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EDITORIAL

Dear readers!

The recent issue of the journal is devoted to several risk governance issues.

Jason Kasozi presents the conflicting ideologies about the decision-making process for business expansion into Africa and suggests ways of improving the process.

Mihoko Sakurai, Jiro Kokuryo survey the municipal government ICT divisions during and after the 2011 Great East Japan Earthquake and Tsunami crisis which reveals the need for creative responses for "beyond assumed level" disasters. Complexity and diversity of the damage were simply too great for any plans to assume. Resident needs toward the municipal governments were also diverse and changed quickly as the time went by. The research also indicates that there would be ways to strengthen the capabilities to execute such spontaneous responses.

Maria Carapeto, Mauricio Acosta estimate the benefits from adopting close-out netting to decrease the exposure to counterparty risk across the world markets and to establish the additional benefits from central counterparties towards decreasing counterparty risk. The novelty of the approach is to estimate a figure for counterparty credit risk (CCR) grouping together most of the financial transactions that generate counterparty risk and to analyze the benefit of netting possibilities in reducing the overall risk exposure, using three different scenarios.

F.Y. Jordaan, J.H. Van Rooyen attempt to explain the source of risk management and diversification benefits that investors may gain from the South African Rand Currency Index (RAIN) as it relates to an equity portfolio with stock market exposure (locally or international). These diversification benefits may result from the negative correlation between RAIN and the South African All Share Index (ALSI).

Mediha Mezhoud, Adel Boubaker provide an analysis of the interaction effects between internal governance mechanisms on the components of initial returns during the listing period. The application of multivariate regressions on a sample of 110 IPO French companies during 2005-2010, has allowed to conclude that the different interactions between these mechanisms significantly influence the level of under / overpricing. Indeed, the positive relationship between internal governance mechanisms and overpricing reflects a substitutability relationship.

Alexandra Ryan Ahmad Dina, Ancella Anitawati Hermawan examine the effect of bank monitoring as an alternative of corporate governance mechanisms on the borrowers' firm value. The strengths of bank monitoring on the borrowers are measured based on the magnitude of the bank loan, the size of the loan from banks with high monitoring quality, the length of a bank loan outstanding period, and the number of lenders. The research hypotheses were tested using multiple regression model with a sample of 230 companies listed in Indonesia Stock Exchange during 2009. The empirical results show that only the size of the loan from banks with high monitoring quality and the number of lenders significantly influences the borrowers' firm value.

We hope that you will enjoy reading the journal and in future we will receive new papers, outlining the most important issues in the field of risk governance and best practices of corporate governance!

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across different jurisdictions should be encouraged. Moreover, results show that the use of central counterparties for settling the outstanding contracts would additionally decrease CCR by over $2 trillion.

EVALUATING THE INVESTMENT DECISION-MAKING PROCESS FOR BUSINESS EXPANSION INTO AFRICA: A CASE STUDY

Jason Kasozi*

Abstract

Africa is a potential domain for international business. However, numerous uncertainties characterize this environment and the challenge for multinationals remains the ability to assess the true value of an Africa-bound investment project. A telecommunications' survey was conducted on Siemens Southern Africa (Siemens) and Mobile Telecommunications' Network (MTN) and the following observations were made: (1) Approaches used by the businesses to value Africa-bound investments were not comprehensive and inclusive. (2) Neutrality existed to the suggestion that Africa is unique and that investment decisions should be customized to suit it. (3) Certain approaches used by the businesses were modified to suit pertaining investment circumstances thereby differing from literature, and (4), participants desired to learn new ways of improving this process suggesting dissatisfaction with the current norm. This paper presents the conflicting ideologies about the decision-making process for business expansion into Africa and suggests ways of improving the process.

Keywords: Investment decision-making, uncertainty, investment appraisal, multi-criteria decision making

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1 Introduction and Background

Multinationals are constantly confronted with decisions that have to be made under different degrees of uncertainty. Managing a company is primarily about managing these uncertainties and understanding the relationship between the existing risks and the opportunities (Olafsson, 2003). Investing in Africa today poses an even greater challenge for companies assessing the true value of an investment due to the numerous socio-political, cultural and technological influences that make this continent unique.

The African market lies at the helm of the economic development process. Factors like liberalization of trade, the rising number of developing countries, a growing trend in technological change, and a fall in trade barriers are a few of the drivers quickly changing this economic landscape. According to the United Nations Conference on Trade and Development (UNCTAD), recent trends in inflows of foreign direct investment (FDI) indicate a rise of up to $55million in revenues, with about 30% contributed by northern Africa, 27.5% by South Africa and the rest, to other regions in Africa (World investment report 2011 by UNCTAD).

Africa-bound multinationals face the challenge of determining whether their current concepts, strategies and approaches for valuing investments, apply to this market without a need for customization. There is insufficient evidence to suggest that such companies are critically evaluating these investments in light of the various unpredictable circumstances facing Africa (Johnson and Turner, 2003). In other cases, this information is kept as "classified" by companies due to the rigorous process of lobbying and meeting compliance requirements, negotiated with the governments in question. However, a growing demand exists to establish the effectiveness of tailored approaches as opposed to standard methods in making expansion decisions.

The inevitable uncertainties associated with investing in Africa are better managed with flexibility rather than fixed scenario expectations. Fixed scenario expectations are usually guided by standardized approaches that ignore certain variables from analysis, which could undermine the true value of a given investment. For instance, investment decisions as cited from literature are consistent with the principle of modern financial theory which states that only those investments that have a positive net present value (NPV) should be funded (Slater and Zwirlein, 1996). According to Zopounidis and Doumpos, (2002), such evaluation tends to ignore important qualitative variables from analysis suggesting that the

conventional NPV criterion fails to capture investment flexibility if it is not customized to account for extraneous variables.

Comprehensive investment decision-making processes in any company determine how accurately a project is evaluated and ultimately, how successful it turns out. Day-to-day decision-making and investment decision-making processes should follow an almost similar pattern with a few exceptions. This is because implementing a company's strategic plan closely relates to implementing a given project although one normally precedes the other.

Thompson and Strickland, (1998), assert that every manager has a role to play in the process of implementing and executing the firm's strategic plan, which ultimately constitutes making investment decisions at some point. Due to insufficient knowledge on investment decision-making for Africa, this paper attempts to explore, extend and hopefully improve on the process.

First, it is important to highlight the inconsistencies associated with the various investment decision-making tools and approaches. The study will then suggest a framework necessary to favor a more accurate investment appraisal process.

This article is organized as follows: this section reviews the relevant literature and proposes a framework to guide investment decisions for Africa; section 2 presents the problem and objectives of the study, section 3 presents the methodology, while the last two sections present the findings and implications for the study respectively.

1.1 Investment Appraisal for Multinationals

The decision to invest abroad is often based on strategic, economic, or behavioral motives. Defensive or aggressive actions are usually taken to strengthen the firm's position (Demirag and Goddard, 1994). The underlying benchmark to such a decision however, should be to determine whether the considered investment will add a value that exceeds the costs and implied risks incurred in implementing it. Although some decisions are taken for non financial reasons, the financial viability of a foreign investment is designed to ensure that the multinational can survive and grow in the long run (Demirag and Goddard, 1994).

Investment decision-makers are provided with various tools with which to value and choose between mutually exclusive foreign investments. A review of these tools cites major practical inconsistencies with their application for investment appraisal mainly due to the rigidity with which they are applied in practice.

1.2 Common Investment Appraisal Methods

Investment appraisal decisions in practice range from those largely subjective, to those based on sophisticated mathematical models (Demirag and Goddard, 1994). An assessment of the most commonly used investment appraisal techniques (i.e. accounting rate of return, the payback period, internal rate of return and net present value), indicates practical inconsistencies with their use especially under conditions of uncertainty.

The accounting rate of return (ARR), which represents the ratio of an investment's average after-tax profits to the amount initially invested into a given project, uses available accounting data and is simple to administer. However, because it uses accounting profits and not incremental cash flows which normally characterize investments of this nature, it ignores the time value of money principle, a critical factor in the investment evaluation process. Similarly, it fails to account for the size of projects when alternatives have to be considered (Atril and McLaney, 2011).

