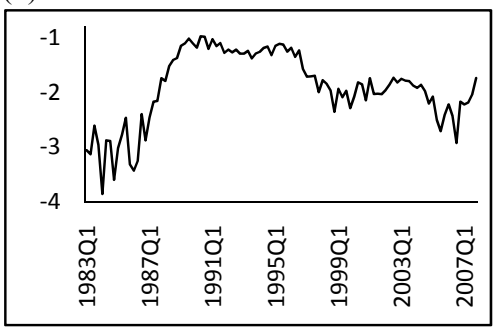
(b) FD



(c) FC

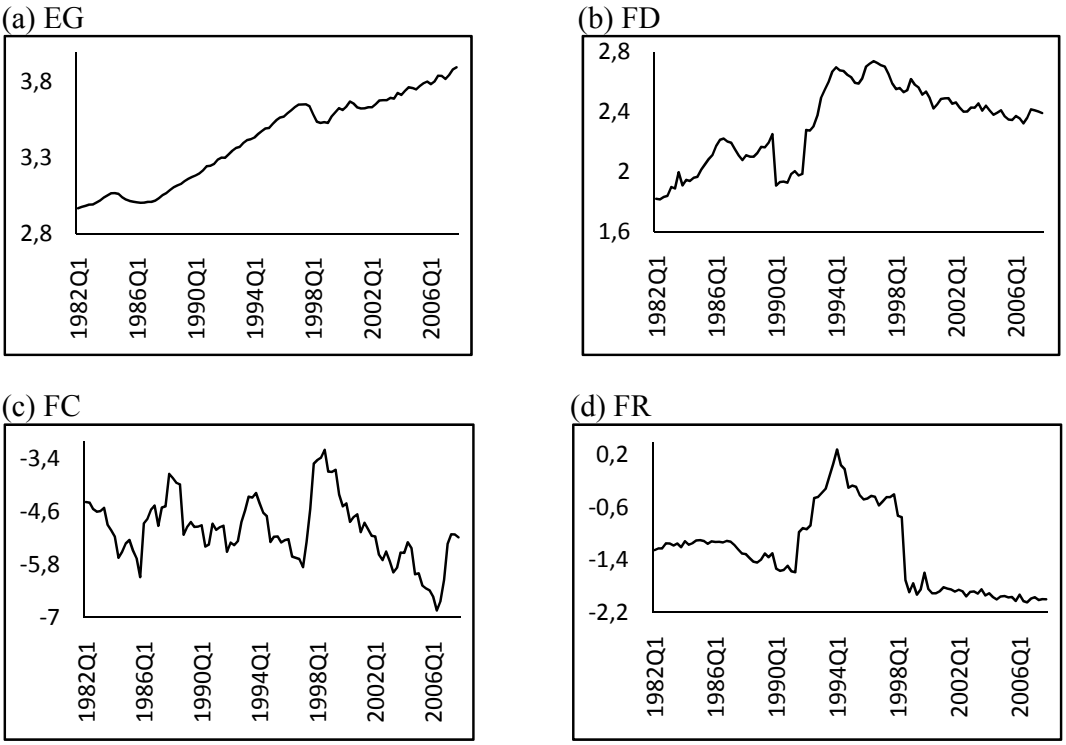


(d) FR



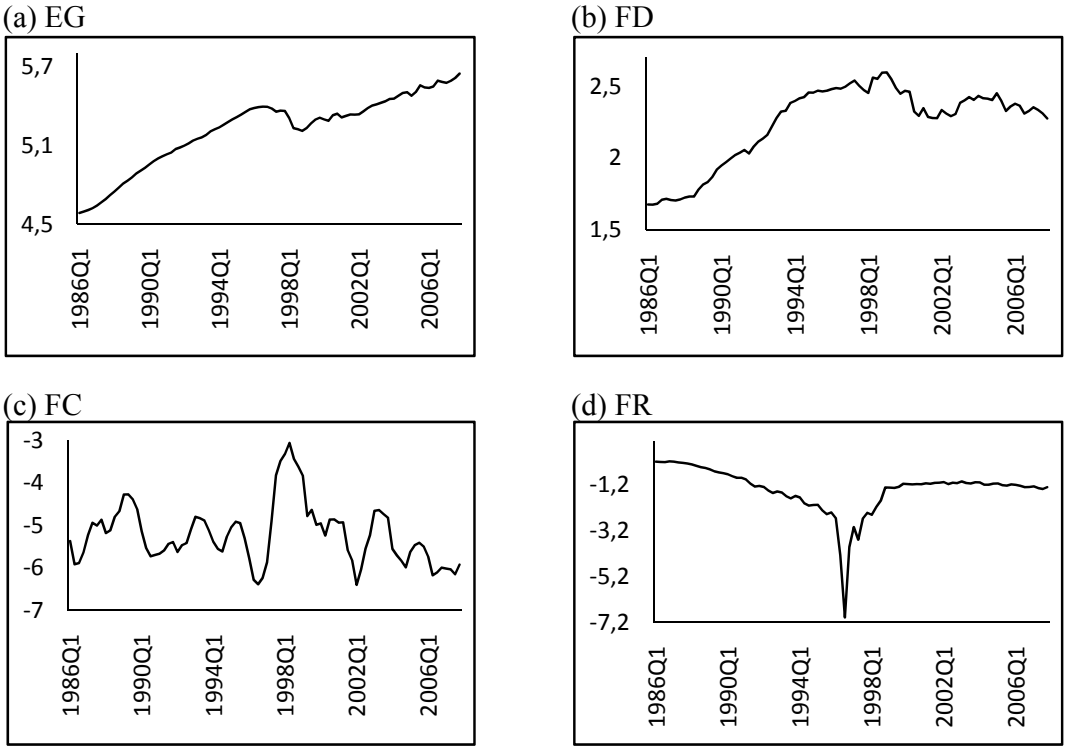
Source: Authors' own estimation.

Figure A4: Malaysia's EG and Summary Indicators



Source: Authors' own estimation.

Figure A5: Thailand's EG and Summary Indicators



Source: Authors' own estimation.

Table A5: Diagnostic Tests Results (LM Version)

(a) India

Panel A			
Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 5.651 [.227]	CHSQ(4) = 2.357 [.670]	CHSQ(4) = 6.397 [.171]
Functional Form	CHSQ(1) = 0.035 [.851]	CHSQ(1) = 0.125 [.724]	CHSQ(1) = 0.547 [.460]
Normality	CHSQ(2) = 14.85 [.001]	CHSQ(2) = 5.278 [.071]	CHSQ(2) = 120.9 [.000]
Heteroscedasticity	CHSQ(1) = 14.90 [.000]	CHSQ(1) = 0.001 [.893]	CHSQ(1) = 0.011 [.915]
Panel B			
Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	CHSQ(4) = 4.616 [.329]	CHSQ(4) = 8.449 [.076]
Functional Form	—	CHSQ(1) = 3.029 [.082]	CHSQ(1) = 11.33 [.001]
Normality	—	CHSQ(2) = 7.052 [.029]	CHSQ(2) = 85.01 [.000]
Heteroscedasticity	—	CHSQ(1) = 9.207 [.002]	CHSQ(1) = 0.313 [.576]

(b) Indonesia

Panel A			
Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 2.331 [.675]	CHSQ(4) = 5.621 [.229]	CHSQ(4) = 7.664 [.105]
Functional Form	CHSQ(1) = 13.42 [.000]	CHSQ(1) = 4.551 [.033]	CHSQ(1) = 2.255 [.133]
Normality	CHSQ(2) = 394.6 [.000]	CHSQ(2)=163.3 [.000]	CHSQ(2) = 66.38 [.000]
Heteroscedasticity	CHSQ(1) = 19.39 [.000]	CHSQ(1) = 2.811 [.094]	CHSQ(1) = 13.66 [.000]
Panel B			
Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	—	CHSQ(4) = 8.886 [.064]
Functional Form	—	—	CHSQ(1) = 6.978 [.008]
Normality	—	—	CHSQ(2) = 49.36 [.000]
Heteroscedasticity	—	—	CHSQ(1) = 2.439 [.118]

(c) Korea

Panel A			
Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 6.956 [.138]	CHSQ(4) = 7.045 [.134]	CHSQ(4) = 5.429 [.246]
Functional Form	CHSQ(1) = 1.301 [.254]	CHSQ(1) = 9.408 [.002]	CHSQ(1) = 0.319 [.572]
Normality	CHSQ(2) = 0.482 [.786]	CHSQ(2) = 59.76 [.000]	CHSQ(2) = 2.630 [.269]
Heteroscedasticity	CHSQ (1) = 0.936 [.333]	CHSQ(1) = 27.43 [.000]	CHSQ(1) = 22.56 [.000]
Panel B			
Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	CHSQ(4) = 5.553 [.235]	CHSQ(4) = 7.203 [.126]	CHSQ(4) = 4.189 [.381]
Functional Form	CHSQ(1) = 0.601 [.438]	CHSQ(1) = 0.700 [.403]	CHSQ(1) = 1.233 [.267]
Normality	CHSQ(2) = 1.696 [.428]	CHSQ(2) = 24.05 [.000]	CHSQ(2) = 13.145 [.001]
Heteroscedasticity	CHSQ(1) = 1.064 [.302]	CHSQ(1) = 0.926 [.336]	CHSQ(1) = 9.173 [.002]

(d) Malaysia

Panel A			
Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 4.353 [.360]	CHSQ(4) = 2.205 [.698]	CHSQ(4) = 4.542 [.338]
Functional Form	CHSQ(1) = 3.714 [.054]	CHSQ(1) = 12.386 [.000]	CHSQ(1) = 0.319 [.573]
Normality	CHSQ(2) = 0.681 [.712]	CHSQ(2) = 1675.2 [.000]	CHSQ(2) = 63.29 [.000]
Heteroscedasticity	CHSQ(1) = 4.455 [.035]	CHSQ(1) = 1.994 [.158]	CHSQ(1) = 2.316 [.128]
Panel B			
Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	CHSQ(4) = 2.134 [.711]	CHSQ(4) = 4.765 [.312]
Functional Form	—	CHSQ(1) = 1.454 [.228]	CHSQ(1) = 0.001 [.975]
Normality	—	CHSQ(2) = 694.0 [.000]	CHSQ(2) = 39.213 [.000]
Heteroscedasticity	—	CHSQ(1) = 0.465 [.495]	CHSQ(1) = 0.287 [.592]

(e) Thailand

Panel A			
Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 7.376 [.117]	CHSQ(4) = 1.584 [.811]	CHSQ(4) = 7.784 [.100]
Functional Form	CHSQ(1) = 6.163 [.013]	CHSQ(1) = 3.435 [.064]	CHSQ(1) = 0.037 [.847]
Normality	CHSQ(2) = 7.166 [.028]	CHSQ(2) = 77.44 [.000]	CHSQ(2) = 33.28 [.000]
Heteroscedasticity	CHSQ(1) = 19.07 [.000]	CHSQ(1) = 3.861 [.049]	CHSQ(1) = 1.171 [.279]
Panel B			
Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	—	CHSQ(4) = 6.702 [.153]
Functional Form	—	—	CHSQ(1) = 0.321 [.571]
Normality	—	—	CHSQ(2) = 14.59 [.001]
Heteroscedasticity	—	—	CHSQ(1) = 3.011 [.083]

Source: Authors' own estimation

Notes: In "EG-VECM", for example, EG refers to the dependent variable, and VECM is the used technique.

New Composite Indicators for Bulgarian Business Cycle

Roumen Vesselinov[1]

Abstract

The paper presents the creation of a new composite coincident monthly indicator for Bulgaria. The Bry-Boschan method is used to determine the turning points for the Bulgarian business cycle for the 2000-2011 period. A new composite leading indicator is also created and tested. The paper finds that the latest recession for Bulgaria had started in June 2007 and was still continuing by March 2011. The national business cycle was lagging the Euro Area cycle before 2007 and was early after that.

Keywords: business cycle, coincident, leading, indicator

JEL Classification: E32

1. Introduction

The work on this study was driven by three major factors. First, in the light of the recent 2007-2009 world economic and financial crisis many politicians and researchers became acutely aware of the need to have a reliable and strong measure of the current economic situation. Second, great debate has ensued among economic researchers and practitioners in Bulgaria regarding when the recent crisis has started and when or whether the crisis was over. Third, the recent availability of new reliable monthly data from the National Statistical Institute (NSI) of Bulgaria lent themselves for use in this area of research.

This work is a continuation on some previous work (Vesselinov, 2004; 2008). The paper presents a new set of indicators based on a larger set of available and more reliable data. There are published measures of the current economic activity in Bulgaria like the Economic Activity Indicator of the Bulgarian Ministry of Finance (http://www.minfin.bg/), and previous work by the Agency for Economic Analyses and Forecasts (www.aeaf.bg). The main difference with the current work is that most of them are based on quarterly data while our indicators are monthly, and second, our leading indicator is stand-alone and not derived from the current economic activity measure.

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The need for a reliable measure of the current economic situation has long ago been established (Zarnowitz, 1992). The so called reference series or reference cycle is the first instrument needed to evaluate the current phase of the business cycle. The Gross Domestic Product (GDP) is one of the most important indicators of economic development but it is available only quarterly and for our purposes we would need monthly data. In some cases a single indicator, like the index of industrial production has been accepted as a reference series (OECD, 1997, p. 7). But the majority of researchers recommend using a composite indicator (Diebold and Rudebusch, 1999; Lahiri et al., 2003; Conference Board, 2000) which is usually calculated using several monthly indicators combined in one measure. We chose this methodology because it is widely used, and, in our opinion, it is directly applicable and very appropriate for our data.

The paper presents the creation of a new composite coincident monthly indicator for Bulgaria. The Bry-Boschan method is used to determine the turning points for the Bulgarian business cycle for the 2000-2011 period. A new composite leading indicator is also created and tested. Another goal of this study is to compare the business cycle of Bulgaria and the Euro Area. The main question here was whether the two cycles are synchronized or not and how different the timing is.

2. New Composite Coincident Business Cycle Indicator (CBCI)

The data for the components of the coincident indicator are from the online database of the Bulgarian NSI (www.nsi.bg).

The following series were considered for inclusion as components of the new CBCI:

C1. Industrial production index;

C2. Construction production index;

C3. Turnover index in retail trade;

C4. Labor (number of employed by the end of the month);

C5. Income (average monthly wages and salaries);

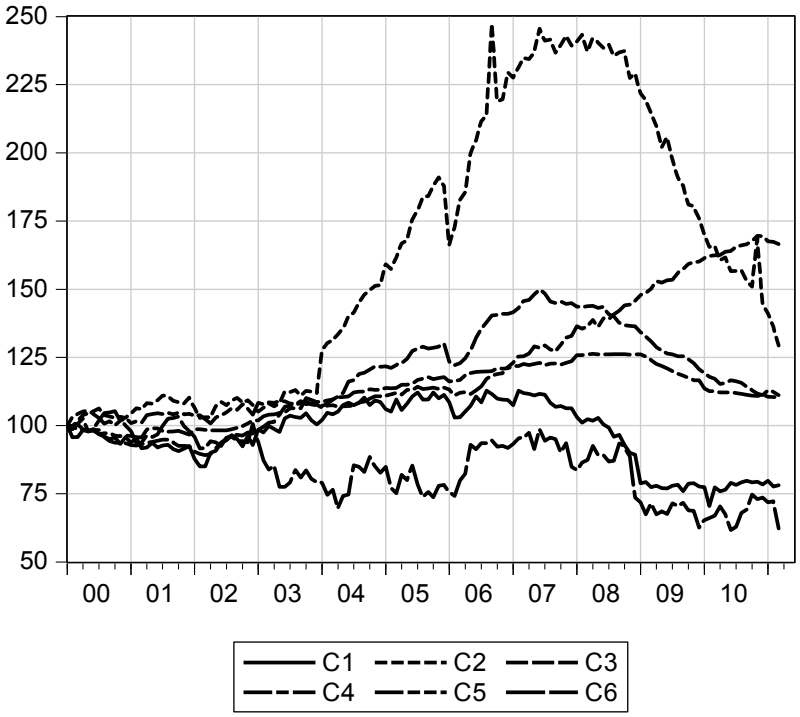
C6. Service sector (business survey of current business situation in the service sector).