The payback period (PB) method measures the time taken to recover the initial amount invested into a project. The calculated payback period should be less than the maximum acceptable payback period for a project to be considered. It is commonly used by large firms to value small projects due to its computational simplicity and intuitive appeal. It also measures the level of risk exposure because of its consideration to the timing of cash flows (Arnold, 2008; Gitman, 2009). A study by Grinyer & Green, (2003), found the use of PB, instead of NPV, motivating to risk-averse managers who then, by default, adopt more positive NPV projects, so that the appropriate use of PB results in more wealth for shareholders than would occur using NPV directly. However, this approach is considered inferior to NPV because it is not based on discounted cash flows.

Internal rate of return (IRR) like NPV is a discounted cash flow technique that takes into account the time value of money. It is a percentage measure, unlike NPV, which measures the absolute financial benefit of a project (Arnold, 2008). It's regarded inferior to the NPV because it incorrectly assumes that generated cash flows are reinvested at the IRR rate and may conflict with the NPV when competing projects of differing size or time horizons are considered (Gitman, 2009; Atril and McLaney, 2011).

NPV is the most popular capital budgeting technique found by subtracting a project's initial investment from the present value of its cash inflows discounted at a rate equal to the firms cost of capital (Gitman, 2009). Theoretically, all projects with a net present value greater than zero should be accepted. However, as literature suggests, not all-positive NPV projects are acceptable due to capital rationing. Based on certain criteria, projects with low negative or zero NPV could also be considered if the investment

climate is positive over the long run. Studies by Olafsson, (2003), recommend the inclusion of management options into the project valuation process. Such options when considered have an impact on the resulting NPV value and influence management's initial decision to accept or reject a project. Analysis also indicates that a manager at a typical company, who receives equity-based compensation, is likely to favor projects that lower the firm's risk, thereby undertaking such projects even if they have negative NPV and ignore some high-risk projects that have a positive NPV (Parrino, Poteshman, and Weisbach, 2005).

What makes discounted cash flow methods like NPV so popular to the valuation process? First, the NPV criterion of valuation is based on a decision analysis approach, a straightforward way of determining the value of a project based on the information available to the decision-maker. It is considered the only approach that is consistent with the firm's objective of maximizing shareholder wealth.

The advantage in NPV valuation lies in its ability to incorporate a risk-adjusted discount rate which can be used as a benchmark for evaluating acceptable projects. This traditional approach to NPV valuation is administratively simple because risk factors can easily be factored into the analysis to raise or lower the hurdle rate. This paves way for a more accurate appraisal process if such factors can be accurately quantified. NPV evaluation also accurately isolates as good, those projects whose expected cash inflows occur in the earlier stages of the investment, from those that occur later during the investment horizon (Brigham and Daves, 2010).

The first major inconsistency with the NPV method lies with its inability to accurately estimate the appropriate discount rate since the latter depends on unstable macro and firm specific factors that cannot be exhaustively and accurately quantified in the valuation process. Secondly, NPV valuation tends to ignore the "strategic" value of a risky investment and helps little in evaluating complex or strategic investments. NPV's limited timeline for accurate valuation (5 to 10 years) makes it inadequate in evaluating the additional value that can result from a project due to prospects of future growth and other managerial flexibilities, that may interact with future uncertainties (Ho and Liu, 2003; Arnold, 2008). Such uncertainties include among others, options to expand or contract a project, the sunk and/or opportunity costs to consider in this regard, and options to delay, hold, or speed up an investment (real options). Thirdly, NPV is not commonly used in production and inventory decisions where the dominant methodologies are long run average cost and total cost without discounting. According to Sun and Queyanne, (2002), the economic order quantity (EOQ) model is commonly used here because of its implicit consideration to cost.

In other related studies done to determine whether NPV maximizes shareholder wealth, Berkovitch and Israel (2004), concluded that whereas the NPV provides a measure by which prospective projects may add value to the firm, other informational and agency considerations prevent it from guiding the implementation of an optimal capital budgeting outcome. They explained that if a manager of a subsidiary were faced with two mutually exclusive projects with positive NPV, a possibility exists that the manager could choose the project that requires a higher initial investment without regard to its NPV. Such a choice could be inconsistent with the company's primary goal of maximizing wealth, but consistent with considerations of the subsidiary's operating environment. Ultimately, the effectiveness of the NPV in guiding the valuation process would be flawed. Against such backdrop, numerous theories and models have been developed to both facilitate the NPV valuation criterion and to substantiate the investment valuation process as a whole.

1.3 Current Trends in Project Appraisal

New trends in corporate planning are designed to exploit the aspect of environmental uncertainty since the latter is a major factor affecting the accuracy of most investment valuation techniques (Zopounidis and Doumpos, 2002). During times of high uncertainty, Park and Herath (2000) identified three competing methodologies that apply to project valuation. These include;

(1) decision analysis, a straightforward approach of laying down future decisions and sources of uncertainty, in a decision-tree format. The technique is designed to calculate the value of a project by taking into account the amount of information available at one's disposal. The risk attitude of a particular decision-maker may also be quantified through his/her subjective utility function (Park and Herath, 2000). The investment alternative with the highest expected utility is chosen based on a given criterion. Decision analysis complements NPV valuation by identifying critical variables that affect the determination of the hurdle rate (discount rate) used in the valuation formula. Unfortunately, these variables are hard to quantify and may not remain stable over the investment horizon.

(2) capital asset pricing model (CAPM) which adopts the perspective of investors in the market and measures investments based on their value to the market or their contribution to investor's wealth. A market risk premium is added to the risk-free interest rate of a particular market to determine the risk-adjusted rate, which is then used as the discounting rate for the expected future cash inflows. This risk-adjusted discount rate (RADR) captures the risk attitude of the market according to Park and Herath, (2000), and becomes an essential input to the NPV formula or the valuation process in entirety. The

CAPM is essential to the determination of a discount rate because it implicitly considers both systematic and unsystematic risk factors. It paints a clearer picture on the level of uncertainly to be considered in the valuation process. However, it is based on a variety of impractical assumptions that render the calculated rate of return unrealistic and inaccurate. These include, among others, the assumption that capital markets are highly efficient and that investor information is equally distributed. Therefore, it has suitably been used to value security investments and not investments of a strategic nature that require a lot of strategic or resource input. Reilly and Brown (2003) suggested the use of the arbitrage-pricing model (APT) as a more appropriate method for valuing an investment due of its consideration of multiple risk factors and comparably fewer derivation assumptions.

(3) Real option analysis is a recent and more advanced approach to project valuation which is based on the opportunity to make decisions after a firm has assessed how events in its environment unfold. Cash flows from a completed project are used to estimate the value of an expected project with consideration to other extraneous variables existing at the time. The results are then inputted into the option valuation process following a probability analysis to account for uncertainty. The advantage of this method over the CAPM and NPV is inherent in its flexibility to change the course, pace or use of the project in future if events unfold in an unexpected way (Arnold, 2008).

By definition, real option analysis is a new way of thinking about corporate investment decisions in which the decision to invest or divest is simply an option which gives the holder the right to make an investment without the obligation to act on it. It provides executives with the ability to react to new circumstances that could greatly influence their initial investment decisions for better. The presence of real options enhances the worth of an investment so that these options become the sum of the NPV and the value of the real option to consider. The greater the number of options and the greater the uncertainty surrounding their use, the greater the project is worth (Arnold, 2008).

Another trend in the decision-making process was developed by Zopounidis and Doumpos (2002), in which they suggested a multi-criteria approach to decision making. This new approach provides decision-makers with the ability to view financial decision problems through an integrated and realistic approach based on sophisticated quantitative analysis techniques like; stochastic processes, Monte Carlo simulation and multi-criteria decision analysis (MCDA). The development of MCDA is based on the finding that a single objective, goal, or criterion is rarely used to make real-world decisions. Several valuation techniques lend themselves to a single objective and usually ignore multiple conflicting decision factors. The MCDA approach, according to them identifies the existence of multiple criteria, conflicting situations between criteria, and the complex subjective nature of the evaluation process, becoming an invaluable tool for complex investment decision-making. Most recent approaches to project valuation lend themselves to variations of the above-mentioned approaches and include works by, Munoz, Contreras, Caamano and Correia, (2011) and Xu, (2011). However, such evaluation approaches are regarded complex for most investment decision-makers and may not apply appropriately for Africa.