All series except C6 needed seasonal adjustment and they were adjusted using the X12 method. Where appropriate the components were adjusted for inflation.

The above time series were taken into consideration following the justification by The Conference Board (Conference Board, 2000, p. 13). They are broadly related to the current economic activity like production, employment, income, construction, retail trade etc.

In this study we use the methodology of The Conference Board (Conference Board, 2000, p. 47) for constructing a composite indicator. The dynamics of the components of CBCI is presented in Figure 1.

Figure 1: Components of CBCI
(Indexes 2000=100)



Applying the Conference Board methodology we constructed the new CBCI. We experimented with 4 different versions of the index:

CBCI1: includes C1 to C4;

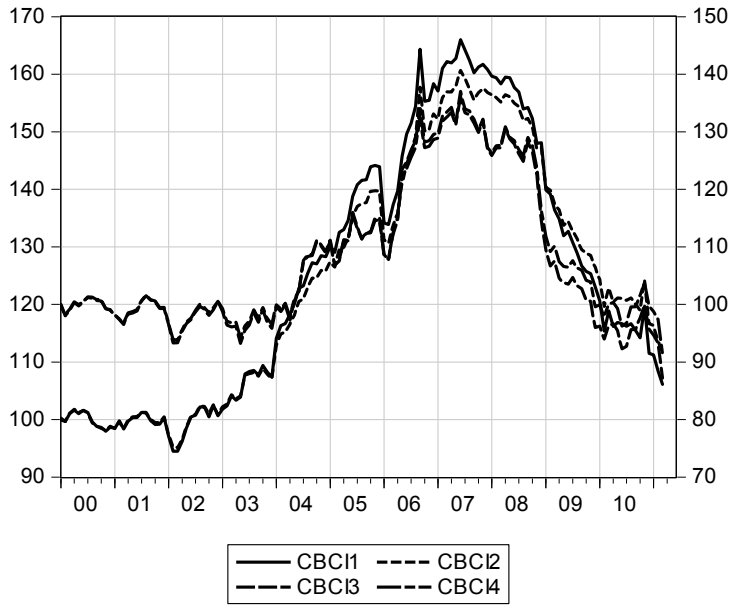
CBCI2: includes C1 to C4, plus C5;

CBCI3: includes C1 to C4, plus C6;

CBCI4: includes C1 to C6;

The four versions of the CBCI are presented in Figure 2.

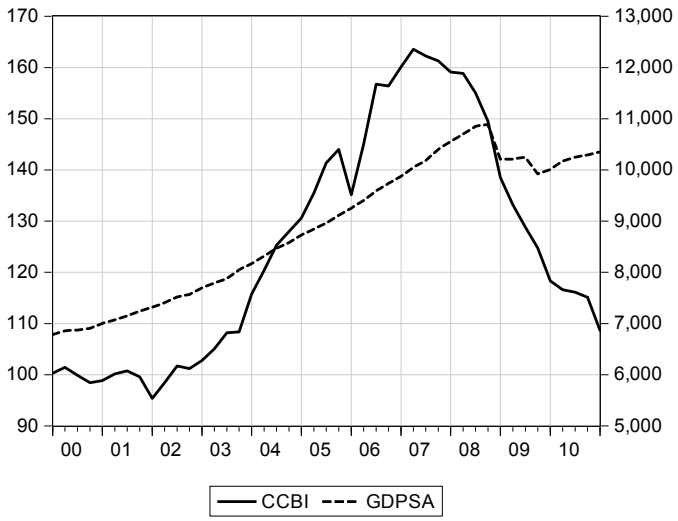
Figure 2: Four Versions of CBCI
(Indexes 2000=100; CBCI1 and CBCI2 - left-hand scale)



Econometric tests (Alberola-Lopez and Martin-Fernandez, 2003) showed that there is no significant difference between the four time series. Following the principle of parsimony we selected the version with fewest components as the final version of the CBCI. Thus the final indicator has only four components: C1 to C4.

Before we employ the new index we tested its quality. First and foremost, we checked the correspondence between the new coincident indicator and GDP. We converted the monthly CBCI into a quarterly series by taking the quarterly averages and compared them to GDP. The results are presented in Figure 3.

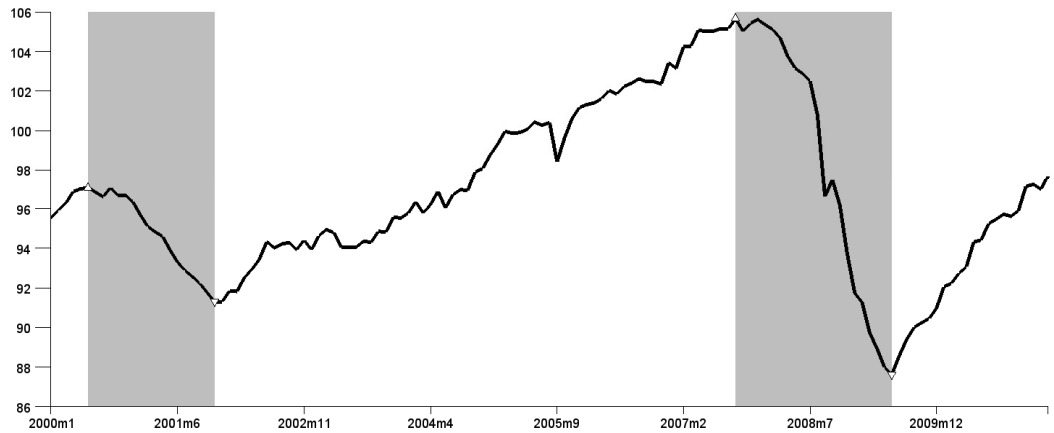
Figure 3: GDP and CCBI
(CCBI Index 2000=100, left-hand scale; GDP in mln BG leva, 2000 prices)



As expected the new coincident indicator resembles to a certain extend the dynamics of GDP, seasonally adjusted and in constant 2000 prices.

The main purpose of constructing a coincident indicator is to use it for determining the turning points of the classical business cycle. The classical methodology for this purpose was defined by Bry and Boschan (Bry and Boschan, 1971). We tested the current applicability of the classical methodology on the U.S. coincident indicator published by OECD (OECD, 2011). According to the official dating of the US business cycle by NBER after year 2000 there were two recessions: March - November 2001 and the "Great Recession" December, 2007 - June 2009. With the Bry-Boschan method and the OECD indicator for US we were able to match almost exactly the official turning points of the US business cycle (see, Figure 4). This result gave us the confidence to use the Bry-Boschan method further in the study.

Figure 4: Confirming US Business Cycle Turning Points with the Bry-Boschan Method
(US CCBI Index 2005=100)



We applied the Bry-Boschan method to the new CCBI for Bulgaria for the period January 2000 – March 2011. The results are presented in Figure 5 and Table 1.

According to the classical Bry-Boschan method there were two periods of recession. First recession: July 2001 to February 2002, and second recession starting in June 2007 and still continuing by March 2011. Obviously according to this measure, the latest recession in Bulgaria had started very early, at the same time as the "great recession" in the U.S. but did not end in 2009 and in fact the economy is in recession at least by March 2011.

Figure 5: Bulgarian Business Cycle 2000 – 2011
(Bulgarian CCBI Index 2000=100)

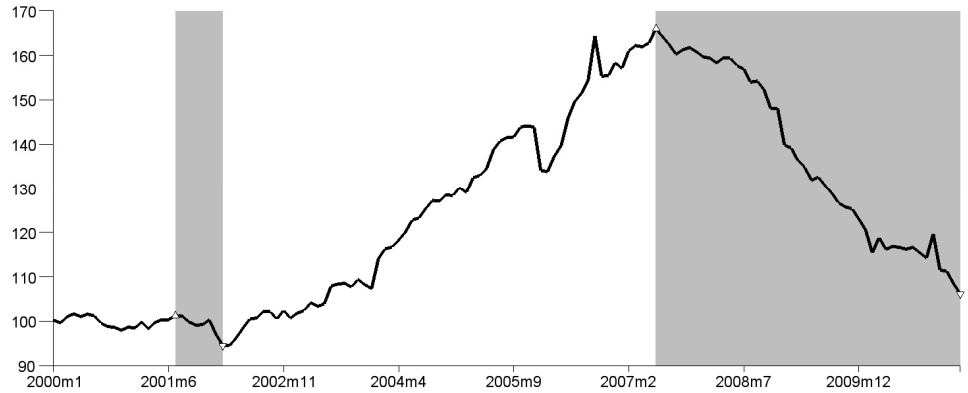


Table 1: Bulgarian Business Cycle 2000 – 2011

Recession			**Duration (months)**
No.	**Peak**	**Trough**	
1.	July 2001	February 2002	8
2.	June 2007	Still in recession by March 2011	At least 46

3. Comparison of Bulgarian and Euro Area Business Cycle

Euro Area business cycle analysis is based on the reference series for Euro Area (17 countries) published by OECD (OECD, 2011). The Bry-Boschan method applied to this reference series gave us three recessions for the Euro area (Table 2 and Figure 6).

Figure 6: Euro Area Business Cycle 2000 – 2011
(EU17 CCBI Index 2005=100)

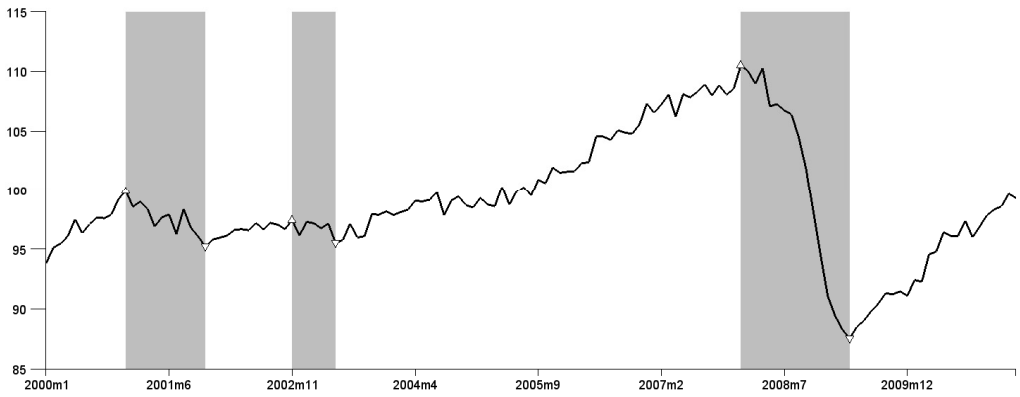


Table 2: Euro Area Business Cycle for 2000 – 2011

Recession			**Duration (months)**
No.	**Peak**	**Trough**	
1.	December 2000	November 2001	12
2.	November 2002	May 2003	7
3.	January 2008	April 2009	16

The first recession for the period is December 2000 to November 2001, and the second recession is November 2002-May 2003. The last, "Great Recession" for Europe lasted from January 2008 to April 2009. As compared to the US it started later and ended earlier.

Before joining the EU in 2007 the Bulgarian business cycle was somewhat lagging the Euro Area cycle since the first recession in Bulgaria for the period started 7 months later than the Euro Area's first recession. Bulgaria missed the second recession for the area in 2003. But six months after joining EU Bulgaria fell into the "Great Recession" and had not recovered by the end of March 2011, while the Euro Area as a whole recovered by April 2009. The Bulgarian "Great Recession" started 6 months earlier than the Euro Area, and continued at least two years longer.

4. New Leading Business Cycle Indicator

The idea of a leading business cycle indicator is to predict the turning points of the business cycle and give early warnings for impending recessions. The lead time should be at least 3-6 months if not more.

We constructed the new leading indicator for Bulgaria using the same methodology as the new coincident indicator described earlier. The difference here is the new component series. There are 6 component series for the leading indicator:

Comp1: Business climate in industry;

Comp2: Business climate in construction;

Comp3: Business climate in retail trade;

Comp4: Business climate in services;

Comp5: Vacancies;

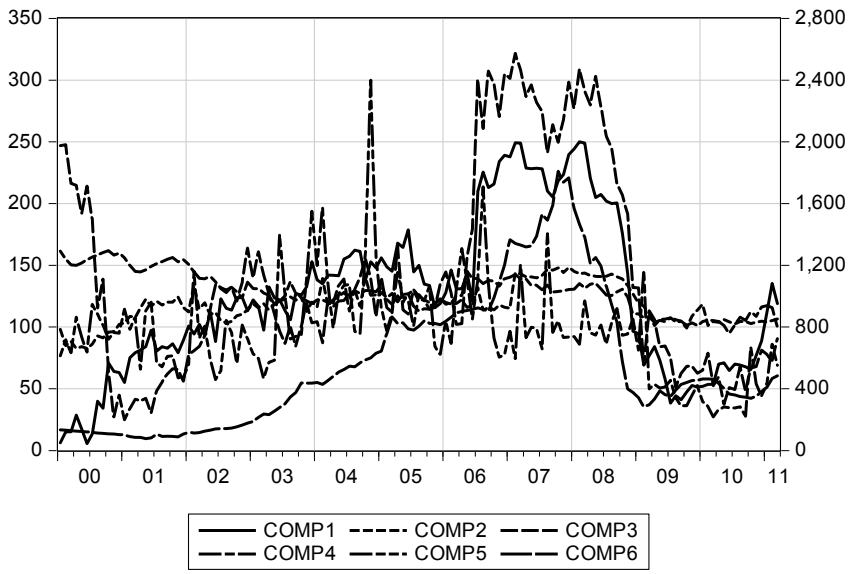
Comp6: Bulgarian Stock Exchange index (SOFIX).

All series are monthly data or average monthly data (e.g. SOFIX) for January 2000 – March 2011. The first four series are published by the Bulgarian National Statistical Institute (www.nsi.bg), the vacancies are published by the Bulgarian National Employment Agency (www.az.government.bg) and SOFIX is published by the Bulgarian Stock Exchange (www.bse-sofia.bg).

The above components were included following suggestions by The Conference Board (Conference Board, 2000, p. 13). They are broad measures closely related to expected business climate in four major economic sectors, vacancies in labor market and stock prices.

The dynamics of the six components are presented in Figure 7.