Current trends on project expansion into Africa should focus on identifying, quantifying and devising means to minimize environmental and other constraints in order to increase investment certainty. Factors which hinder business expansion into Africa (growth factors), and those that hinder the successful entry into foreign markets (international marketing factors), should be considered. This study proposes a scenario-sensitive approach to valuing investments for Africa.

1.4 The Proposed Conceptual Framework

This framework is based on the premise that the marketing and orientation strategy chosen by the company as a model for expansion has implications on the uncertainties the company will have to consider when evaluating an investment. The study identifies typical expansion scenarios for any multinational planning to expand into Africa. These are adapted from Igor Ansoff's product-market growth model (Ansoff and Antoniou, 2005), as depicted in the table below.

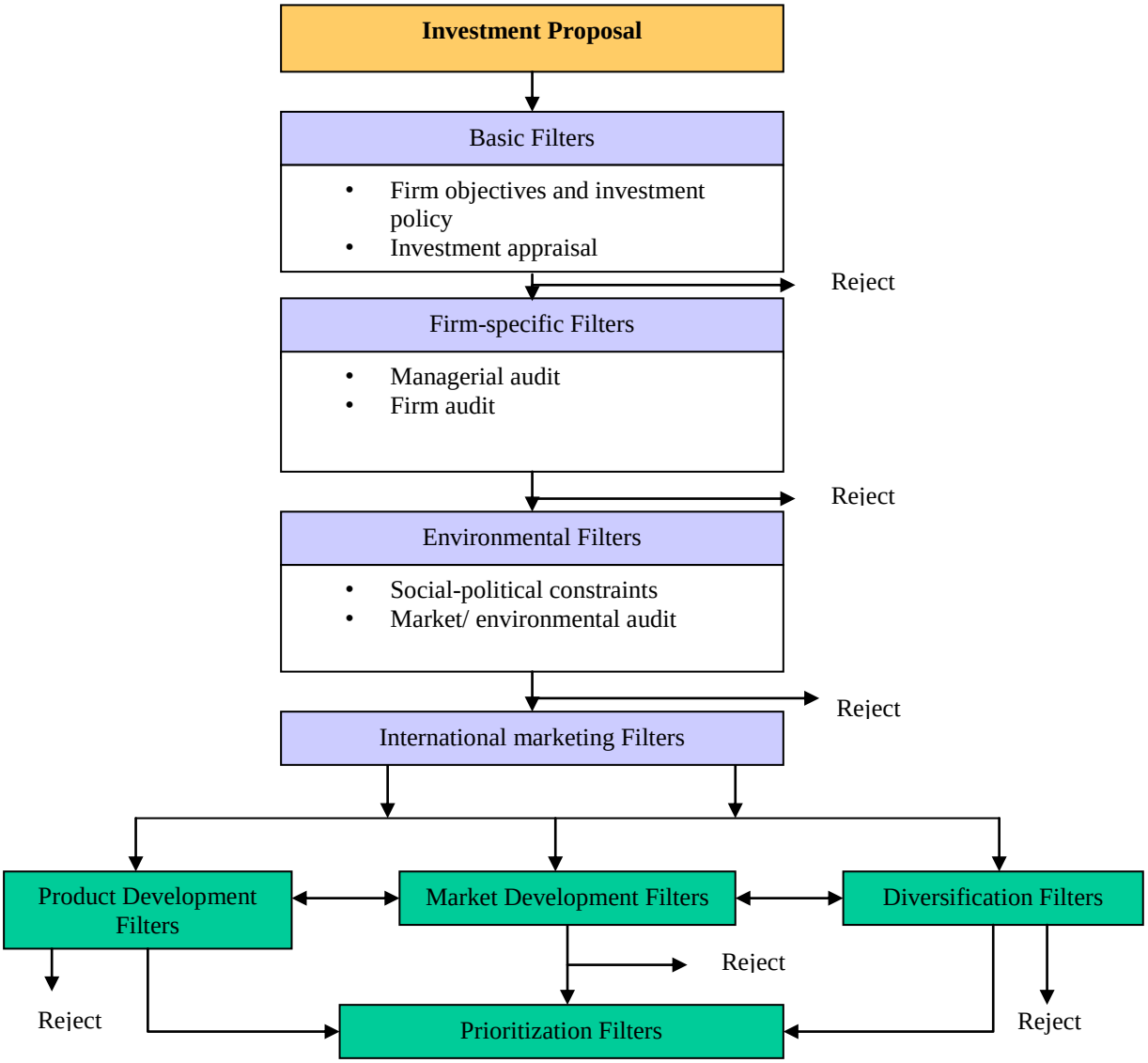
Table 1. Ansoff's growth model

PRODUCT / *MARKET*	**PRESENT**	**NEW**
PRESENT	Market penetration	Product development
NEW	Market development	Diversification

Source: Adapted from Ansoff, H. and Antoniou, P. 2005

Depending on the market orientation of a company, implications for the strategy chosen and the inherent risk characteristics differ among the three scenarios above. For example, introducing a new product into an existing market (product development) could include among others, numerous cost-constraints or risks from the time ideas are generated up until the rollout phase. Developing a new market segment for an existing product (market development) entails extensive promotional costs and uncertainties associated with the market audit process. Diversification, on the other hand, is a high-risk strategy because it involves high costs associated with both product and market developments (Onkvisit and Shaw, 2004).

Figure 1. Framework to guide investment decisions for expansion into Africa



Within the context described above, the basic approach of applying the framework in the diagram below is to subject a typical investment proposal to various investment evaluation filters, designed in a top-down fashion, with evaluation approaches increasing in complexity. Each filter acts as a benchmark above which the proposal can be considered acceptable and below which it should be rejected. The basic filters at the top of the structure deal with first steps in the investment evaluation process and include variables that assess an investment based on the firm's investment policy and mission statement. Valuation techniques like NPV, IRR and PB are applied at this stage if sufficient knowledge on the project's expected cash inflows is available to support such valuation. Normally, at this stage the expected cash inflows won't be estimated with absolute certainty. For all investments this step is essential since it qualifies the project's minimum requirements for shareholder wealth maximization.

Proposals which meet this minimum criterion are subjected to a more critical evaluation that involves an assessment of firm and environmental-specific constraints that could further affect the investment. A

more detailed financial appraisal approach using the option analysis criterion is done at this stage. Qualifying proposals are then further assessed through international marketing filters, which are to a large extent, scenario biased. It is at this stage that the organization should prioritize proposals based on the available funds.

A scenario-sensitive approach to decision-making has four advantages. First, at every evaluation level, a proposal may be qualified or disqualified based on whether it meets the stipulated minimum requirements. Secondly, depending on the chosen mode of expansion, every investment should be evaluated based on that scenario for expansion and the uncertainties to consider therein, since proposals will differ significantly across scenarios. Thirdly, for refinement purposes, risk factors based on both social-political and marketing constraints can be assigned to every project under valuation so that the latter can be assessed based on a cumulative score - and a decision made based on that. The company may have a minimum benchmark score above which the project can be considered for funding. Lastly, the model helps eliminate in-depth quantitative analysis whose level of accuracy could be low. A typical manager can subjectively disqualify a given investment for failure to satisfy a given qualitative criterion without having to go through the whole process of variable quantification.

For example, in any entity, projects that do not comply with the mission and values of the business should be eliminated without the need to quantify them. Figure 1 represents a summarized schematic of the proposed framework.

2 Problem Statement

Today, the Chief Financial Officer (CFO) of a typical multinational firm is faced with the task of choosing from a multitude of investment proposals, feasible and value-adding projects to consider for funding. This challenge is compounded by the fact that the company may not have in place an appropriate framework with which to evaluate such proposals especially if they pertain to expansion across domestic boundaries. Efficient financing decisions and the complexity of the financial decision-making process become necessary.
Common appraisal techniques are based on the assumption that the considered proposal is well formulated regarding the realities involved. There techniques consider a single objective, evaluation criterion, or point of view that underlies the conducted analysis (the mono criteria paradigm). In such cases, financing solutions are easily obtainable.