Figure 7: Components of the Leading Indicator
(COMP6, right-hand scale)

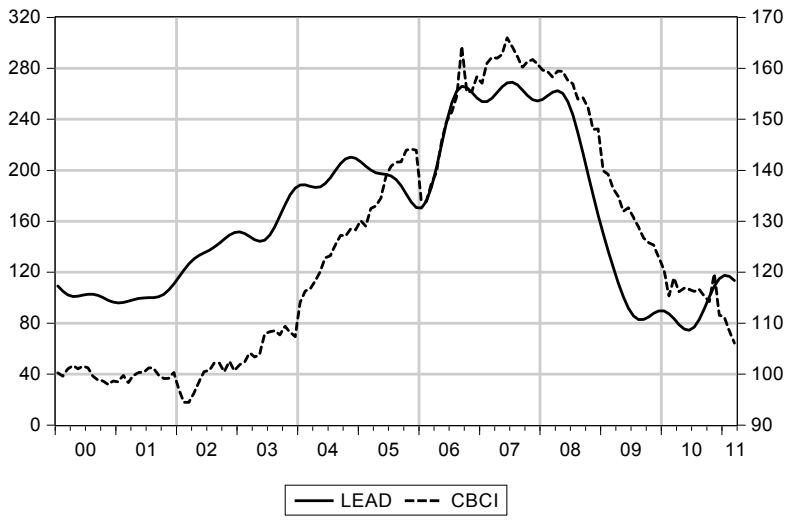


The new leading indicator was constructed using the methodology of The Conference Board (Conference Board 2000, p. 47) for constructing a composite indicator.

The composite coincident and leading business cycle indicators are presented in Figure 8. The Leading indicator is smoothed using the fast Fourier transformation (Brockwell and Davis, 2002, p. 28).

As is clear from the graph the leading indicator seems to give early warnings of the change of direction in the business cycle. However more turning points are needed before we can confirm that the leading indicator is useful for practical purposes.

Figure 8: Coincident (CBCI) and Leading (LEAD) Indicators
(Indexes 2000=100, LEAD, left-hand scale)



5. Conclusion

The newly created coincident business cycle indicator for Bulgaria revealed good econometric qualities and could be used as a viable research tool. The applied Bry-Boschan method for dating of the Bulgarian business cycle gave a definitive answer for determining the turning points of the recessions for 2000-2011 period. The national business cycle seemed to be lagging the Euro Area cycle before January 1, 2007 and was early after that. The current "Great Recession" for Bulgaria started in June 2007 and was still continuing by March 2011. It seemed to be very deep and very long and not synchronized with the Euro Area business cycle. The leading indicator gives signs that the"Great Recession" for Bulgaria may be nearing its end.

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Investment style of Jordanian mutual funds

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Abstract

The study investigates the mutual funds investment style in the Jordanian context. It uses monthly returns of five mutual funds from July 2000 to December 2009. To do so, it employs the 4-factors model with explanatory variables the market portfolio return, a small minus large capitalization indicator variable, a high minus low book-to-market indicator variable, and a variable that account for momentum effect. These factors are used as benchmarks to investigate the investment style. The results indicate that mutual funds returns tend to follow those of the market portfolio. In terms of investment style, mutual funds managers tend to favor small capitalization stocks, past winners stocks, and low book-to-market ratio stocks, respectively.

Keywords: Mutual funds, 4-factors Model, Investment Style, Market portfolio, Size, Book-to-Market, Momentum

JEL Classification: C33, G11, G23

1. Introduction

The last decades have witnessed tremendous growth of the mutual funds industry regarding to their basic investment roles in pooling money from different investors and invest them in financial securities. The explosion of assets under management by mutual funds has intensified the focus on their investment strategies. The fund's managers state the fund's investment strategies by following certain investment styles systematically. These styles help managers to select rewarded securities that deliver a positive risk-adjusted fund's performance. Carhart (1997) revealed that high ranked mutual funds tend to hold more small stocks than low ranked funds. The high ranked funds' returns are strongly

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positively correlated with the one-year momentum factor, while the low ranked funds' returns are strongly negatively correlated with the momentum factor. Chan, Chen & Lakomishoks (2002) found that most of the mutual funds adopt styles that bunch around an overall market index. In aggregate, they have concluded that funds tend to invest in small stocks, stocks with low book-to-market ratio (BMR), and past winners stocks. In addition, they have indicated that managers who hold growth stocks do better than the managers that hold value stocks on style-adjusted basis. Contrary, Zhangpeng, & Rahman (2005) found that Chinese funds strongly invest in large-cap stocks and slightly prefer growth (low BMR) stocks. On the other hand, Stotz (2007) found that Germany's funds invest in small stocks and stocks with low BMR, while they do not adopt the momentum as investment style. In addition, he has indicated that the investment style of a fund influence its performance, where funds' managers who primarily invest in small-cap growth stocks with high momentum are able to achieve a positive risk-adjusted performance. Generally, most studies focused on size, BMR, and past stock return (momentum) to analyze the funds' equity investment styles.

In the Jordanian context, the appearance of mutual funds goes back to the law of the securities commission in 1997 that restructured the Jordanian financial market and authorized the establishment of mutual funds. Thus, the first mutual fund was established in 2000. In 2003 many amendments were included to organize and restrict the mutual funds' activities.

In 2005, benefitting from the economic growth, reflected in 92.9% growth in the ASE's general index, the total assets of Jordanian mutual funds reached 100 million JD and achieved 28 million JD as profit, which represented 28% of their assets.

Building on the aforementioned, the study seeks to determine the investment style of mutual funds in Jordan from July 2000 to December 2009.

The mutual funds industry in Arab market received less attention in terms of academic studies. Therefore, this study is one of the first comprehensive empirical studies that investigate the investment style of mutual funds in Jordan. It represents a guide for foreign investors to discover this field of investment and understand the investment strategies of the mutual funds in the Jordanian market.

The study also helps investors to rationalize their investment decisions before pouring their money in these funds through the analysis of the funds' investment abilities to select premium stocks.

The paper is structured as follows: the following section defines the concept of investment style and describes the 4-factors model of Carhart (1997). It also exhibits the evolution of the Jordanian stock market and mutual fund market. The third section discusses the variables of the study. The fourth section describes the study's data and methodology, which includes the funds profile, data source, period of the study, and the data treatment. The fifth section reports the descriptive statistics of the variables, Unit root and Granger-Causality tests, and the investment style results. The last section presents the conclusion.

2. Investment style analysis

Investment style is any set of characteristics that comprises a large part of an investment discipline. Investors can devise disparate investment styles using a multitude of stocks characteristics in many different ways (Hu, 2005).

Style analysis is a powerful technique that was developed by Sharpe (1992) for determining the exposure of a fund's portfolio to various assets classes that are included in the portfolio. It helps analyst to obtain a clear idea of the fund portfolio components.

Regarding a strong relationship between investment style and fund performance, the fund's portfolio should be compared to appropriate benchmark portfolios that reflect the fund's investment style to enable the analyst to distinguish between the skills of fund's manager from the investment style. This is especially when a fund manager has no control over style selection.

Chan, et al. (2002) cited that, rather than analyzing individual portfolio holdings, the style analysis allows to analyze the fund's return by looking how the fund's historical returns are related to various benchmarks, because if a fund's manager follows a certain style, the fund's return should track its style-specific benchmark.

For example, a fund's managers who invested primarily in small-cap stocks and growth stocks would be said that they follow a small-cap growth investment style, while Large-cap value style is the style of managers that invest in large-cap and value stocks.

Generally, the studies (e.g. Davis, 2001; Chan et al., 2002; Hu, 2005; Stotz, 2007) consider that the factors: market portfolio, size, BMR, and momentum are appropriate benchmarks to analyze the investment styles of the mutual funds.

Fama & French (1993) used firm characteristics such as size and BMR in addition to the market index to explain the cross-section of stock returns. They conducted several tests and concluded that the three-factor risk-return model captures the cross-sectional variation in average stock returns better than the market index.

Carhart (1997) extended the Fama & French 3 factors-model by including a fourth common factor that captures the tendency for stocks with positive (negative) past returns to produce positive (negative) future returns. This factor is known momentum (MOM). Formally, he has proposed the model as follows:

$$R_t - R_{f,t} = \beta_0 + \beta_1 (R_{m,t} - R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_t \quad (1)$$

where

$R_t - R_{f,t}$: excess return of mutual fund

$R_{m,t} - R_f$: excess return of market portfolio

SMB_t: size factor.

HML_t: book-to-market ratio factor.

MOM_t: momentum factor.

Hu (2005) found that these factors: market, size, BMR, and momentum explain strongly the cross-sectional stocks return in international context and in different periods, while Stotz (2007) mentioned that these four benchmarks have two advantages:

a) The model overcomes the problem of benchmarks bias because the power to explain the fund's return is higher than Fama & French 3-factors model.
b) The model permits to identify the investments style of the mutual funds. Positive significant β_2, β_3 and/or β_4 indicate that the manager follows small, value and/or winner stocks style, while negative significant β_2, β_3 and/or β_4 indicate that manager pursues large, growth and/or loser stocks style.

The Jordanian stock market is one of the oldest stock exchanges in the region. In 1978, Amman Financial Market (AFM) was established, making the first organized and official Jordanian stock exchange. In 1999, a series of reforms, adopted by the government that aimed at amplifying the role of the private sector in the Jordanian economy, gave birth to three institutions that collectively form Jordanian capital market: Amman Stock Exchange (ASE), Securities Depository Center (SDC), and Jordan Securities Commission (JSC).

Bolstered by a strong and liberal regulatory framework, the 1999 reforms, for the first time, brought the laws and instructions related to investment companies. Just after, in 2000, the first Jordanian mutual fund was established. In 2003, some amendments were included to restrict and organize mutual funds activities. In 2009, the Jordanian mutual funds have reached five funds, which reveals that mutual funds in Jordan are still in the infancy stage.

ASE realized enticing performance comparing to the markets of the region. During the period of 2003-2006, the average growth rate of ASE general index was estimated at 42%, exceeding the markets of regions of Middle East and North Africa that realized average growth rates 36% and 37%, respectively. In 2007, ASE realized 36.3% of average growth rate while the average growth rate of Arabian markets reached 38.3%.

There are encouraging indicators that make investors optimistic about future financial investment in the Jordanian market. The number of listed companies jumped from 163 in 2000 to 262 in 2008 and the market capitalization has moved from 3509.64 JD million in 2000 to 25,406.3 JD million in 2008. The general index grew by 261% during 2001-2008. It was at 1727.0 point in 2001 and reached 6243.1 point in 2008 (ASE, 2009).

The main characteristic of ASE, which may interests the mutual funds, is the dominance of the financial sector on the market capitalization, representing the biggest parts of the market's capitalization with 61.0% in 2008. In addition, in 2008, foreign investors have possessed 49.2% of all the market capitalization, which indicates that Jordanian market provides appropriate investment climate for local and foreign mutual funds.

3. The study variables

After discussing the study's model, we define the variables of the study.

1 - Excess Fund's Return: is the excess fund's return from the risk-free rate of return. The fund's return is calculated as the rate of return between the actual and previous fund's Net Asset Value (NAV). NAV changes according to the change of the securities' income and the average price (capital gain) of the securities that are included in the fund's portfolio.

2 - Excess Market's Portfolio Return: is the excess market's portfolio return from the risk-free rate of return. The market portfolio is usually approximated by a value weighted general market index. The market's return is calculated as the rate of return between the actual and previous closed price of the market index. The previous studies revealed that the market's returns have statistically significant effect on the mutual funds returns because the market portfolio's stocks considerably compose the fund's portfolio. For example, Low (2007) and Stotz (2007) found that the market's returns have a positive effect on the funds' returns.

3 - SMB: (Small Minus Big) is a proxy to mimic the risk factor of stocks returns that relates to the firm size. The size is measured by market capitalization. SMB has been formulated as Fama & French (1993) methodology, which is the difference in the returns of portfolios that consists small capitalization stocks and large capitalization stocks, respectively.

Banz (1981) was among the first researchers who investigated the effect of size, measured by market capitalization, on risk-adjusted returns. Banz (1981) found that the size not only adds to the explanation of the risk-adjusted stocks return but there is a significant negative relationship between the firm's capitalization and stocks return. Fama & French (1993) found that SMB has a positive effect on the portfolio return. The same result was found by Carhart (1997) and Chan et al. (2002), which means that mutual fund's managers prefer stocks of small firms over the stocks of big firms.

4 - HML: (High Minus Low) is a proxy to mimic the risk factor of stocks returns related to BMR (value/growth stocks). HML was formulated as Fama & French (1993) methodology, which is the difference in returns of portfolios that consists of high BMR (value) stocks and low BMR (growth) stocks, respectively.

Stattman (1980) was among the first researchers who documented the premium attached to value stocks. He found a significant positive relationship between current value of BMR and future stock returns indicating that stocks with high BMR (value stocks) realize higher returns than stocks with low BMR (growth stocks). In Amman Stock Exchange Saleh & Bitar (2009) affirmed that size and BMR effects explain most of the variation in stocks returns, where the CAPM fails to give powerful explanation. Other studies such as Chan et al. (2002), Zhangpeng & Rahman (2005) and Stotz (2007) found that the BMR factor has a negative effect on the funds' returns, which implies that the funds' managers prefer the stocks with low BMR (growth stocks).

5 - MOM: momentum means that in the short and intermediary term, stocks prices continue to change in the same direction. Therefore, the stocks that have recently performed relatively well go on to deliver higher returns in the near future, and the stocks that have recently performed relatively bad continue to perform badly in the near future (Bulkley & Nawosah, 2009). MOM was calculated as Carhart (1997) methodology. It is measured as the difference in the returns of portfolios that contains stocks with high returns over the prior year (winners) and stocks with low returns over the prior year (loses).

Jedgadeesh & Titman (1993) were the first who observed that over an intermediate horizon of twelve months, past winner's stocks on average continue to outperform past loser's stocks. After that, Carhart (1997) demonstrated that past returns can be used to predict future returns and labeled this behavior as Momentum effect.

The studies like those of Carhart (1997), Daniel, Grinblatt, Titman, & Wermers (1997) and Eser (2007) found that momentum has a positive effect on the funds' returns, which means that the funds' managers select the winners stocks and neglect the losers stocks.

4. Data and Methodology

The study investigates the investment style of all mutual funds that are registered by JSC, which are five mutual funds, from July 2000 to December 2009. The information on mutual funds in Jordan is very limited because this industry is not yet developed. The study has relied on different sources to provide general view about these funds as Table 1 reveals.

The funds should have regular monthly NAVs observations from their inception date, and each fund should have at least 30 months of observations.

The study uses the mutual funds monthly NAVs that are collected from the funds' reports to estimate the monthly funds' returns. The study investigates the investment style for each fund separately and then investigates them as a group by using the panel regression approach that blends the characteristics of both cross-sectional and time series data. Based on this approach the model of the study becomes as follows:

$$R_{i,t} - R_{f,t} = \beta_0 + \beta_1 (R_{m,t} - R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \varepsilon_{i,t} \quad (2)$$

where

i = Number of mutual funds.

t = Fund's monthly return over time.

The study uses the Value Weighted General Index (VWGI) of Amman Stock Exchange (ASE) as proxy for market portfolio, whereby the monthly closing prices of VWGI are used to calculate the monthly returns of the market portfolio. The monthly returns of 3-months treasury bills are used as risk-free rate return to calculate the excess funds returns and the excess market returns.

To formulate the SMB, HML, and MOM variables, the study uses the monthly closing price of the stocks of companies that formulate VWGI of ASE. The SMB and HML

Table 1: Mutual funds profile

	Jordan Securities Fund(JSF)	First Trust Fund(FTF)	Horizon Fund (HF)	Growth Fund (GF)	Global Jordan Fund (GJF)
Administrator	Housing Bank for Trade & Finance	Arab Banking Corporation/Jordan	Capital Bank of Jordan.	Arab Jordan Investment Bank.	Gulf Clearing Company
Description	Open-end, Asset Allocation fund invests in diversified portfolio; listed companies, T-bills, Corp bonds, CDs and other mutual funds.	Open-end balanced fund invests in a balanced portfolio of listed equities, corporate fixed income securities, and money market instruments.	Open-end balanced fund invests in T -bills, company bonds, equities and other mutual funds.	Open-end fund.	Open-ended equity fund, invest at least 60% in listed equities, may invest in fixed income, money market instruments
Objective	Achieving a medium to long term capital appreciation in the NAV.	Achieving medium to long-term capital appreciation in NAV.	Achieving long term capital appreciation of NAV.	Preservation of capital with the above average returns compared to deposits.	Achieving capital appreciation with optimum returns, within controlled levels of risk, over the medium to long term.
Currency	Jordanian Dinar	Jordanian Dinar	Jordanian Dinar	US Dollar	US Dollar
Inception date	October 2001	June 2000	Mars 2005	February 2001	May 2007
Minimum Investment	JD 500	JD 1000	JD 1000	USD 50,000	USD 50,000
Total Assets in 2005	JD 77,726,859	JD 9,983,538	JD 10,352,476	JD 1,364,886	N.A

Source: Developed by Hacini. I (2010) from the mutual funds' reports.

are constructed according to Fama & French (1993) methodology. The companies sample are sorted from big to small companies based on their market capitalization at the end of each month, beginning from July 2000 to December 2009. The companies are divided to five equal groups; each group contains 20% of the sample [1].

The study formulates two portfolios; small portfolio and big portfolio. The small portfolio contains stocks of companies group with lowest market capitalization, and big portfolio contains stocks of companies group with largest market capitalization. The weighted monthly returns of small and big portfolios are calculated, where the weight of each stock in small and big portfolios is proportional to their market capitalization. The weighted returns of small and big portfolios are calculated according to the following formula:

$$PR_{S/B} = \sum_{i=1}^{n} SRi * Wi \quad (3)$$

Where $PR_{S/B}$ is the weighted returns of small and big portfolios, SR is the stock's return, and W is the stock's weight in the portfolio. SMB is small portfolio's return minus big portfolio's return. The sorting procedure to obtain the small and big portfolios is repeated at the end of each month. As a result, monthly time series of returns of the SMB are obtained.

Similarly, to formulate HML, The companies sample of VWGI are sorted from high to low based on their BMR at the end of each month, beginning from July 2000 to December 2009. Companies are divided to five equal groups; each group contains 20% of the sample. The study formulates two portfolios; value portfolio and growth portfolio, where the value portfolio contains stocks of companies group with highest BMR, and growth portfolio contains stocks of companies group with lowest BMR. The returns of the value and growth portfolios are calculated, which equal the average returns of the portfolios' stocks. HML is value portfolio's return minus growth portfolio's return.

The sorting procedure is repeated at the end of each month to obtain the returns of value and growth portfolios. As a result, a monthly time series of the returns of the HML are obtained.

MOM is formulated according to Carhart (1997) methodology. The companies sample of VWGI are sorted from high to low based on the average returns of their stocks over last 12 months at the end of each month, beginning from July 2000 to December 2009. The ranked companies are divided to five equal groups; each group contains 20% of the sample.

Two portfolios are formulated; winner portfolio contains stocks of companies with highest average stocks' returns over last 12 months, and loser portfolio contains stocks of companies with lowest average stocks' returns over last 12 months. MOM is winner portfolio's return minus loser portfolio's return.

The sorting procedure is repeated at the end of each month to obtain the returns of winner and loser portfolios, providing a monthly time series of returns of MOM.

[1] The VWGI sample began with 38 companies to reach 60 companies in 1994 and 70 companies in 2001 and finally 100 companies in 2007. Therefore, 20% of the sample represents 12 companies in 2000, 14 companies in 2001, and 20 companies in 2007.

5. Empirical results

5.1 Descriptive statistics

Descriptive statistics of the variables during the study period are presented in the Table 2:

Table 2: Descriptive statistics of the variables

	$R - R_f$	$R_m - R_f$	SMB	HML	MOM
Mean	0.0025	0.0087	-0.0171	-0.0465	-0.0018
Median	0.0030	0.0010	-0.0134	-0.0401	-0.0062
Maximum	0.1330	0.2326	0.2650	0.0985	0.1256
Minimum	-0.2284	-0.2185	-0.2314	-0.4349	-0.1726
Std. Dev	0.0390	0.0707	0.0835	0.0728	0.0599
Skewness	-1.0526	0.1215	0.3762	-1.6012	-0.1847
Kurtosis	9.8822	4.2829	4.1948	9. 6871	2.9183

$R - R_f$: excess return of mutual funds. $R_m - R_f$: excess return of market portfolio (VWI general index). **SMB**, **HML**, and **MOM** are factors that mimic the size, BMR, and one-year return momentum, respectively.

The mutual funds exhibit a positive average excess return $R - R_f$ 0.25%, but it is less than the market $R_m - R_f$ average excess return 0.87%, this confirms that the market outperforms the mutual funds on the raw return basis. Consequently, the funds risk (standard deviation) is less than the market risk. $R - R_f$ exhibits a negative skewness -1.05, which indicates that most of the funds excess returns, during the study period, were negative. In addition, $R - R_f$ are characterized by excess kurtosis 9.86. $R_m - R_f$ is characterized by a positive skewness 0.12, and excess kurtosis 4.28. Generally, these features are common characteristics of the emerging markets. Figure A1 in Appendix exhibits the variation of $R_m - R_f$, SMB, HML, and MOM over the period of the study.

5.2 Unit root test

To test the stationarity of the study variables the study uses three methods; Levin, Lin & Chu, and Im, Pesaran & Shin tests for panel data sets ($R_{i,t} - R_{f,t}$), and Augmented-Duckey-Fuller for single series ($R_{m,t} - R_{f,t}$, SMB_t, HML_t, MOM_t).

Table 3 reports the results of the Unit root test. The results show that all the variables reject the null hypothesis of the existence of Unit root (non-stationarity) at 1% level, which indicates that all variables are stationary at the level during the study period. These results suggest that the returns series display a degree of time dependency[2].

[2] Time series ($R - R_f$, $R_m - R_f$, SMB, HML, and MOM), which are return series in nature, have a constant mean, constant variance, and constant autocovariances over time.

Table 3: Unit root test results

Variable	Method	DW	T-Statistic	Probability
$R - R_f$	Levin, Lin & Chu (Common Unit root)	-	-8.51	0.000***
	Im, Pesaran & Shin (Individual Unit root)	-	-8.15	0.000***
$R_m - R_f$	Augmented-Duckey-Fuller (level)	2.09	-7.79	0.000***
SMB	Augmented-Duckey-Fuller (level)	1.93	-8.00	0.000***
HML	Augmented-Duckey-Fuller (level)	1.95	-9.34	0.000***
MOM	Augmented-Duckey-Fuller (level)	2.00	-9.79	0.000***

$R - R_f$: excess return of mutual funds (panel data). R_m - **R_f**: excess return of market portfolio (VWI general index). **SMB**, **HML**, and **MOM** are factors that mimic the size, BMR, and one-year return momentum, respectively.
*** Significant at 1% level.

5.3 Granger-Causality test

The study uses the Granger causality test to support the choice of the variables. Granger (1969) revealed that causality is inferred when past values of X can determine the current values of Y. Therefore, if the changes in X precede the changes in Y and the future value of Y can be predicted better by past values of X with a smaller forecast error variance, it could be said that X Granger causes Y. The results are reported in Table 4.

Table 4: Granger Causality test results

Null Hypothesis : H_0	F-statistic	Probability
$R_m - R_f$ does not Granger cause **$R - R_f$**	2.6167	0.0084***
SMB does not Granger cause **$R - R_f$**	3.7938	0.0002***
HML does not Granger cause **$R - R_f$**	5.0976	0.0000***
MOM does not Granger cause **$R - R_f$**	5.5885	0.0000***

$R - R_f$: excess return of mutual funds (panel data). **$R_m - R_f$:** excess return of market portfolio (VWI general index). **SMB**, **HML**, and **MOM** are factors that mimic the size, BMR, and one-year return momentum, respectively.
*** Significant at 1% level.

The results show that all the independent variables $R_m - R_f$, SMB, HML, and MOM Granger-Cause the dependent variable $R - R_f$ at 1% level. This suggests that the future fluctuations of excess mutual funds returns $R - R_f$ can be determined and predicted to some extent by using a part of the information provided by $R_m - R_f$, SMB, HML, and MOM. Therefore, these results demonstrate the validity of the model to investigate investment style of Jordanian mutual funds.

5.4 The investment style results

Specifically, to get efficient estimation concerning the investment abilities, the model should be free from Heteroscedasticity, as Lee & Rahman (1990) showed that the test of investment abilities of funds that ignores the Heteroscedasticity lead to biased conclusion. Therefore, the reported results are adjusted, by White's procedures, to avoid the Heteroscedasticity problem for both single and panel estimations.

5.4.1 Single mutual funds

The results of investment style for each single fund are reported in Table 5.

Table 5: Investment style for each fund

	JSF	**FTF**	**HF**	**GF**	**GJF**
α	0.001	0.001	-0.006	-0.001	-0.001
$R_m - R_f$	0.592***	0.275***	0.481***	0.408***	0.800***
SMB	0.168***	0.063***	0.157***	-0.002	0.251***
HML	-0.073	-0.023	-0.075	0.011	0.042
MOM	0.034	0.098***	0.009	0.066*	0.117*
Adj-R^2	0.79	0.62	0.65	0.53	0.83

*** Significant at 1% level.

* Significant at 10% level

The results reveal that market return has a positive effect on all mutual funds that is statistically significant at 1% level, which indicates that the funds' managers follow the movements of the market and remain close to the market portfolio return to reduce their investment risks. SMB has a positive effect on four mutual funds, which indicates that most funds prefer to hold small stocks in their portfolios except one fund GF prefers big stocks but it is statistically insignificant. This result is supported by Eser (2007), who found that the highest ranked mutual funds on average hold smaller stocks.

HML is statistically insignificant in all funds. Some funds JSF, FTF, and HF tilt to invest in growth stocks. Saleh & Bitar (2009) have proved that growth stocks outperform the value stocks in Jordanian market. The rest of funds GF and GJF prefer value stocks over growth stocks.

Finally, MOM has a positive effect on all mutual funds. It is statistically significant just on three funds FTF, GF, and GJF. Therefore, all funds favor winner's stocks that have performed well in the prior year. Chan et al. (2002), Carhart (1997) and Daniel et al. (1997) have also confirmed that past price trend of stocks is used by funds managers as a basis to select stocks.

5.4.2 Mutual funds as group

The study also uses the panel regression approach to confirm the results for investment style obtained from the analysis of each single fund. The results are reported in Table 6.

Table 6: Investment style of funds as group

R-squared : 0.6406 Adj R-squared : 0.6370		F-statistic: 176.95 Probability : 0.000***		DW: 1.693 N. Obs: 402
Variable	**Coefficient**	**Std-Error**	**T-Statistic**	**Probability**
α	-0.0011	0.0012	-0.9145	0.3610
R_m - $\mathbf{R_f}$	0.4714	0.0679	6.9437	0.0000 ***
SMB	0.1050	0.0358	2.9318	0.0036***
HML	-0.0290	0.0175	-1.6567	0.0984*
MOM	0.0581	0.0138	4.2108	0.0000***

*** Significant at the 1% level.

* Significant at the 10% level.

The results show that R_m - R_f, SMB and MOM have positive effects that are statistically significant at 1% level, while HML has a negative effect that is statistically significant at 10%. The adjusted R^2 is 0.6406, which means that 64.06% of variation in R - R_f is accounted by R_m - R_f, SMB, HML, and MOM. While F-statistic reveals that, the estimated regression is statistically significant at 1% level.

Generally, as investment style, the mutual funds' managers in Jordan primarily follow the market portfolio with a coefficient (β_1) equals 0.4. Secondly, when they deviate from the market portfolio, they favor the small stocks with a coefficient (β_2) equals 0.1, then winner's stocks with a coefficient (β_4) equals 0.06, and lastly growth stocks with a coefficient (β_3) equals 0.029. This strategy consists with the investment conventional wisdoms that mutual funds pick smaller and winners stocks with lower BMR.

6. Conclusion

It is clear that mutual funds' managers in Jordan have a conservative investment strategy; therefore, they track the market portfolio as the primary investment style. This strategy is explained by the infancy of this industry in Jordan, where the funds' managers do not bear high risks and ensure rewarding returns to attract risk aversion investors. Furthermore, the funds' managers in Jordan adopt other stocks' characteristics to diversify the fund's portfolio and realize abnormal returns. To do so, they select small, growth, and past winners stocks.

The mutual funds managers prefer small stocks because they are less informationally efficient and are not widely followed by investors, this makes these stocks less efficiently priced in the market. Therefore, the funds' managers exploit these opportunities by investing in these stocks to realize abnormal returns. The priority of growth stocks is explained by low liquidity risk and earning stability associated with this kind of stocks. The funds' managers invest in past winners stocks based on their belief that these stocks keep their increasing trend over the short and intermediate horizon.

The study recommends that the fund managers should reassess the investment styles and maintain comfortable liquidity to adopt the rewarding investment styles in the right time to diversify the fund's portfolio and improve its returns.

Mutual funds, those limited to market portfolio as investment style, should expand their investment style to include the size, BMR, and momentum to diversify their portfolios and benefit from the premiums of these stocks.