In reality, however, such proposals are founded on different, often-conflicting decision factors (objectives, goals and criteria), which have to be considered simultaneously. These numerous uncertainties cloud the viability of investments into Africa today making it increasingly impossible for multinationals to accurately estimate the true value of an investment proposal, with the result that some initially promising projects tend to fail. This requires financial managers to make capital budgeting and financing decisions through an integrated and realistic approach in order to choose investments that add shareholder value in the long run. Frameworks that guide complex decision-making have to be developed to assist managers with this task.

2.1 Objectives of the Study

2.1.1 Primary Objective

The primary objective of this study was to evaluate the investment decision-making process for companies expanding into the African market.

2.1.2 Secondary objectives

To help achieve the primary objective, the secondary objectives of the study were:

1. To provide a literature overview of the investment decision-making framework for business expansion into the African market.

2. To determine the level at which companies expanding into Africa are incorporating these investment decision-making requirements suggested by literature.

3. To develop new concepts or theoretical perspectives to serve as a point of departure for further research.

3 Methodology

An empirical study was conducted on the investment decision-making executive of Siemens Southern Africa (Siemens) and Mobile Telecommunications Network (MTN) - both telecommunication companies resident in South Africa, but with several interests within Africa. A total of 60 questionnaires designed using a five-point Likert scale were administered to a projected target sample of 60 respondents, 30 from each company. The choice of the sample of respondents was done purposively to identify members who form part of the investment decision-making executive of the businesses. To ensure this, the CFO of each company was requested to distribute the questionnaires to members who constitute the investment decision-making executive of his company.

The questionnaire containing 28 questions including biographic data, had questions based on the literature-developed financial decision-making framework for business expansion. It was then divided into four broadly defined analytical components; structure, process, tools and perceived level of satisfaction, with questions ranging from, among

others; the perceived composition of the investment decision-making executive, the required level of interdepartmental involvement, the sequence and complexity of tools and/or approaches to apply, the duration required for the decision-making process, the uniqueness of the African market and the level of satisfaction towards the current approaches adopted by the business.

Results highlighting key variations in the investment decision-making process were then analyzed and represented using frequency distribution graphs and pie charts to assess the general trend in the investment decision-making process. Using the Statistical Analysis Software (SAS) package and Pivot tables from Microsoft excel, mean scores on these components were determined together with their measures of relative spread (standard deviation scores) to assess the respondents' perceived degree of opinion regarding the investment decision-making process of their business.

A decision-support scale designed to mirror the 1 to 5 point Likert scale was used to categorize mean and standard deviation scores per question into zones of framework support (4 to 5), indecision (2-4) and zones of framework rejection (0-2). The data on the responses was coded and tested for reliability and validity before analysis was done. It was then assumed that the distribution of respondents and responses followed a normal distribution pattern so that decisions made by the companies to invest into Africa followed a normal distribution pattern. This enabled the researcher to make inference based on average and standard deviation measures and to extrapolate the findings to depict a general trend in the investment decision-making process for multinationals in the telecommunications' industry, currently expanding into Africa. The decision-support tool used to categorize the findings is depicted in the table below:

Table 2. The decision support tool

1 **STRONGLY DISAGREE**	**2** **DISAGREE**	**3** **NEITHER AGREE NOR DISAGREE**	**4** **AGREE**	**5** **STRONGLY AGREE**

ZONE OF FRAMEWORK REJECTION	**ZONE OF FRAMEWORK INDECISION**	**ZONE OF FRAMEWORK SUPPORT**

4 Results

The target sample of respondents (60) comprising the investment decision-making executive of the businesses, provided a response level of 44 fully answered questionnaires (25 from Siemens and 19 from MTN), representing about 73% of the total sample targeted. 36% of these were female while 73% belonged to the finance department. Senior management, management and executive positions accounted for 86% of the respondents. 83% of the respondents had participated in the investment decision-making process of their business. An analysis of the various components under study indicated the following:

4.1 Structure

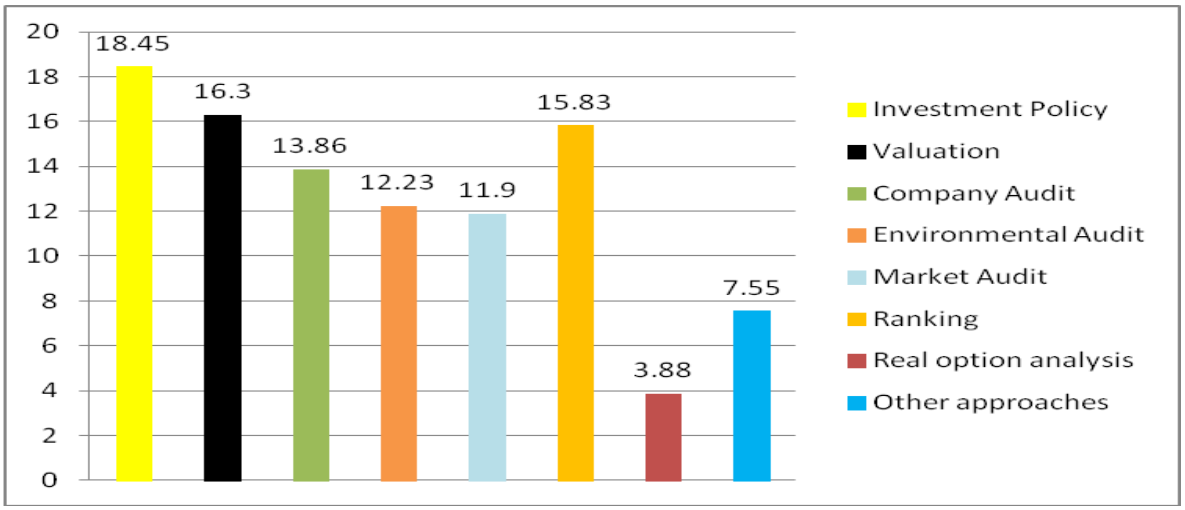
Selected questions from the questionnaire were used to assess this analytical component and to identify; what respondents perceive as the optimal composition of the investment decision-making executive, the perceived level of interdepartmental involvement necessary and whether or not decision-making for Africa should be left exclusively to the finance department. The majority of respondents were uncertain or disagreed that top management should be responsible for identifying and appraising investment opportunities for their business (2.86 average on the rating scale). However the majority believed that this task should be left to the finance department (4.09 average on the rating scale). The spread in either of these cases was minimal (0.69 and 0.89 respectively), indicating a level of accuracy. A majority of respondents (4.27 average on the rating scale with a spread of 0.22), acknowledged the need to adopt projects that offer a return higher than their company's adjusted weighted average cost of capital (WACC). This suggests a high level of financial knowledge when making investment decisions in general. However, there was neutrality on interdepartmental involvement.

4.2 Process

This component assessed the perceived level of complexity or "depth" typical of any investment decision-making process in terms of approaches, tools and the time-frame required to complete an accurate evaluation for an Africa-bound investment proposal. Results indicated a high level of agreement (4.32 average on the rating scale with a spread of 0.39) that both quantifiable and non quantifiable factors should be considered when making expansion decisions into Africa. A majority of respondents (3.23 average on the rating scale) were unsure whether approaches to

appraise investments for Africa should be similar to those applied when investing in other developed continents. Also, a majority of respondents (4.27 and 4.14 average on the rating scale respectively), recognized the need to apply time value of money concepts and to include a greater interdepartmental participation in the decision-making process suggesting that such projects perform better than those deliberated only by top executives. These results agreed with what is documented in literature but contradicted an earlier observation that this process should be handled exclusively by the finance department. It was noted that complexity of a given investment determines how long the deliberation process takes and the necessary number of tools and/or approaches to apply, consistent with the developed framework. Figure 2 below illustrates the order in which these investment appraisal techniques are applied. An interesting observation is that 7.55% of respondents selected the option "other" thereby supporting the suggestion that companies expanding into the African market are modifying their investment appraisal process to differ from literature and possibly to align with the market. These approaches warrant further investigation.