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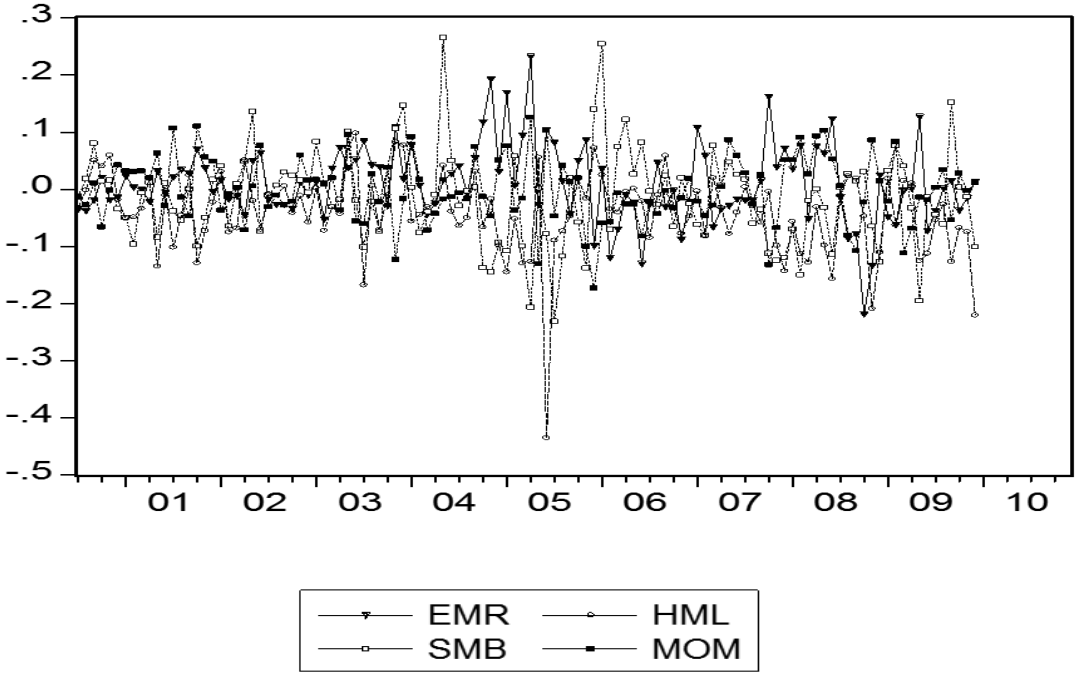
Appendix

Figure A1: The variation of R_m - R_f, SMB, HML and MOM from July 2000 to December 2009



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Structural Breaks, Parameter Stability and Energy Demand Modeling in Nigeria

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Abstract

This paper extends previous studies in modeling and estimating energy demand functions for both gasoline and kerosene petroleum products for Nigeria from 1977 to 2008. In contrast to earlier studies on Nigeria and other developing countries, this study specifically tests for the possibility of structural breaks/regime shifts and parameter instability in the energy demand functions using more recent and robust techniques. In addition, the study considers an alternative model specification which primarily captures the price-income interaction effects on both gasoline and kerosene demand functions. While the conventional residual-based cointegration tests employed fail to identify any meaningful long run relationship in both functions, the Gregory-Hansen structural break cointegration approach confirms the cointegration relationships despite the breakpoints. Both functions are also found to be stable under the period studied. The elasticity estimates also follow the a priori expectation being inelastic both in the long- and short run for the two functions.

Keywords: Energy demand modeling, structural breaks, parameter stability, cointegration

JEL Classification: C13, C22, C51

1. Introduction

Central to the estimation of energy demand functions in both developed and developing economies are the issues of variables' long run relationship and elasticity estimates. These issues fundamentally inform the forecasting power of energy demand models. Investigating the cointegration relationship among energy demand, prices and income is germane to establishing any meaningful policy inference regarding energy planning. In the same vein, understanding the sensitivity or responsiveness of energy demand to changes in price and income is essential in evaluating different implications of energy related policies such as

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carbon emissions reduction, optimal energy taxation, efficient energy pricing and energy conservation.

To this end, many empirical studies in the literature have been devoted to formulating and estimating demand functions for different energy products such as gasoline and kerosene (see, Cheung and Elspeth, 2004; Dahl and Kurtubi, 2001; Dahl, 1994, 2006; De Vita et al., 2006; Eltony, 2003, 2004; Halicioglu, 2007a; 2007b; Hendry and Juselius, 2000, 2001; Hughesn et al., 2006; Polemis, 2006). The empirical findings from these studies with respect to the long run relationship among energy demand, energy prices and income seem to be univocal. They all reveal the existence of cointegration relationship among the variables and the significance of price and income elasticity estimates, though with varying degree, in their respective economies.

However, most of the empirical studies fail to notice the fact that cointegration relationship may have a structural break during the sample period. Structural break in the cointegration relationship eventually implies a significant change in the cointegration parameters or even a change in the existence of cointegration relationships. Previous studies investigating long-run elasticities of energy demand in Nigeria and other developing countries heavily rely on the assumptions of time series with no structural changes and of long-run relationships that are temporally stable (see, Iwayemi et al., 2010; Dayo and Adegbulugbe, 1987; Akinboade et al., 2008; Cheung and Elspeth, 2004; Dahl and Kurtubi, 2001). However, this may not be the case given the fact that economic data often come from processes with time dependent parameters. Also, apart from the possibility of structural break, one of the fundamental challenges in energy demand modeling concerns the interaction between the price elasticity of energy demand and income.

The conventional cointegration techniques which are mostly used in the literature often fail to account for structural break effects on the relationship leading to biased estimation. This also has implications on knowing the stability of the parameters over the period under consideration (Granger and Newbold, 1974; Phillips, 1986; Leybourne and Newbold, 2003). In allowing for the effects of regime shifts in energy demand modeling in Nigeria, this study employs the Gregory and Hansen (1996) residual based test which accounts for endogenous structural break and also Hansen (1992) and Quandt and Andrews (1993) tests for parameter stability[1].

On the specification of alternative energy models, this study employs two models, namely; the *Basic model and Price-Income Interaction Parameter model.* The latter captures the extent to which the responsiveness of energy consumption to price changes increases or decreases as income changes, while former represents the conventional specification of energy consumption expressed as a function of price and income. For instance, the sort of a model employed in the estimation of energy demand, to a large extent, determines the eventual results and findings as regards the elasticity estimates. In this respect, to test the robustness of price and income elasticity estimates produced by the basic energy demand

[1] Given the rejection of cointegration with unknown break in the parameter, Gregory and Hanson (1996) technique allows the test of the null of no cointegration for the variables under consideration with I(1) order in the presence of structural break in the cointegration relationship.

model, there is need for alternative energy model specification. While there are different studies on energy demand estimation, only a few really considered alternative energy model specification, issue of structural breaks and parameter stability. However, in the case of Nigeria, no empirical study has extensively considered these issues. In lieu of this, the study contributes to the literature by making an ingenious attempt by employing alternative model specification and also addressing the issue of structural breaks and parameter stability in energy demand modeling in Nigeria.

The research questions this study seeks to answer are: What are the policy implications of the existence of structural breaks and/or regime shifts on the cointegration relationship of energy demand model in Nigeria? How sensitive are price and income elasticity estimates to alternative energy model specification when considering the price elasticity and income interaction possibility in the case of Nigeria? It should, therefore, be stressed here that while the objectives of this study are drawn from the above highlighted research questions, the contribution of this paper are as follows. This study employs an alternative cointegration technique under the assumption of possibility of structural break/ regime shift in energy (gasoline and kerosene) demand functions in Nigeria. Also, the study reformulate and re-estimate energy (gasoline and kerosene) demand model specifications with the aim of capturing the interaction effect between price elasticity of energy demand and income in Nigeria.

The rest of the paper is structured as follows. Section 2 presents basic theory of cointegration with structural breaks/regime shifts. While section 3 concerns the model specification and description of data employed, section 4 involves the empirical analysis and results discussion. Finally, section 5 concerns the policy relevance of the study and conclusion.

2. Basic Theory of Cointegration with Structural Breaks/Regime Shifts

In investigating the relationship among economic variables in the face of structural breaks, the concept and dynamics of cointegration in time series econometrics has been further examined. Different types of cointegration with structural breaks haven been identified namely: cointegration with parameter changes, partly cointegration and cointegration with mechanism changes[2]. Based on the works of Perron (1989), Banerjee, Lumsdaine, and Stick (1992), Perron and Vogelsang (1992) and Zivot and Andrews (1992) where the null of a unit root in univariate time series is tested against the alternative of stationarity while allowing for a structural break in the deterministic component of the series, Gregory and Hansen (1996) developed a residual-based cointegration approach that

[2] Simply speaking, cointegration with parameter changes means the parameters of the cointegration equation happen to change at some time, but the cointegration relationship still exists. Partly cointegration means the cointegration relationship exists before or after some time but disappears in other periods. Cointegration with mechanism changes means the former cointegration relationship is destroyed because new variables enter the system and they form a new type of cointegration relationship (see, Baochen and Shiying, 2002).

allows for regime shifts. This approach centers on deriving an alternative hypothesis of one break in the cointegrating vector.[3] According to Gregory and Hansen (1996), the power of the Engle-Granger (1987) test of the null of no cointegration is substantially reduced in the presence of a break in the cointegrating relationship. To overcome this problem, they extended the Engle-Granger test in order to allow for breaks in either the intercept or trend of the cointegrating relationship at an unknown time. Therefore, given the rejection of cointegration with unknown break in the parameter, Gregory and Hanson (1996) technique allows testing the null of no cointegration of variables with I(1) order in the presence of structural break in the cointegrating relationship[4].

3. Data and Model Specification

3.1 Data

Given the underlying objectives of this study, the data used are: real gross domestic product per capita, real gasoline and kerosene prices, gasoline and kerosene consumption per capita. All data are further expressed in their natural log forms. The analytical scope of the data ranges from 1977 to 2008. All data are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin various issues.

3.2 Model Specification

Throughout the literature, energy demand function specification had rather assumed the standard consumer theory-based demand model specification. Basically, the demand function of a typical rational economic agent presupposes consumption of a commodity as a function of income, price of the commodity, price of other commodity etc. The econometric model used in this study reflects previous studies of energy demand function (see, Iwayemi et al., 2010). Apart from the fact that it is a common energy demand specification used in a large number of previous studies, it is also convenient for us to adopt this model since it allows for direct comparison with previous results from the literature. Therefore, for the case of simplicity and parsimony, we adopt the basic energy demand model (q) which is essentially specified as a function of energy price (p) and income (y). Specifically, we estimate the following model for both gasoline and kerosene demand functions:

$$q_t = \alpha_0 + \alpha_1 p_t + \alpha_2 y_t + e_t \tag{1}$$

[3] In the presence of structural break(s)/regime shift, the common test for cointegration between variables becomes bias since the distributional theory of evaluating the residual-based tests is not the same. In Gregory and Hansen (1996), Nason and Watt (1996), the impact of break in the test for cointegration is further explained as the rejection frequency of the ADF test is said to fall dramatically in the presence of a break in the cointegration vector.

[4] See the appendix for details

Meanwhile, it should be recalled here that one of the fundamental objectives of this study is to estimate demand functions for both gasoline and kerosene using an alternative model specification which incorporates price elasticity and income interaction possibility effect. The idea is to capture the extent to which the responsiveness of consumers to price changes increases or decreases as income changes over time. Basically, the price elasticity of energy demand is expected to be equal to:

$$Ep = \alpha_1 + \alpha_2 + \alpha_3 y_t \tag{2}$$

Since the price elasticity is less than zero, a positive coefficient α_3 on the interaction term indicates a decrease in the price response as income rises. Consequently, the following represents the simple price-income interaction model employed:

$$q_t = \alpha_0 + \alpha_1 p_t + \alpha_2 y_t + \alpha_3 p_t y_t + e_t \tag{3}$$

3.3 Econometric Analytical Procedures

The standard econometric analytical procedures of time series model estimation are strictly adhered to in this study. We commence our empirical exercise by performing unit roots test with the aim of confirming the integration properties of the variables employed by employing the Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) tests (Dickey and Fuller, 1979; Phillips and Peron, 1988). Also, batteries of cointegration techniques including the more recent and robust Gregory and Hansen (1996) approach are employed. Following the results of the cointegration tests (where cointegration relationship is established), we proceed to estimating the elasticity estimates of the functions. Given the fact that the responsiveness of both the price and income varies with the type of model specified among other factors, we specify different energy demand models such as the basic, dynamic and the price-income interaction models with the aim of strengthening the robustness of the analysis. Finally, following the results of the elasticity estimates obtained from these models, we perform different parameter stability tests such as the Hansen test and Quant-Andrews unknown break point test. The intention is to affirm the dynamics of parameter stability over the period under analysis.

4. Empirical Analysis and Discussion

4.1 Unit root test

The study performs the unit root tests on the variables under consideration, namely gasoline consumption per capita, kerosene consumption per capita, income per capita, prices of gasoline and kerosene. As earlier highlighted, two unit root tests- ADF and PP- are used. While the null hypothesis for both tests is that there is a unit root, the optimal lag lengths selection is done by the Schwarz Bayesian criteria. All unit root test regressions are run with a constant and trend term. The results as detailed in Table 1 indicate the existence

of unit root for all the variables at their levels. In other words, the tests were unable to reject the null hypothesis for all the variables. However, the variables appear to be stationary at first difference, i.e. integrated at order 1. This result, therefore, implies that examination of possible cointegration relationship among the variables is worthwhile.

Table 1: Unit Root Tests

ADF test Statistic	***Variables***	***t-statistics***	***Prob.****
At Level	GDP (y)	-0.232	0.925
	Gasoline Consumption (q)	-2.084	0.251
	Gasoline Price (p)	6.174	1.000
	Kerosene Consumption (q)	-1.733	0.538
	Kerosene Price (p)	-0.297	0.841
At First Difference	GDP (y)	-4.846	0.000
	Gasoline Consumption (q)	-6.747	0.000
	Gasoline Price (p)	-2.914	0.053
	Kerosene Consumption (q)	-5.011	0.000
	Kerosene Price (p)	-3.659	0.022
P-P test Statistic	***Variables***	***t-statistics***	***Prob.****
At Level	GDP (y)	-0.412	0.896
	Gasoline Consumption (q)	-2.067	0.258
	Gasoline Price (p)	8.831	1.000
	Kerosene Consumption (q)	-1.617	0.592
	Kerosene Price (p)	-0.410	0.901
At First Difference	GDP (y)	-4.795	0.000
	Gasoline Consumption (q)	-7.762	0.000
	Gasoline Price (p)	-2.799	0.060
	Kerosene Consumption (q)	-4.371	0.000
	Kerosene Price (p)	-8.512	0.000

*MacKinnon (1996) one-sided p-values

4.2 Cointegration tests without structural breaks

Among the cointegration techniques employed here are the VAR-based multivariate Johansen, Engle-Granger, and Phillips-Ouliaris single-equation cointegration techniques. The results of the respective cointegration tests are presented in Table 2, 3 and 4. One of the

striking features of the results pertains to the seemingly conflicting cointegration evidences among the variables. For instance, while the VAR-based Johansen maximum likelihood tests suggests the existence of one cointegrating vector among all variables in the two energy demand (gasoline and kerosene) models, findings from both the Engle-Granger and Phillips-Ouliaris single-equation cointegration techniques, refute the cointegration evidence among the variables. It must, however, be noticed that the conventional cointegration tests results in the presence of structural break(s)/regime shift become biased (see, Gregory and Hansen, 1996; Gregory et al., 1996). For instance, it would be erroneous and of course misleading to conclude and/or deduct policy inference based on the results of cointegration tests as seen in Table 3. More specifically, since the power of residual-based cointegration tests such as the Engle-Granger and Phillips-Ouliaris often fall dramatically in the presence of a break in the cointegration vector, there is need for an alternative cointegration test which fundamentally allows for the possibility of structural breaks/regime shifts in our models.

Table 2: Multivariate Johansen Cointegration Test

(a) Gasoline				
Ho	H_A	λ_{tr} ***test***	λ_{tr} *(0.95)*	***Prob***
r = 0	r=1	32.12	29.79	0.026
r ≤ 1	r=2	7.60	15.49	0.509
r ≤ 2	r=3	0.05	3.84	0.819
Ho	H_A	λ_{tr} ***test***	λ_{tr} *(0.95)*	***Prob***
r=0	r=1	24.53	21.13	0.016
r=1	r=2	7.54	14.26	0.427
r=2	r=3	0.05	3.84	0.819
(b) Kerosene				
Ho	H_A	λ_{tr} ***test***	λ_{tr} *(0.95)*	***Prob***
r = 0	r=1	31.58	29.79	0.036
r ≤ 1	r=2	4.38	15.49	0.870
r ≤ 2	r=3	0.01	3.84	0.907
Ho	H_A	λ_{tr} ***test***	λ_{tr} *(0.95)*	***Prob***
r=0	r=1	22.20	21.13	0.042
r=1	r=2	4.36	14.26	0.427
r=2	r=3	0.05	3.84	0.819

Note: Critical values are calculated following the approach in Mackinnon et al. (1999)

Table 3: Conventional Residual-Based Cointegration Tests

(a) Gasoline				
Engle-Granger Test				
Dependent	***tau-statistic***	***Prob.****	***z-statistic***	***Prob.****
y	-0.998559	0.9662	-2.894700	0.9653
p	-1.988986	0.7427	-17.09904	0.1333
q	-3.350912	0.1675	-14.36408	0.2502
Phillips-Ouliaris Test				
Dependent	***tau-statistic***	***Prob.****	***z-statistic***	***Prob.****
y	-1.306669	0.9326	-4.456231	0.9123
p	-1.111021	0.9564	-4.963319	0.8880
q	-3.380565	0.1597	-15.00221	0.2192
(b) Kerosene				
Engle-Granger Test				
Dependent	***tau-statistic***	***Prob.****	***z-statistic***	***Prob.****
y	-2.240376	0.6304	-9.023312	0.6065
p	-2.118709	0.6867	-10.34714	0.5046
q	-3.928277	0.0605	-16.94599	0.1418
Phillips-Ouliaris Test				
Dependent	***tau-statistic***	***Prob.****	***z-statistic***	***Prob.****
y	-1.850440	0.7963	-5.835018	0.8389
p	-1.589986	0.8764	-5.591521	0.8535
q	-3.922518	0.0612	-15.39430	0.2015

Note: Probability values are calculated following the approach in MacKinnon et al. (1996)

4.3 Cointegeration tests with structural breaks

Given the short-coming of the earlier conventional tests in identifying any meaningful long run relationship in the presence of structural breaks, this study finds it needful to further subject the long run relationship among the variables in both energy functions to a more rigorous and robust test which consents to possibility of structural breaks in the relationship. The result of this test is depicted in Table 4. Though, the results reveal that evidence of cointegration is not found when considering the assumption of a level shift and a level shift with trend (i.e. C and C/T models), evidence of cointegration relationships is clearly established when assuming a shift which allows the slope vector to shift (model C/S), otherwise known as structural break in both functions. Having identified plausible

breaks in the systems, the test does suggest that a structural break in the cointegration vector is important and needs to be taken care of in the specification of energy demand functions in Nigeria.

Table 4: Gregory-Hansen Structural Break Cointegration Test

(a) Gasoline Demand Model

Model	*ADF**	*Breakpoint*	*Zt**	*Breakpoint*	*Zα**	*Breakpoint*
C	-3.90 (1)	1979	-3.80	1978	-22.01	1978
C/T	-5.70 (1)*	1979	-5.22	1978	-32.71	1980
C/S	-12.56 (1)**	1981	-10.60**	1982	-54.69	1979

(b) Kerosene Demand Model

Model	*ADF**	*Breakpoint*	*Zt**	*Breakpoint*	*Zα**	*Breakpoint*
C	-4.24 (0)	1999	-4.30	1999	-25.68	1999
C/T	-5.00 (1)	1980	-4.60	1980	-29.00	1980
C/S	-34.23 (2)**	1979	-11.38**	1980	53.88	1980

Note: The 5% CVs are -5.50 and -58.33 for the ADF/Zt*and Zα* tests, respectively (see, Table 1 of Gregory and Hansen, 1996)

4.4 Long run estimates

With the aim of estimating more rigorously the elasticity estimates for both the demand for gasoline and kerosene functions, this study embarks on specifying three different models, namely the Ordinary Least Square (OLS), Dynamic OLS[5] and Price-Income Interaction models. While the OLS and Dynamic OLS respectively represent the commonly applied basic models in the estimation of energy demand functions, the Price-Income Interaction model aims at capturing the interaction effect between price elasticity of energy demand and changes in income. As earlier rehearsed, the need is to capture the extent to which the responsiveness of energy consumption to price changes increases or decreases as income changes. Table 5 depicts different long run elasticity estimates as estimated from these three models. As evident from the table, the long run elasticity estimates of both the OLS and DOLS are not significantly different for both the gasoline and kerosene functions. To start with, price and income elasticity estimates seem to follow

[5] The Dynamic Ordinary Least Square (DOLS) is an asymptotically efficient estimator which eliminates the feedback in the cointegrating system as advocated by Stock and Watson (2003) and Stock and Watson (1993). It involves augmenting the cointegrating regression with lags and leads so that the resulting cointegrating equation error term is orthogonal to the entire history of the stochastic regressor innovation.

the *a priori* expectation in terms of their relationships with respect to signs and magnitudes. We find that both price and income elasticity estimates are negatively and positively signed, respectively. They are also shown to be inelastic, though with varying degree (here, income elasticites are found to be higher than price elasticities for both energy demand functions). Meanwhile, the findings from the Price-Income Interaction model show that the coefficients on price, income and the interaction term are significant for the period under investigation for both functions. Finally, the error correction terms of the respective models also follow the expected sign and magnitudes.

Table 5: Long Run Elasticity Estimates

(a) Gasoline

Variables	*OLS*	*Dynamic (OLS)*	*Price-Income Interaction*
Constant	0.063 (4.057)	0.016 (3.862)	0.192 (4.001)
Income	0.714 (2.086)	0.511 (2.171)	0.358 (1.916)
Price	-0.015 (-2.031)	-0.104 (-1.692)	-0.016 (-1.137)
Price-Income	----------	----------	-0.233 (-1.874)
SR Ect(-1)	-0.328 (-3.090)	-0.432 (-0.2.750)	-0.622 (-3.00)
Adj. R^2	0.45	0.57	0.68

(b) Kerosene

Variables	*OLS*	*Dynamic (OLS)*	*Price-Income Interaction*
Constant	0.187 (5.862)	0.022 (3.524)	0.178 (1.969)
Income	0.680 (2.171)	0.403 (2.611)	0.371 (3.057)
Price	-0.195 (-1.728)	-0.0816 (-1.692)	-0.205 (-2.174)
Price-Income	----------	----------	0.109 (1.702)
SR Ect(-1)	-0.495 (-2.897)	-0.212 (-1.880)	-0.398 (-2.710)
Adj. R^2	0.49	0.60	0.74

4.5 Parameter Stability Test

One of the aims of this study is to examine whether the estimated long-run relationship between the energy demand and its determinants in Nigeria really exhibits the desired property of structural stability over time[6]. The study applies two different parameter stability tests, namely the Hansen and Quandt-Andrews breakpoints test for one or more

[6] Since the estimation periods for our study cover the fairly volatile period, it is important to check whether the models (hence, parameters) under estimation are really stable over these periods.

unknown structural breakpoint(s). Basically, Hansen (1992) proposes three tests (Lc, MeanF, and SupF) for parameter instability based on the full modified statistics.[7] The test which is performed using a trimming region of 15% simply examines the null hypothesis of no sudden shift in the regime (Narayan and Narayan, 2010). The results of the test for parameter instability for both functions (gasoline and kerosene) are presented in Table 6 together with their probability values. As evident from the results, these tests show signs of parameter stability. This, result is also confirmed by the G-H Cointegration test, though structural breaks are identified in the system. Therefore, we can conclude that there is strong evidence that parameters are stable for the two energy demand functions.

The study also applies the Quandt-Andrews breakpoints test with the null hypothesis of no breakpoints within a trimming region of 15%. The test statistics which are based on the Maximum statistics, Exp statistic and the Ave statistic (see Andrews, 1993 and Andrews and Ploberger, 1994) are reported in Table 7. The entire summary statistic measures fail to reject the null hypothesis of no structural breaks within the period considered.

Table 6: Hansen Parameter Instability Test

(a) Gasoline				
	Stochastic	*Deterministic*	*Excluded*	
Lc statistic	Trends (m)	Trends (k)	Trends (p2)	Prob.*
0.056113	2	0	0	> 0.2
(b) Kerosene				
	Stochastic	*Deterministic*	*Excluded*	
Lc statistic	Trends (m)	Trends (k)	Trends (p2)	Prob.*
0.052265	2	0	0	> 0.2

[7] The null hypothesis of co-integration goes against the alternative of no co-integration, since the absence of co-integration is captured by an alternative hypothesis of parameter instability (Lee and Chang, 2005)

Table 7: Quandt-Andrews Unknown Breakpoint

(a) Gasoline		
Statistic	*Value*	*Prob.*
Maximum LR F-statistic (1982)	4.776451	0.8295
Maximum Wald F-statistic (1982)	4.776451	0.8295
Exp LR F-statistic	1.480448	0.5889
Exp Wald F-statistic	1.480448	0.5889
Ave LR F-statistic	2.775443	0.4590
Ave Wald F-statistic	2.775443	0.4590
(b) Kerosene		
Statistic	*Value*	*Prob.*
Maximum LR F-statistic (1982)	4.982240	0.8032
Maximum Wald F-statistic (1982)	4.982240	0.8032
Exp LR F-statistic	1.467755	0.5945
Exp Wald F-statistic	1.467755	0.5945
Ave LR F-statistic	2.213750	0.6235
Ave Wald F-statistic	2.213750	0.6235

Note: Since the original equation was linear, the LR F-statistic is identical to the Wald F-statistic.

5. Policy Relevance and Conclusion

The primary goal of the paper centers on investigating the cointgration status of energy demand models with a special focus on structural breaks/regime shifts, parameter stability and alternative model specification. Hence, the study estimates petroleum products demand functions for Nigeria from 1977 to 2008. Specifically, demand functions for both the gasoline and kerosene are estimated under two different models.

The main finding as revealed in this study is that in the energy (gasoline and kerosene) functions, price and income elasticity estimates are inelastic both in the long and short run. Also, the responsiveness of consumers to price changes tends to decreases as income increases over time in the case of kerosene demand. However, in the case of gasoline demand, the results show an increase in the price response as income rises. There

are evidences of structural breaks in the cointegration in both models for kerosene and gasoline demand. Also, the result from parameter tests reveals that price and income elasticity estimates in both models are stable. It is envisaged, therefore, that substantial policy lessons would be drawn from the findings of this study especially in the current phase of energy industry deregulation in Nigeria. Having identified plausible breaks in the systems, the test does suggest that a structural break in the cointegration vector is important and needs to be taken care of in the specification of energy demand functions in Nigeria.

Finally, it should be emphasized here that further empirical studies could still explore the short run dynamics of energy demand in Nigeria through the use of other methods such as the Error Correction and VAR techniques as this would further enrich the empirical literature.

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Appendix

Structural Breaks Cointegration

As earlier stated, this cointegration technique is an extension of ADF, Zα, and Zt tests for cointegration and can be seen as a multivariate extension of the endogenous break test for univariate series. Basically, in the G-H tests, there are four different models for the analysis of structural change in the cointegrating relationship. These models are: (i) level shift, C; (ii) level shift with trend, C/T; (iii) regime shift where both intercept and slope coefficient change, C/S; and (iv) regime shift where intercept, slope coefficient and trend change, C/S/T. Hence, the following equations represent the specifications of the models, respectively:

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \alpha y_{2t} + e_t \tag{4}$$

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \delta t + \alpha y_{2t} + e_t \tag{5}$$

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \delta t + \alpha_1^T y_{2t} + \alpha_2^T y_{2t}\varphi_{t\tau} + e_t \tag{6}$$

$$y_{1t} = \mu_1 + \mu_2\varphi_{t\tau} + \delta_1 t + \delta_2 t\varphi_{t\tau} + \alpha_1^T y_{2t} + \alpha_2^T y_{2t}\varphi_{t\tau} + e_y \tag{7}$$

Equations (4) to (7) represent the generalized standard model of cointegration. The idea here is to allow for both a regime trend shift under the alternative hypothesis (Gregory and Hansen, 1996). The observed data are $y_t = (y_{1t}, y_{2t})$ where y_{1t} is a scalar variable, y_{2t} is a vector of explanatory variables and μ is the disturbance term. While φ represents the dummy variable both y_{1t} and y_{2t} are expected to be I(1) variables. The dummy variable is then defined as:

$$\varphi_{t\tau} = \begin{cases} 0, if\ \ t \le [n\tau] \\ 1, if\ \ t > [n\tau] \end{cases}$$

The unknown parameter, $\tau \in (0,1)$, is the relative timing of the change point and [ ] denotes integer part. Parameters μ_1, α_1 and β_1 measure, respectively, the intercept, slope coefficients and trend coefficient before the break and μ_1, α_1 and β_1 are the corresponding changes after the break. Following the computed cointegration test statistic for each possible regime shift by Gregory and Hansen (1996), equations (4) to (7) are estimated for all possible break date in the sample. The smallest value of ADF(τ), $Z_\alpha(\tau)$ and $Z_t(\tau)$ across all possible break points are selected to reject the null hypothesis of no cointegration[8].

[8] The critical values for the break test are reported in Gregory and Hansen (1996).

Determinants of Maternal Healthcare Utilization in Zimbabwe

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Abstract

Zimbabwe and other developing countries struggle to achieve millennium development goals originally set for 2015. To assist health policy making, there was an investigation of how demographic, socioeconomic and cultural factors determine maternal healthcare services use in Zimbabwe. A logistic model for four different maternal healthcare services using data from the 2005/6 Zimbabwe Demographic Health Survey was estimated. Secondary education increases the odds of use of maternal health services by at least 2 times at 1 percent level of significance whilst access to information increases the odds by 1.52 at the 5 percent level of significance. Women in urban areas are more likely to give birth at healthcare facilities OR 3.49 compared to their rural counterparts at 1 percent significance level. Women from highest income households are more likely to give birth at health facilities than those from poorest households OR 6.44 at 1 percent level of significance whilst the pattern is consistent for other services as well. Other important determinants are age, education, wealth, polygamy and religious affiliation. Generally, policy makers have to appreciate that these factors affect different maternal health services differently. Consequently, strategies to improve the uptake of maternal healthcare like mass media and health workers, particularly for disadvantaged sections of the population like rural areas and the uneducated, should be targeted at specific components rather than planning umbrella strategies.

Keywords: Utilisation, Maternal healthcare, Millennium Development Goals, Zimbabwe

JEL Classification: I10, I18, I19

1. Introduction

There has been a considerable amount of evidence showing that good health in general and maternal health in particular can play a major role in poverty alleviation and human development (Thomas and Strauss, 1997; Govindasamy and Ramesh, 1997; Filippi, Ronsmans and Campbell, 2006; Odwee, Okurut and Adebua, 2006). Women's health in particular, needs proper attention to avoid reduction in consumption levels associated with

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the loss of a mother which was observed in Zimbabwean households (Lindelow, 2002). More broadly, investment in maternal health has valuable equity benefits, since differences in maternal and child mortality and morbidity mirror the huge discrepancies between rich and poor people both within and between countries (Borghi et al., 2006).