Figure 2. Sequence of application of valuation approaches



4.3 Tools

This component assessed the perceived approaches necessary to appraise investments for Africa, including the various techniques employed. There was a general consensus (4.05 average on the rating scale), that several other factors other than valuation techniques are essential for valuing investments for Africa. However, whether or not companies apply these approaches could not be verified since most of the respondents were unsure (3.22 average on the rating scale). It was concluded from the respondents that they do not apply a detailed evaluation process since subjects (2.73 average on the rating scale), did not know what various approaches like multi-criteria decision analysis and real option analysis entailed. Similarly, they could not say whether projects with low negative or zero NPV but with viable real options value are acceptable. This suggests a general lack of knowledge about recent trends in the evaluation process.

4.4 Level of satisfaction

The level of satisfaction with current approaches adopted by the business, in valuing Africa-bound investments, was an important measure for establishing whether there is a need for improvement. Respondents were neutral (3.05 average on the rating scale) to the suggestion that the African market is unique and that investment evaluation methodology be customized to suit it. A significant number (3.17 average on the rating scale) did not think enough time is accorded to evaluating investments of this nature and could not support the statement that their company regularly evaluates it's investment decision-making process in order to improve it (3.68 average on the rating scale). Finally, subjects were neutral to the suggestion that they were satisfied with the current approaches adopted by their business (3.18 average on the rating scale), and a significant number were keen to learn ways of improving this process (4.14 average on the rating scale).

4.5 Overall means procedure

The Statistical Analysis Software (SAS) was used to determine the overall mean score and the overall spread around this mean. These values were chosen based on the Likert Scale and a high average score would indicate support for the literature-developed

decision-making framework. The results obtained are indicated in the table below.

Table 3. Overall means scores (SAS)

ANALYSIS VARIABLE SCORE				
N	Mean	Standard Deviation	Minimum	Maximum
616	**3.569264**	**1.1406**	**1**	**5**

The overall results indicate a general level of indecision among the respondents, with a considerable spread in opinion. This means that the develop framework received only partial support as the majority could not support or reject it.

5 Conclusions and Managerial Implications

This study set out to investigate how the investment decision-making process for companies expanding into Africa is done in order to suggest ways of improving it. From a theoretical perspective, the researcher noted that an accurate evaluation process should be inclusive of other departments other than the finance department and that the process should be adapted to accommodate advanced methods of valuation like real option analysis and scenario planning, among others, to supplement the conventionally used NPV valuation methods which fail to account for investment flexibility. These, and others, were the areas of focus during this study.

In practice, it was determined that this process is left exclusively to the finance department and involves little interdepartmental participation although respondents expressed a need for involvement. The need to involve other departments in investment decision-making cannot be over stressed! For all projects, an efficient procedure for channeling investment knowledge is essential since each project development plan entails a different degree of uncertainties. It will not make investment sense for top management to approve a project while the human capital required to drive the implementation process is scarce, for instance. Similarly, identification of viable investment projects cannot be restricted to top executives alone as senior management and management teams can quite effectively identify viable projects on a strategic management perspective. Their closer interaction with lower management also ensures greater project cohesiveness and stimulates cooperation. An all inclusive departmental involvement in the process of decision-making is therefore crucial.

Whether approaches for appraising investments for Africa should be customised to suit this market or not, remains an area for further study because respondents were neutral to this suggestion. The important question to ask is whether Africa has the same uncertainties compared to the more developed continents of Europe and America? Greater uncertainty requires a careful and comprehensive project evaluation process. At this point, it can only be argued the investment appraisal for Africa requires greater flexibility to account for the ever changing environmental variables that undermine the true value of an investment.

There was perceived knowledge on the investment valuation process, regarding time value of money techniques. However, this excluded the use of complex evaluation approaches, like real option analysis and multi-criteria decision analysis. It was concluded that investment appraisal eliminates important variables from the project valuation process. Recent trends in project appraisal are complex and challenging for decision-makers. However, when employed, such techniques reduce investment uncertainty and increase accuracy. Criteria to include such approaches in the investment decision-making process should set the precedence for further studies.

The complexity of the decision-making process, it was noted, depends on the level of company commitment to the project, size of the project and the considered time horizon required for completing the project. This is a logical finding given that investment projects into Africa are characterised by options for growth and sustainability, among other factors. The question of whether investment projects should be evaluated in phases, depending on the expansion plan, requires further studies.

It was also observed that a gap exists in the approaches adopted by the companies under study (practice) and the approaches recommended from literature (theory). It cannot be ascertained whether these approaches lead or lag one another. However, after detailed investigation, the CFO of one of the companies (name not disclosed), claimed that the company supplements common valuation approaches with excel-enhanced sensitivity measures based on the expected earnings before interest and tax with depreciation (EBITDA), and will only undertake a project that falls within its predetermined sensitivity domain. Whether such an approach leads or lags the conventional approaches evidenced from literature, requires further study. This observation indicated that these companies are customizing some valuation approaches to suit their investments environment.

Finally, the developed investment decision-making framework for business expansion into Africa, received partial support about its correlation to the current approaches adopted by the businesses. Some suggestions from the framework received total support

while others, none. Overall, respondents expressed a need to learn more advanced techniques for project evaluation, especially for companies venturing into Africa. This study was investigative to pave way to a more accurate analysis. The methodology was designed with simplicity, merely to provide an indication of the investment decision-making choices of companies expanding into Africa today. These results reflect investment behaviour of companies within the telecommunications' industry and cannot be generalised to all companies currently expanding into Africa. Certain aspects of the investment decision-making processes (as identified in literature) warrant further study.

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PREPARING FOR CREATIVE RESPONSES TO "BEYOND ASSUMED LEVEL" DISASTERS: LESSONS FROM THE ICT MANAGEMENT IN THE 2011 GREAT EAST JAPAN EARTHQUAKE CRISIS

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Abstract

A survey of the municipal government ICT divisions during and after the 2011 Great East Japan Earthquake and Tsunami crisis reveals the need for creative responses for "beyond assumed level" disasters. Complexity and diversity of the damage were simply too great for any plans to assume. Resident needs toward the municipal governments were also diverse and changed quickly as the time went by. The research also indicates that there would be ways to strengthen the capabilities to execute such spontaneous responses. Creative solutions executed during the 3.11 crisis were supported by the existence of open source software available on the net and skilled engineers that were capable of exploiting them. Frugal information system will be useful to improve preparedness for creative responses.

Keywords*:* Municipal Government, Information System, Disaster, Preparedness, Creative Response

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1 Introduction

Six month after the devastating Great East Japan Earthquake and the subsequent tsunami on March 11, 2011, LASDEC (Local Authority Systems Development Center) requested Keio University to conduct a survey on how ICT (information and communication technology) systems and organizations coped during and after the crisis. The objective of the survey was to formulate a standard business continuity plan (ICT-BCP) for the local governments so they may be better prepared for future disasters. Structured interviews of 13 municipal governments in the hardest hit areas were conducted from November 2011 to January 2012. The data was supplemented by interviews of other municipalities conducted outside of the LASDEC study in writing this paper.

Shortly after the field work started, however, researchers came to the realization that the complexity and the diversity of the damages were huge among the municipalities surveyed. In fact, so huge that it would be unrealistic to expect that a single BCP will provide adequate preparation for all local governments. Diversity of resident needs toward municipal government services also varied greatly. This would make the task even more complex. Even if a comprehensive plan can be made, the cost of execution will be prohibitive.

Based on our survey of the municipal governments' struggle to maintain critical resident life support services, as well as theoretical frameworks provided by public health crisis management literature such as Settle (1985), the authors came to the notion of "preparedness for creative responses". We define creative responses in this paper as autonomous actions taken by local officials to deal with damages that were not assumed in disaster response plans.

We assert the usefulness of this notion based on our observation that many unplanned activities were necessary to cope with "beyond assumed level" situations, while such activities were helped by libraries of prepared tools that were available. In summary, we assert that preparation for disaster should include both action plans for assumed events, AND development of creative response capabilities to deal with damages beyond assumed levels.

We believe that "frugal IS" notion (Watson et al, 2012) will be helpful in preparing for creative responses in future crises in municipal government ICT systems.

2 The Great East Japan Earthquake

The Great East Japan Earthquake occurred at 14:46 Japan Standard Time on March 11, 2011. At a Richter scale of 9.0, it was the largest earthquake on record for Japan. More damaging than the quake itself, a tsunami of up to 40 meters hit the coastline, devastating cities and towns. The Fire and Disaster Management Agency reported 16,131 deaths, 5,994 injuries and 3,240 missing as of January 2012. It also reported 128,497 houses totally lost and more than 900,000 partially destroyed.

The tsunami also destroyed all power supply to the cooling systems of the nuclear power plant in Fukushima causing a meltdown. As of January 1, 2012, 159,124 people from Fukushima had still not returned to their homes.

ICT division played an important support role in the recovery processes of all municipal governments. It would have been impossible to execute tasks without the support of ICT systems. ICT divisions were responsible for maintaining the infrastructure for various information systems.

ICT systems themselves were also hit. The interruption of communication and the loss of information system capabilities for operations were significant hindrances to the entire recovery process. People and organizations were deprived of the information and the processing capabilities necessary to deal with the situation. The effect was particularly noticeable at the municipal government level. There are 1742 municipal governments in Japan as of October 1. 2012. In the three layer (national prefectural and municipal) structure of Japanese government, municipal governments are the closest governments for the people serving their daily needs directly.

Most significantly municipal governments are in charge of keeping resident information which serves as the foundation for government.

3 Diversity, Complexity and Temporal Shifts of the Crisis

Both the extents and the scales of the earthquake damage were diverse, as the damages were combinations of quake and tsunami damages. The affected areas were also very large with different geographical conditions.

The expectations of ICT divisions and the requisites for and processes towards recovery varied greatly along several variables. The variables included structural damage to government facilities and server rooms, loss of data, whether power supply and network connectivity could be resumed immediately, whether communication tools such as cell phones remained functional and the degree of mass emergency evacuation to locations outside the affected area.

Also notable were temporal changes in the situation. As the situation changed with time, required capabilities to deal with the situation also changed.

The capabilities necessary in the initial phase was as follows:

Immediate response measures in the municipalities that experienced major devastation focused on saving lives and guiding survivors to evacuation centers, and in some areas little priority was given to reopening resident service counters (there was however a sense of urgency regarding the need for access to residents' personal information in order to facilitate rescue operations). Some ICT divisions even dispatched employees to do relief work with just skeleton staff remaining at the office. At these municipalities, as well, providing support to the affected people at various post-disaster stages was difficult without the use of ICT(including information system). It became more evident than ever that post-disaster expectations toward ICT divisions change as time passes.

4 Could a Uniform Plan be Effective?

4.1 Planned Response to Assumed Level Damage

In general, regional disaster response plans drawn up by each municipality specify the scope of action to be taken by the relevant organization during a disaster, such as setting up disaster response headquarters and confirming the safety of residents. Some plans also clarify the role of each operational division in the event of a disaster.

After the disaster response headquarters were started up, many of the municipalities dispatched personnel for tasks such as operating evacuation centers and transporting goods under instructions from those headquarters. Further, although several of the regional disaster response plans stipulated that the role of the ICT divisions during a disaster would be information services for the residents this was not possible because key communication means were disrupted.

The response measures summarized below require a large number of people working at the disaster site to carry out numerous activities, including creating lists of survivor names and other information, manning resident service counters to issue Disaster-victim Certificates required to avail of disaster relief and other support systems, distribution of relief money, accepting applications for temporary housing, and tearing down damaged buildings and clearing debris. Municipal governments are mandated by law to perform these tasks. An ICT supports the role.

The disaster response measures taken by the ICT divisions of 13 municipalities surveyed can be primarily divided into the following:

1) Documenting evacuee names and other information (on paper and computer)

2) Restoring operation of information processing

systems

– Upgrade of existing systems

– Development and introduction of new systems

3) Verifying information in various lists with previously documented residents' information

4) Issuing of Disaster-victim Certificates

I) is extremely labor-intensive tasks and most of the municipalities made significant efforts to complete this unexpected post-disaster duty that employees also found demanding.

4.2 Damages Beyond Assumed Level

The types of damages observed at the 13 municipal government office buildings following the earthquake and tsunami and beyond assumed situations that arose subsequently were as follows:

- Loss of lives of majority of executives in the higher tier.
- Collapse of government office buildings.
- Damage to the server, ventilation systems and other equipment.
- Loss of data.
- Suspension of power supply.
- Damage to telecommunications cables and equipment (disruption of communications).
- Destruction of office automated systems.
- Difficulty in getting employees and other personnel to the government office building.
- Inability to enter the server room (malfunction of electronic locks due to power outage).
- Relocation of the server room.
- Relocation of administrative functions.

In addition, in areas affected by the nuclear accident, access to the government offices became difficult for local and outside personnel despite no damage to the buildings themselves, and relocation of data servers outside the region, and of administrative functions is increasingly apparent.

Post-disaster risks could potentially give rise to diverse situations. In particular, a power failure will upset the operation of information processing systems and disrupt communication with the outside. Hence measures to ensure uninterrupted power supply are of utmost importance. During the survey as well, most of the municipal governments emphasized the need for stable power supply. The time taken for commercial power supply to be resumed at the 13 government office buildings varied greatly by municipality, ranging from one day to several months. Although it may be close to impossible to anticipate the time required for power supply to be restored, measures must be implemented to clarify beforehand the tasks that must be carried out during a power failure and to create systems that will ensure uninterrupted power supply to essential ICT equipment. Initiatives must also be taken to prepare for other responses such as the relocation of some administrative functions, in the event of prolonged power outages.

4.3 Response beyond assumed events by ICT Divisions

With regard to ICT divisions, however, none of the 13 municipalities surveyed had drawn up action plans that included business continuity planning, and responses by the respective ICT divisions at the time of the disaster were mainly based on their own discretion.

The following is a typical timeline of responses, created based on activities conducted by employees of ICT divisions at the municipalities that were surveyed, in the months that immediately followed the disaster on March 11.

1) Immediately after disaster struck, checked the condition of the servers and other equipment in the server room.

2) Confirmed resident whereabouts, and helped with transporting goods and other tasks related to the operation of evacuation centers.

3) After power supply was resumed, worked on restoring information processing systems, networks and other related equipment within the facility.

4) Studied the introduction of and developed information processing systems that can be used for disaster response activities.

5) Worked to restore public data networks in the region.

5 Plan vs. Preparedness

Settle (1985) argued that emergency management should be financed in four stages, i.e., mitigation, preparedness, response and recovery. Shoaf et al (2000) adopts same four stage model in the analysis of disaster management. In the context of this model, our research is about preparedness and response stages. We place a particular focus on preparedness for responses to damages that were not assumed before the event.

An important aspect of preparedness is planning. Gebbie and Qureshi (2002) emphasized the importance of emergency response plans which should include the chain of command and the agency roles. They also emphasized the importance of regular practices asserting that "plans that are never practiced or that are poorly understood will probably be useless". On the topic of practices, Watkins (2000) points out that FEMA (The Federal Emergency Management Agency) is adopting a five category model, i.e., orientation, drill, tabletop, functional, and full-scale.

As mentioned above all of the 13 municipalities we interviewed in the LASDEC survey had regional disaster response plans. The plans defined the chain of command and the tasks to be performed. ICT divisions, however, were simply out of scope of the plans in spite of their importance. We are supportive of the national government initiative to equip all municipalities with ICT-BCP.