Although the MDGs top global health priorities at the moment, health for all remains an elusive goal in most developing countries (Carr, 2004). There is an increasingly visible gap between households that have access to healthcare and those who are excluded from such benefits (WHO, 2005). In 2004, maternal mortality rates for Sub Saharan countries stood at 900 deaths per 100 000 live births compared to 9 deaths per 100 000 live births for developed countries (WHO, 2004). In Zimbabwe, the under five mortality rate for the richest fifth of the population was reported to be 62 deaths per 1000 live births compared to 100 deaths per 1000 live births for the poorest fifth who are constrained from accessing healthcare by their incomes (Gwatkin et al., 2003). In fact, researchers have found that a large proportion of mothers and children remain excluded from the health benefits that others in the same country enjoy. For example, Gwatkin et al. (2003) found that 94 percent of births by the richest fifth of Zimbabwean women are attended by medically trained personnel compared to only 57 percent of the poorest fifth. This paper uses the Zimbabwe Demographic Health Survey of 2005/6 to find out the major determinants of maternal healthcare utilisation and determine if these determinants are universal to all maternal health services. This will help healthcare policy makers to formulate strategies for the provision of maternal healthcare and achievement of the MDGs.

A variety of studies have been carried out in different countries to investigate factors that influence maternal healthcare utilisation (Elo, 1992; Govindasamy and Ramesh, 1997; Magadi et al., 1999; Navaneetham and Dharmalingam, 2000; Mekonnen and Mekonnen, 2002; Abouzahr and Wardlaw, 2003; Stephenson et al., 2006; Sarma and Rempel, 2007). Most of them investigate how socioeconomic, demographic and cultural factors influence utilisation.

Age is the most used demographic characteristic. From theory, ageing leads to rising depreciation in health stock which implies increasing marginal cost of health investment. The demand for health capital is thus expected to fall with ageing (Grossman, 2000). However, the demand for healthcare inputs for health stock may rise due to inelastic demand curve for health. Empirical evidence has various findings. Age can be negatively related to healthcare utilisation since it captures past maternal experience especially where there were no complications in previous pregnancies and child health (Sarma and Rempel, 2007). This negative relationship, however, could be due to diminishing marginal willingness to invest in the additional children's health, that is, in the case of mistimed or unwanted pregnancies (Magadi et al., 1999). There are cases however, where younger women have been observed to utilise less maternal healthcare (Magadi et al. 1999), and also where older women utilise more healthcare which is attributed to the experience hypothesis which says that maternal age reflects the woman's accumulated knowledge of healthcare services and the value she places on modern facilities (Elo, 1992; Grossman, 2000).

Socioeconomic and cultural factors include education, wealth status, religion, polygamy, exposure to the media, place of residence and autonomy in decision making.

Commonly held beliefs and norms that could be religious or cultural, shape the way individuals perceive their own health and the health services available. Religious and cultural beliefs have been found to be sources of exclusion from maternal healthcare utilisation in India and Africa (Stephenson et al., 2006). Although most studies have ignored polygamy, it is a customary practice that is associated with traditionalists. Stephenson et al. (2006) found that women in polygamy were less likely to report for delivery at a health institution. Maternal healthcare utilization is constrained by women's lack of decision making power, the low value placed on women's health and the negative or judgmental attitudes of family members (WHO, 2005). Women with more autonomy in decision making, which is determined by the society and culture, have also been found to be more likely to use maternal healthcare (Stephenson et al., 2006).

On access to the media, Stephenson et al. (2006) found that women who were exposed to reproductive messages were more likely to utilise health facilities for delivery in Malawi, Kenya and Tanzania whilst no effect was found for Ghana, Ivory Coast and Burkina Faso. This implies that the impact of access to the media on maternal healthcare utilization is country specific.

Costs and proximity to a healthcare facility are health facility related characteristics which also influence maternal healthcare utilisation. From economic theory, price is negatively related to demand. Although healthcare in Zimbabwe is subsidized, there are registration fees that are demanded especially at municipal clinics. In addition to that, healthcare is characterised by implicit costs like time and transportation. Sarma and Rempel (2007) found distance to a healthcare facility negatively related to utilisation, especially for distances of more than ten kilometers. The Zimbabwean government claims that it has done good work by reducing distance to healthcare facilities through the construction of healthcare facilities around the country. The average distance to the nearest healthcare facility is between eight to ten kilometers (MHCWZ, 1999). We will seek to validate the claim made by the government that it has done enough to reduce the problem of having to travel long distances to healthcare facilities in Zimbabwe. Women residing in rural areas have also been found to utilise less healthcare than their urban counterparts in Ethiopia (Mekonnen and Mekonnen, 2002). Navaneetham and Dharmalingam (2000) had conflicting findings for different components of maternal healthcare in India.

Education has been found to be a source of exclusion in studies conducted in India and different countries in Africa. Mekonnen and Mekonnen (2002) found education linearly increasing with utilisation in Ethiopia. Navaneetham and Dharmalingam (2000) found uneducated women less likely to use maternal healthcare, but found no differences in utilisation among the educated. The household's level of wealth has also been found to be an important determinant of maternal healthcare utilization with the poor being the most disadvantaged (Castro-Leal et al., 2000; Carr, 2004). Furthermore, public healthcare programmes targeted to reach the poor end up benefiting only the rich instead (Castro-Leal et al., 2000).

Findings from other countries have been inconsistent and sometimes actually conflicting. It appears however, that most of these studies conclude that the impact of factors that determine healthcare utilisation are unique to settings. Different settings have

different socioeconomic backgrounds, cultural Practices, demographic characteristics and income distribution. Furthermore, no quantitative study has been carried out yet to study how the factors influence maternal healthcare utilisation in Zimbabwe. This study thus seeks to discover how demographic, cultural and socioeconomic variables influence particular groups of women from utilising different maternal health services.

This paper is organized as follows. Section 2 describes research methodology of the study followed by section 3 which contains the empirical analysis and results. The last section presents discussion of the research findings and conclusions.

2. Methodology

This study uses secondary data from the Zimbabwe Demographic and Health Survey (ZDHS) 2005-6. The survey was carried out by the Central Statistical Office (CSO), assisted by Macro International Inc. between August 2005 and March 2006. A sample of 8907 women was interviewed during the survey. This large dataset gives an advantage of low variance associated with estimating using large samples. The birth records dataset from the survey contains information on maternal healthcare utilisation. It provides healthcare information on women who had pregnancy any time in the five years prior to the survey, from the time they were pregnant to the infancy of the child. The dataset was obtained from Macro International's MEASURE DHS project website www.measuredhs.com.

Maternal healthcare is a package consisting of different components. In order to determine if determinants of utilisation are the same for all components such that a single strategy can be used for the whole maternal healthcare package, determinants of antenatal care, uptake of Tetanus Toxoid (TT) injections, place of delivery and postnatal care will be investigated. The logit model will be used to estimate the utilization of each of these four components of maternal healthcare.

We estimated utilisation of maternal healthcare using the following logistic model;

P (Utilization = 1|X) = F (Age, Age squared, Education level, Wealth Status, Place of residence, Whether child was wanted, Independence in decision making, Religion, Distance to facility, Cost of care, Access to information, Whether in Polygamy)

The equation says that the probability of a woman utilising maternal healthcare given observed characteristics X, is given by a function F. F is a function of the observed characteristics X. By assuming that the stochastic term follows a cumulative logistic distribution, F becomes a cumulative distribution function for the logit model. The odds ratios were estimated in STATA 10.

3. Results

3.1 Sociodemographic characteristics

Table 1 presents the sociodemographic characteristics of the sample. 8907 women of mean age 35.2 years were interviewed. On average, each woman has 4 children whilst

only 25.89 percent are formally employed. 10.62 percent of the respondents never attained any education whilst 46.75 percent and 40.54 percent attained only primary and secondary education respectively. 46.57 percent of these women live in poverty whilst 74.92 live in rural areas. 75.99 percent of the women are married whilst 4.24 percent are divorced and 12.83 percent are widowed.

3.2 Multivariate Analysis

Logistic regressions were conducted using STATA 10 for each of the four maternal healthcare services and the results presented in Table 2 were obtained. Table 2 shows the results of multivariate analysis of the antenatal care, TT injections, place of delivery and postnatal care utilisation in terms of odds ratios and p- values. Cost of healthcare and autonomy in carrying out healthcare decision are insignificant variables for all maternal healthcare components under analysis.

3.3.1 Tetanus Toxoid Injections

Age, education, wealth status, type of marriage and whether the current pregnancy was wanted are the determinants of the uptake of TT injections. The odds of taking the required TT injections are two times higher among women who attained secondary education than among those who had no schooling at all significant at 1 percent level. Women who belong to the richer and richest societies are 61 percent and 91 percent more likely to take the required TT injections than women from the poorest family settings at 1 percent significance level whilst the middle class women are 38 percent more likely to do the same at 5 percent significance level. Women who wanted the current pregnancy are 20 percent more likely to use the service whilst women in polygamous households are 22 percent less likely to take adequate TT injections compared to women in non polygamous households both at 5 percent significance level. There Age squared variable shows an odds ratio of 1 implying that the odds of women at both ends of the reproductive age spectrum utilising TT injections are not different from those of women in the middle ages at 10 percent significance level.

3.3.2 Antenatal Care

Age, education, wealth status, religious affiliation, access to information, polygamy and whether the current pregnancy was wanted are the determinants of antenatal care utilisation. The odds of utilising antenatal care are 1.83 times and 4.84 times higher among women who have attained secondary education only and higher education respectively than among women who never attended school both significant at 1 percent. The odds of utilising the same service are 1.84 times higher amongst women from the richest households than among women from the poorest households at 5 percent level of significance.

Table 1: Demographic characteristics of respondents

Characteristics	
N	8907
Mean Age, years (SD)	35.2 (8.4)
Mean Parity, n(SD)	4.1 (2.2)
Occupation n (%)	
Agriculture Self Employed	16.59
Household and Domestic	3.5
Formal Employment	25.89
Unemployed	54.02
Education (%)	
At least High School	2.09
Secondary school	40.54
Primary school	46.75
Never attended school	10.62
Wealth Status Index (%)	
Poorest	24.87
Poorer	21.70
Middle	19.84
Richer	18.17
Richest	15.43
Place of Residence (%)	
Urban	25.08
Rural	74.92
Marital Status (%)	
Married	75.99
Divorced	4.24
Widowed	12.83
Other	6.93

Traditionalists and apostolic women are 19 percent less likely to use this same service than those from other religious affiliations at 5 percent level of significance whilst women from polygamous households are 31 percent less likely to use the service compared to women from non polygamous households at 1 percent level of significance.

Table 2: Odds Ratios and p- values for the determinants of uptake of TT injections, Antenatal Care, Delivery at health facility and Postnatal care

Variables	TT2		ANC		Delivery at health facility		Postnatal care	
	OR	p-value	OR	p-value	OR	p-value	OR	p-value
Age	0.92**	0.038	1.12***	0.008	1.02	0.716	1.00	0.998
Age2	1.00*	0.057	0.99**	0.012	1.00	0.687	1.00	0.559
Distance								
Close	1		1		1		1	
Too far	0.99	0.903	1.13	0.27	0.80*	0.058	1.06	0.704
Wealth								
Poorest	1		1		1		1	
Poor	1.20	0.102	1.06	0.591	1.30**	0.022	1.27	0.165
Middle	1.38**	0.017	1.25*	0.092	2.01***	0.000	1.24	0.357
Richer	1.61***	0.006	1.21	0.322	2.50***	0.000	1.24	0.491
Richest	1.91***	0.006	1.84**	0.022	6.44***	0.000	0.71	0.681
Religion								
Other	1		1		1		1	
Trad/Apostolic	0.86*	0.081	0.81**	0.016	0.75***	0.007	0.89	0.433
Child wanted								
No	1		1		1		1	
Yes	1.20**	0.034	1.48***	0.000	1.33***	0.004	0.98	0.889
Residence								
Rural	1		1		1		1	
Urban	0.72*	0.075	0.78	0.219	3.49***	0.000	0.89	0.803
Education								
No education	1		1		1		1	
Primary	1.33	0.122	1.23	0.312	1.53*	0.082	0.80	0.38
Secondary	2.01***	0.000	1.83***	0.006	2.90***	0.000	1.04	0.895
Higher education	0.91	0.752	4.84***	0.003	17.7***	0.006	-	
Polygamy								
No	1		1		1		1	
Yes	0.78**	0.039	0.69***	0.004	0.65***	0.002	0.81	0.249

Information								
No access	1		1		1		1	
Less than 7 days	0.97	0.816	1.23	0.127	1.16	0.360	1.16	0.545
At least 1 week	0.91	0.497	1.49**	0.024	0.91	0.611	1.18	0.604
Everyday	1.07	0.535	1.41***	0.002	1.04	0.779	1.52**	0.05
Antenatal Care								
No	-			-	1		1	
Yes					2.13***	0.000	1.86***	0.000

***, ** and * represent 1 percent, 5 percent level of significance and 10 percent levels of significance

The odds of utilising antenatal care are 1.49 times higher amongst women who listen to radio programmes than amongst those who do not have access to the same media at 5 percent level of significance, although the odds fall to 1.41 times for those who listen every day at 1 percent significance level. Women who wanted the current pregnancy are 46 percent more likely to utilise the same service compared to those who had not wished for the pregnancy at 1 percent level of significance. There Age squared variable shows an odds ratio of 0.99 implying that the odds of women at both ends of the reproductive age spectrum utilising antenatal care are almost the same as those of women in the middle ages at the 5 percent significance level.

3.3.3 Delivery at Healthcare Facility

Education, wealth status, type of marriage, the desire for current pregnancy, place of residence, distance to the health centre, religious affiliation and antenatal care influence delivery at a healthcare facility. The odds of delivery at a healthcare facility are 17.7 and 2.9 times higher among women who attained higher education and up to secondary education respectively than among those who had no schooling at all both significant at the 1 percent level. The odds of delivery at a healthcare facility amongst women who belong to the middle, richer and richest societies are 2, 2.5 and 6.4 times higher than amongst those women from the poorest family settings all at 1 percent level of significance whilst the odds for women from the poor society utilising the same service are 1.3 times higher at the 5 percent significance level. Traditionalists and apostolic women are 25 percent less likely to use the same service than those from other religious affiliations whilst women who wanted the current pregnancy are 33 percent more likely to use the service, both significant at the 1 percent level. The odds for delivery at a healthcare facility are 3.5 times higher among women from urban areas than among their rural counterparts at 1 percent level of

significance. Women in polygamous households are 35 percent less likely to deliver at a healthcare facility compared to those from non polygamous households also at 1 percent significance level. Women who cited distance as a big problem for getting to the nearest healthcare facility are 20 percent less likely to give birth at health centers, significant at 10 percent level. The fact that a woman attended antenatal sessions has also proved to be a significant determinant of delivery at health centers. The odds for delivery at a health centre are 2.1 times higher among women who attended antenatal sessions than amongst women who did not get antenatal care at 1 percent level of significance.