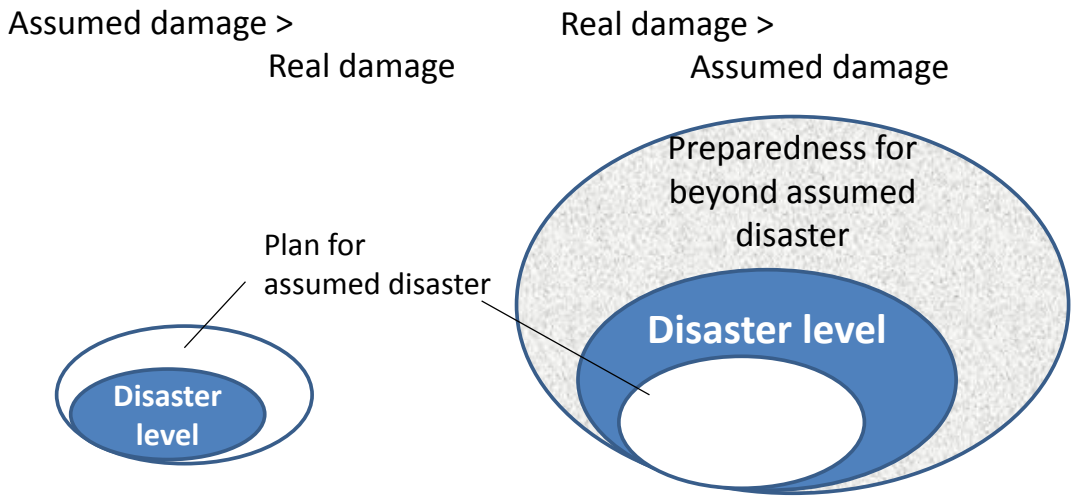
While we support better planning, our field research also revealed that the extent and diversity of the damage can be far beyond any prior assumptions. This implies that even if ICT-BCP existed, a uniformly prepared set of responses would have been insufficient to meet the diverse and rapidly changing needs of the residents.

This by no means reduces the importance of planning. It is naturally useful to make predictions of damages and make plans to respond to the situation. Determination of the chain of command is critical and it is wise to stock of supplies based on careful estimation of the need. Such plans should also be widely shared by all people concerned.

At the same time, we recognize the importance of flexibility in decision making in executing disaster management plans (Kunreuther and Miller, 1985). To respond to the changing situations, strategic incorporation of current information is essential.

We propose to apply the concept of preparedness in thinking about increased capabilities of officials to flexibly respond to unexpected events (See figure).

Figure 1. Preparedness for beyond assumed disaster



In this regard, preparedness is at the opposite of "plans" that are made based on predicted and assumed damage. Damages within assumptions can be dealt with by plans. We need to prepare capabilities for creative responses for damages beyond assumed level.

6 Comparative Study of Disaster Victim Support Operations

6.1 Uses of the Planned Solution and there limits

Disaster Victims Support System is a Linux based and national government endorsed comprehensive post disaster support system. (We call the system Nishinomiya system in this paper after the municipal government that developed it). It was developed after 1995 Hanshin Awaji Earthquake that killed thousands to prepare for future similar events. Source codes (program that can be read and written by humans) for the software had been made openly available for other municipal governments in 2005 and to everyone including private companies after the Great East Japan Earthquake in 2011.

In spite of this good intentions and investments, the system was not utilized as expected in the relief efforts of Great East Japan Earthquake.

Instead, municipal governments opted to use simpler measures such as the use of Microsoft Excel. Even in municipal governments where the Nishinomiya system were used, they had to modify original software to suit local requirements. In summary, all of municipal governments had to conduct ICT development work at a time when people were starving and freezing outside. We believe this was inevitable. We also believe such process can and should be done with minimal resources and time.

It would serve the risk management community to analyze why the use of the Nishinomiya system was limited.

One reason for the less than expected use of the package was lack of time to learn how to operate the software package in the disaster situation. It is notable that much ICT resources were spent in the most critical moments developing systems that meet the demands of the diverse local situations.

Information processing systems that were restored or newly introduced and the timing of measures taken differ by municipality. The system types may, however, be broadly divided into the following two types:

- Systems based on residents' information that link to all government functions.
- Individual systems for each function (issue of

Disaster-victim Certificates, distribution of relief funds, etc.).

The Nishinomiya system was one example of an existing system that is based on residents' information and links to all government functions. Survey respondents were also asked questions about the introduction of this system. Although none of the municipalities had installed the system before March 11, 2011, Miyako City, Ishinomaki City, Kesennuma City, Minamisanriku Town and Iwaki City have introduced it since and selectively use only those features of the system that are required for their individual operations. Miyako City utilizes the system to manage distribution of relief funds; Ishinomaki City for the issue of Disaster-victim Certificates; Kesennuma City for the management of debris removal; and Minamisanriku Town to manage distribution of relief funds and occupancy of temporary housing facilities.

Following the disaster, many municipalities considered introduction of the Nishinomiya system, but were forced to defer introduction for the following reasons:

- Installation on data server was not successful.
- Data processing is required, making use of the system cumbersome.
- A drop in performance was expected when handling large volumes of data.
- Study and modification to the system could not be completed in time for issue of the certificates.
- Operational differences with the developer (Nishinomiya City) regarding the format of the Disaster-victim Certificate and other issues.
- Information upload regarding disaster victims was already completed using a different application software.

In hindsight, all of the problems mentioned in the above comments may have been avoided if preparations had been made in normal times to configure the system beforehand and train personnel to be able to upload resident information immediately in the event of a disaster. The reality was that the ICT divisions were too busy to prepare for slim possibilities of catastrophe. And when the time came, the planned tool lacked familiarity among the officials who then avoided the use.

6.2 Creative Response to Impending Necessity: Case Tagajo City's Disaster Victim Management System

Ashenhurst(1972) asserted that information system "must have" modifiability in additions to capability (to and stability to be responsiveness to organizational requirements.

Juergens (1977) argued that "well functioning" systems have unsatisfied users and stressed the importance of user participation. In the context of this paper, these calls for modifiability can be interpreted as calls for developing capabilities among users to execute creative responses themselves.

Table below lists creative responses in ICT by 13 municipalities and their execution dates. We recognized an action as a creative response, when either original software was developed, or modification to the planned package (i.e., the Nishinomiya system) software by changing the source code was made.

Even among the adopters of Nishinomiya system Miyako, Ishinomaki, and Minamisanriku had to modify the system to meet their needs. As many post-disaster tasks cannot be foreseen, it is often difficult to determine beforehand what information installation will be required (and what will not) during a disaster. The following are examples of items that cannot be confirmed earlier and require some form of technical support to upgrade the Nishinomiya system as may be needed after a disaster.

- No record of relocation history of evacuees.
- Information on temporary housing choices of evacuees cannot be uploaded.
- Information on management of relief goods cannot be updated.
- No feature to record transactions at resident service counters.

The operation of information systems to deal with disaster response measures, including the Nishinomiya system, requires more than just installing the system on a server. As explained above, emergency preparedness measures must be taken to enable installation of resident information immediately after a disaster, and training to ensure business continuity and provide support to victims must be implemented beforehand.

In addition, steps must also be taken to ensure speedy coordination between systems to enable extraction of information from the existing resident information system and conversion to the new format.

Tagajo City that we interviewed outside of LASDEC inquiry is an example of a municipal government that developed a new system during in the recovery period. They did so because the Nishinomiya System could not meet its needs. Tagajo City opened its citizen support center on April, 1, 2011. The center's primary tasks were to identify residents' whereabouts/contacts, damages inflicted on their homes/properties, and to provide adequate information on the relief programs.

Information system became necessary to record the history of consultancies and relate them to resident records. The system development to meet the needs started five days before the service began. Faced with lack of resources and time, the city relied on open source software on the net. Necessary adjustments and additions were made to the software parts and were then integrated to fulfill the needs.

Table 1. Creative Responses by Municipal Governments Surveyed (As of January 2012)

Municipalities surveyed		Example of creative responses	Date
Iwate Prefecture	Miyako City	Modified the Nishinomiya system Developed Kyoto-u-system*	Mid-May Late-December
	Rikuzentakata City	Developed residents safety checking system by open source software	Mid-March
	Kamaishi City	Developed Kyoto-u-system*	Mid-April
	Otsuchi Town	Developed original victim support system (Supported by National Research Institute for Earth Science and Disaster Prevention) Developed Kyoto-u-system*	Late-April around May
Miyagi Prefecture	Sendai City	Modified existing tax collection system to develop victims support system	Early-May
	Ishinomaki City	Modified the Nishinomiya system	Early-May
	Kesennuma City	Developed original victim support system by Microsoft access	Mid-April
	Higashimatsushima City	Developed original victim support system	Mid-April
	Minamisanriku Town	Modified the Nishinomiya system	November
Fukushima Prefecture	Iwaki City	Developed original victim support system	Late May
	Minamisoma City	Developed checking residents safety system by MS access Developed original victim support system	March April
	Futaba Town	Developed checking residents safety system by Microsoft excel	March
	Namie Town	Developed checking residents safety system by Microsoft excel Developed original victim support system	March Late-March

*A system created and provided through collaboration between industry, government and academia, under the guidance of the Disaster Prevention Research Institute, Kyoto University.