3.3.4 Postnatal Care

Postnatal care has only two significant determinants. The odds of utilising postnatal care are 1.86 times higher among women who received antenatal care than among women who did not, at 1 percent significance level. The odds of utilising this same service are 1.52 times higher amongst women who have access to radio programmes on a daily basis than among women who do not have access at all significant at 5 percent level.

Goodness of fit statistics show that the estimated model was different from a constant only equation with Pseudo R- squared values of 0.05 for estimations of TT injections, postnatal care and antenatal care. Place of delivery had a pseudo R- squared value of 0.22. However, these statistics have no natural interpretation beyond informing that the model was different from a constant only model. Predictive power statistics showed that the model can correctly predict 60.69, 65.92, 74.61 and 71.23 percent for the uptake of TT injections, postnatal care, place of delivery and antenatal care respectively.

4. Discussion and Conclusion

4.1 Discussion

Generally, we found that the determinants of service utilisation are not uniform across all components of maternal health services. Hence, as adopted in other empirical studies, researchers and policy makers in Zimbabwe cannot generalise but have to be specific about the component of maternal healthcare under scrutiny (Navaneetham and Dharmalingam, 2000; Mekonnen and Mekonnen, 2002; Lubbock and Stephenson, 2008; Kistiana, 2009).

Education has been found to affect the uptake of TT injections, antenatal care and delivery at a healthcare facility albeit, differently. Different education levels actually affect the services differently except for secondary education. Higher education has a positive impact on antenatal care and delivery at a healthcare facility whilst primary education only affects delivery at a health facility. Secondary education results in substantial improvement in the uptake of TT injections, antenatal care and delivery at a healthcare facility compared to no schooling at all. In consistence with previous studies, education has a significantly strong and positive effect on the uptake of TT injections and antenatal care (Govindasamy and Ramesh, 1997; Navaneetham and Dharmalingam, 2000; Mekonnen and Mekonnen,

2002; Kistiana, 2009; McTavish et al., 2011). This clears the ambiguity on the effects of education on healthcare utilisation implied in the Grossman model. According to the Grossman model, the educated generate health at less cost than the uneducated. It is however not clear whether this should cause the educated to utilise more or less healthcare. This finding seems to suggest that since the educated generate health at less cost than the uneducated (Grossman, 2000), they have a higher incentive of utilising maternal healthcare because it is relatively cheaper for them to do so. The implication is that the less educated are less likely to take TT injections and antenatal care. Furthermore, education augments women's autonomy resulting in women developing greater confidence and capabilities to make decisions regarding their own health (Kistiana, 2009). The significant impact of education on delivery at health institutions is evidence that educated women have better knowledge and information on modern medical treatment (Kistiana, 2009). The link from education to higher utilization of health services extends to better health outcomes like lower child and maternal mortality (Boyle et al., 2006). In order to fill in the gap of education, health workers can be used to provide knowledge in villages which can be simplified even in form of pictures to those illiterate. In another study by Lubbock and Stephenson (2008) in Nicaragua, many women acknowledged that their knowledge of maternal health services came from health workers. In addition to that, Sunil et al. (2006) and Karim et al. (2010) found that higher rate of household visits by health workers were associated with improved maternal healthcare utilisation. Social groups can also be useful in promoting maternal and child health. Valadez et al. (2005) found out that with inter-organisational networking, the density of health committees and mothers' clubs associated with ANC attendance by more than three times. Electronic media is another alternative useful for educational campaigns to spread information. More interestingly, McTavish et al. (2011) noted that national policies that are able to address female literacy in Sub-Saharan Africa may help reduce income-related inequalities in maternal health care use.

Access to information has a strong significant impact on the uptake of antenatal care and postnatal care in Zimbabwe. This shows that the electronic media has a strong impact on maternal healthcare utilisation in Zimbabwe. Women without access to the electronic media are at a higher disadvantage in terms of awareness about antenatal and postnatal care. A study in Indonesia had the same findings and went on to suggest mass media campaigns to promote healthcare utilisation (Kistiana, 2009). Higher impact of the media will help complement the effects of education.

Women from apostolic households and those that believe in traditional healing are less likely to make antenatal visits and deliver healthcare facilities than women from other religious affiliations. This shows that religious affiliation is a strong and significant source of exclusion from antenatal care and delivery at healthcare facilities. The exclusion of women affiliated to apostolic sects and traditional practice from antenatal care and delivery services has also been documented elsewhere. Stephenson et al. (2006) found non Catholic women less likely to use maternal healthcare in Ghana, whilst Catholic women were less likely to utilise maternal healthcare in Kenya when compared to Protestants. In Zimbabwe, women affiliated to apostolic sects do not take medical services because they believe in

faith healing and they prefer traditional midwives. Traditionalists do not believe in modern day medicine and they prefer cleansing and traditional herbs. This was also found by Lubbock and Stephenson (2008) and since the problem is community held beliefs, health workers would be more useful as they were found to have significant influence in the same literature.

Polygamy also negatively influences uptake of both antenatal care and TT injections. The reason could be that there would be a number of women relying on one husband for money to travel to healthcare facilities and to pay for healthcare services. In addition to that, polygamy is mostly practised by apostolic sects who believe in spiritual healing. Stephenson et al.'s (2006) had a similar finding whereby women in polygamy were less likely to deliver in healthcare facilities. This is related to findings by Lubbock and Stephenson (2008) in Nicaragua that individual and community knowledge, and the degree of communication with other women affects women's decisions to seek care. Stories about successful pregnancies and deliveries with little or no complications can influence non seeking behaviour. Health workers in this case will be very helpful as they were also found to have an impact towards seeking care Lubbock and Stephenson (2008).

The positive impact that wealth exerts on the uptake of place of delivery, TT injections and antenatal care implies that the poor are excluded from benefiting from these services. This finding is in consistence with Castro- Leal et al.,'s (2000) finding that even public health expenditures meant to help the poor end up benefiting the rich. Some poor women are excluded from maternal healthcare utilisation because they are poor. This is possibly because there are implicit costs of healthcare besides the fee charged for the actual maternal healthcare service. These include transport, opportunity cost of waiting and information costs. This finding is also in consistence with other previous literature by Agboolah (2009) and Lubbock and Stephenson (2008). Brazier et al. (2009) suggested the upgrading of maternity services at primary care facilities to improve poor women's access to maternal healthcare utilization. This was after their study in Burkina Faso showed overall increase in maternal healthcare utilization at upgraded facilities when compared to the current conventional primary care facilities.

A wanted pregnancy is positively and significantly related to uptake of TT injections, delivery at health centre and antenatal care. Previous studies document that a pregnancy that is mistimed or not wanted leads to non utilisation of maternal healthcare (Magadi et al., 1999). There is still need however, to find out the women who get unwanted pregnancies mostly. If they are teenagers, they will be afraid of revealing that they are pregnant. They will be left out on maternal healthcare utilisation because of fear. Infact, it has been found that teenagers are less likely to receive adequate antenatal care and have non-professional deliveries compared to older women (Magadi et al., 2007).

Women residing in rural areas are less likely to deliver at healthcare facilities than their urban counterparts. This finding is not in consistence with findings in Ethiopia by Mekonnen and Mekonnen (2002). As Mekonnen and Mekonnen (2002) explained, most women in urban areas of sub-Saharan countries have increased knowledge and have more access to maternal health services compared with their rural counterparts. Most mass media

programmes to encourage healthcare utilisation reach to the urban population more than in rural areas whilst traditionalists and apostolic sects who do not use modern healthcare consist of a significant population in rural areas than in urban areas. This finding could also be a revelation of the challenges that women in sub- Saharan rural areas face with ambulance and other emergence transportation. Most rural areas do not have effective ambulances compared with urban areas which have private ambulances supplementing municipal and government vehicles. In other cases, the rural district hospital ambulances have challenges in terms of poor road infrastructure which means delayed or slow response to those who call for the services.

The cost variable on its own was found to be an insignificant source of exclusion for all components under study. Advocates of cost recovery schemes argue that charging healthcare service drives the rich to private hospitals leaving public healthcare facilities for the poor. Our finding that cost is not a source of exclusion in Zimbabwe is not surprising. Most hospitals in Zimbabwe are government run. The services that they offer are highly subsidized to the extent that costs cannot be expected to prohibit maternal healthcare utilisation. It has also been found that the distance to a health facility is not a significant determinant of antenatal care, TT injections uptake and postnatal care. This appears to validate the Zimbabwean government's claim that it has eliminated the problem of distance to a nearest health facility.

The data used has several strengths. The Zimbabwe Demographic Health Survey has a large sample size and the survey's structure is almost standard across a range of countries. The sample size and thorough methods of data collection ensure fewer inconsistent or unknown values. The data however could have been more useful to this study had some particular information been collected in quantitative form. Examples are distance to the nearest health facility, cost of transport and cost of health services. Large scale surveys like the ZDHS are expensive and as a consequence, they are only conducted periodically. Although the 2005- 6 ZDHS is the most recent at the time of writing, the information provided might not reflect the current situation and practices. The dataset had major issues with missing data. STATA dropped at least half of the total respondents due to some missing data as a result of people who refused to participate and unanswered. Missing data results in biased findings if the people for whom data is missing are systematically different. In addition to that, there may be inefficient statistical estimates due to the loss of information. Furthermore, missing data can result in increased analytic complexity as analysts use statistical procedures to fill in the missing data. However, the dataset was very large such that even after dropping half the dataset, the remainder was still large enough to ensure reduced bias and there was not a need to manipulate data to fill in missing data. Surveys rely on a self-report method of data collection. Inaccuracies can come up as a result of intentional deception, poor memory, or misunderstanding of questions. Furthermore, this method is descriptive, not explanatory, and, therefore, cannot offer any insights into cause-and-effect relationships.

We can thus conclude that the major determinants of maternal healthcare utilisation in Zimbabwe are cultural, demographic and socioeconomic in nature. This justifies the

use of demographic and sociocultural factors to model healthcare utilisation in developing countries. Different components of maternal healthcare, however, seem to be affected by sociocultural and demographic factors differently. Factors that affect antenatal care, uptake of TT injections and postnatal care are not necessarily the same and also differ in terms of significance.

However, as argued by Mekonnen and Mekonnen (2002), Peabody et al. (2006) and Hulton et al. (2007), service-related factors are also important determinants of exclusion and need investigation. Future research can explore the impact of the providers' characteristics on utilisation of maternal health services. Elements like quality of care, type of provider, actual distance and attitude of staff still need to be explored. Quality of care has in fact been found positively related to higher health outcomes elsewhere (Peabody et al., 2006). Quality of health institutions in India was found to be compromised by essential drug shortages, women being left unsupported, physical and verbal abuse, and births occurring in hospitals without a health professional in attendance, problems also prevalent in Zimbabwe (Hulton et al., 2007).

The impact of maternal childhood on maternal healthcare utilisation might also be explored since it has been found that maternal childhood has an impact on child health outcomes (Gisselmann, 2006). In addition to that, urban migration experience and social ties to urban and international migrants found to lower the barriers to maternal healthcare utilization in Guatemala also need to be investigated for Zimbabwe in future research (Lindstrom and Muñoz-Franco, 2006). Due to high unemployment, a lot of potential workforce has migrated to Europe and neighbouring countries. They support their relatives back home financially which might have an influence in access to healthcare.

Studies on maternal and child healthcare have been found to have implications for other reproductive health services. Seiber et al. (2005) found the intensity of maternal and child healthcare utilization positively associated with subsequent contraceptive use among in Guatemala. This implies that findings in this study can also be used to for policy purposes on other reproductive health services where research is scarce or out dated. More importantly, attention to these findings improves maternity utilization with ripple effects to maternal and infant mortality reduction as noted by Onah et al. (2006).

4.2 Conclusion

The major objective of this study was to find out the determinants of different maternal healthcare services. In particular, there was an attempt to find out how determinants of maternal healthcare utilisation interplay. In addition to that, by comparing the determinants of different components of maternal healthcare, there was also an effort to find out if the study of one component can be used to make conclusions about all maternal healthcare services.

The determinants of utilisation influence the uptake of different maternal healthcare services differently. This means that policy makers have to be careful in terms of structuring strategies to improve utilisation. A strategy that might improve antenatal care utilisation

will not necessarily have a significant impact on postnatal care. Variables that policy makers have to pay attention in developing countries include education, wealth status, preference of the pregnancy, religious affiliation, polygamy, place of residence, access to information and age.

A number of policies can be recommended from these findings. Firstly, in order to improve maternal and child health, there is a need for targeting a particular service and develop strategies particularly for that service instead of an umbrella strategy for all maternal health services. Uneducated women are less likely to use both antenatal care and TT injections. Making secondary education universal in Zimbabwe might solve this issue albeit in the long run. Health workers can be used in maternal health awareness programmes which are more useful and realistic in the short run. In particular, policy makers should use the electronic and mass media to communicate and spread awareness. These can help fill the void of formal education lacking in some sections of the population. This method can also be used to influence decisions in cases where the pregnancy is mistimed or unwanted and also to change attitudes in the case of sociocultural factors like polygamy and religious affiliation. Lastly, the government can improve delivery at healthcare facilities by addressing challenges of road infrastructure and find out ways for increasing emergency medical transportation in rural areas like engaging private ambulance services.

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Appendix

Table A1: Odds Ratios and Cluster adjusted 95% Confidence intervals for the determinants of uptake of TT injections, Antenatal Care, Delivery at health facility and Postnatal care

Variables	TT2	ANC	Delivery at health facility	Postnatal care
Age	0.92 [0.84- 0.99]	1.12 [1.03- 1.22]	-	-
Age2	1.00 [0.99- 1.00]	0.99 [0.99- 1.00]	-	-
Distance				
Close	-	-	1	-
Too far			0.80 [0.64- 1.01]	
Wealth				
Poorest	1	1	1	-
Poor			1.30 [1.04- 1.63]	
Middle	1.38 [1.06- 1.80]		2.01 [1.54- 2.62]	
Richer	1.61 [1.14- 2.26]		2.50 [1.71- 3.65]	
Richest	1.91 [1.20- 3.05]	1.84 [1.09- 3.09]	6.44 [2.81- 14.8]	
Religion				
Other	-	1	1	-
Trad/Apostolic		0.81 [0.68- 0.96]	0.75 [0.61- 0.92]	
Child wanted				
No	1	1	1	-
Yes	1.20 [1.01- 1.42]	1.48 [1.24- 1.76]	1.33 [1.1- 1.61]	
Residence				
Rural	-	-	1	-
Urban			3.49 [2.09- 5.83]	
Education				
No education	1	1	1	-
Primary				
Secondary	2.01 [1.37- 2.96]	1.83 [1.19- 2.82]	2.90 [1.76- 4.77]	
Higher education		4.84 [1.72- 13.6]	17.7 [2.3- 139.2]	
Polygamy				
No	1	1	1	-
Yes	0.78 [0.61- 0.99]	0.69 [0.53- 0.88]	0.65 [0.49- 0.85]	

Information				
No access	-	1	-	1
Less than 7 days				
At least 1 week		1.49 [1.05- 2.1]		
Everyday		1.41 [1.14- 1.76]		1.52 [1.0- 2.3]
Antenatal Care				
No	-	-	1	1
Yes			2.13 [1.76- 2.59]	1.86 [1.41- 2.45]

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