Requirements for the system were 1) to give consistent advices to each resident based on integrated records of all advices given to him/her on separate occasions, 2) to have an integrated and simultaneously accessible database that can be accessed from multiple help desks, 3) to be available for long term use as residents will need long term assistance.

A popular CRM (customer relationship management) system in the commercial world, SugarCRM, was chosen as the core engine. SugarCRM could operate on browsers and some parts were offered free of charge. Thus by limiting the use of the software to narrowly defined areas (record of advisees, advising officials, and advices given), the city could freely customize and use the system.

Other tools used were PHP programming tools, MySQL database tools, Apache server software, Eclipse development environment. All were available on the net. Development was done at City's server room that survived the disaster. As the tools were open systems that required no more than browsers and little installation burden, existing equipment could be used. Number of terminals could be added liberally as many of the tools were also license free without the worry of paying more for license and/or violating copyright.

The system was used in following steps:

Step1: Resident identification; Data was imported from City Government official resident record and could be searched to be the key for subsequently adding records of advice.

Step2: Inputting resident problems; Interview records of residents are inputted. If a resident visits multiple times, new records are added on top of previous records under a single key.

Step3: Issuing consultancy records to advisees; To give sense of assurance to residents, copies of interview records and advices given are handed to the advisees. Advisee can bring the copy to the subsequent consulting opportunities.

The system was put in operation on April 1 in time for the opening the center. One hour guidance was given to the advising officials that operated the system. No major problem occurred and minor functional additions were made to the system as the system operated. The system served over 30,000 consulting occasions by 700 officials as of April 30, 2012, including those that were sent by other municipalities as relief staffs.

7 Preparedness for Creative Responses in ICT

7.1 Frugality and Flexibility

As illustrated above, system development became necessary at times of 3.11 crisis. Plans that are based on assumptions of damages are important, but we have to also prepare for damages that exceed our assumptions. Preparedness for creative responses is necessary.

How then, can we improve our preparedness? We would like to consider this within the scope of ICT.

The notion of "frugal information system" (Watson et al.,2012) provides a clue.

A frugal information is defined as an information system that is developed and deployed with minimal resources to meet the preeminent goal of the client. According to Watson et.al (2012), following "4U" information related design concept should be incorporated in order to build systems with frugality: Ubiquity (The drive to access to information unconstrained by time and space), Uniqueness (The drive to know precisely the characteristics and location of a person or entity), Unison (The drive for information consistency) and Universality (The drive to overcome the friction of information systems' incompatibilities).

We would like to apply the concepts in analyzing the cases we observed in our survey to verify the usefulness of the concepts.

7.2 4Us in Great East Japan Quake cases

In the case of Tagajo, while successfully started to serve the residents by consistent consulting, lack of unison in the systems subsequently became an issue. While consistency existed within the domain of consulting, it did not connect with other government services. Various databases were created for different tasks. Data about individual were stored in different databases. With the lack of effective link code, it was difficult to integrate the database later.

This experience suggests that lack of unison leads to failures in uniqueness and universality. Faced with the problem of scattered database, officials of Tagajo subsequently generated individual ID for linking purpose and integrated the systems. This action improved the efficiency of the operation greatly.

While unison, uniqueness and universality were lacking from Tagajo system, at least in the initial phase, we can say that ubiquity firmly existed. The system was developed by integrated open software that adopted standard interface and were available on the internet.

The central government endorsed Nishinomiya System, was on the opposite end of 4U spectrum. It had uniqueness, unison and universality features. In theory, it also had ubiquity feature as it was made with open software on Linux. However it was stored in a locked area that was not openly accessible. It also required highly skilled engineers. Faced with technical requirements that the officials were not using on daily basis, they tended to avoid the use the system in the fear they may not be able to launch the system. Many municipalities, that opted to avoid the use of the Nishinomiya system and also lacked the skill level of Tagajo City, instead relied on windows based systems with package software such as excel that were readily available.

Looking at above cases, it is important to incorporate flexibility building and operating information system to prepare for creative responses in emergency situations.

To this end, we may add a fifth U, i.e. "usual use". Ashenhurst(1972) asserts that information systems should have usability, operability, and maintainability to fulfill the users' needs.

Our survey confirms that it was far easier to fulfill usability criteria for systems that were used on usual basis than for special purpose tools that were not used ordinarily. Thus we should try to use tools that we usually use, rather than applying special tools designed for special occasions. It was the use of browsers in Tagajo case. It was the use of Microsoft packages in others. Officials' familiarity with tools is critical at times of emergency to realize creative responses.

In addition to application of frugal IS concept, importance of preparation for flexibility in ICT development should be emphasized. Tools that are not used daily cannot be used at times of emergency. Staffs should be trained to use frugal and flexible systems in normal times.

8 Applying Cloud Computing for Creative Response

Loss of important data, such as birth and resident records as a result of Great East Japan Earthquake is prompting the municipal governments to consider the use of emergent cloud computing technologies. Cloud computing is an information system architecture in which data and application are stored in the network instead of local machines such as PCs and servers. This technology can be used both to backup data in secure locations and to provide information processing capabilities to damaged area quickly. It is at the core of national government policies to prepare for the next big disaster.

We believe the introduction of cloud computing technology can and should be used to construct frugal information system with 4U (or 5U) features. This will be achieved by: (1) assuming use of internet and cloud infrastructures, (2) share open system for common "tasks" on the cloud, and by (3) developing locally customized interface software to fulfill the diverse needs of each municipality.

Separation of application software from the infrastructure is a major feature of this proposal. By having a nationally run infrastructure, small municipal governments will be freed from developing costly infrastructure. Cloud computing resources can then be applied via the internet to flexibly to whichever localities in need of using the resources to build creative responses to beyond assumed level events. In regular times, only minimal resources can be used. That will help to save costs for small municipalities with weaker financial foundations.

Use of cloud computing technology is still limited in Japan at this point time, but externalization (as opposed to internal ownership) of resources will be essential in enhancing the capabilities of municipal governments to handle ever increasing information processing needs.

A second opportunity is structuralization of application software. We observed that while there is a great diversity in the requirements for information processing, critical processes such as identification of residents, as well as many legally defined processes such as the issuance of relief funds, remains common. Thus, by separating the two and building a common engine for the common tasks, municipal governments can focus on areas that they need to customize. This will greatly reduce cost and more importantly, time to develop systems that meet the emergency needs of the residents. In summary, the use of cloud can add flexibility to the municipal governments operations to execute creative responses when they become necessary.

A prerequisite for adopting this technology is to have a reliable infrastructure. Here again, the system can be frugal. The infrastructure should provide minimal connectivity universally and ubiquitously. Having an open interface above all, is essential.

Software performing the common tasks as described in the previous section, can also be considered part of the infrastructure. Cost of developing such software can be shared by coalition of municipal governments to lessen the burden for each. Open interface for such systems should be created so that municipalities can creatively custom design whatever systems required to meet adhoc needs without having to develop basic systems from the scratch.

9 Conclusion

"Beyond assumed level" is a term that many Japanese heard almost every day in the days after Fukushima nuclear plant accident that followed the tsunami. What became evident in the experience was that when you assume certain extent of damage, you tend to forget preparing for damages beyond. We were unprepared for worst tsunami in recorded history because we prepared assuming the previous worsts in the history. It is easy to argue that we should have prepared for even worse, but that would have been economically unrealistic. It will continue to be unrealistic to prepare for infinite level of risks.

Great East Japan Earthquake taught us that events beyond assumed level do happen, and we should somehow deal with them creatively. Creativity may be partially god given and uncontrollable for humans. At the same time we can train ourselves to be creative and prepare tools to be creative.

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WHY PROTECT FINANCIAL MARKETS?

Maria Carapeto, Mauricio Acosta***

Abstract

The purpose of this paper is to estimate the benefits from adopting close-out netting to decrease the exposure to counterparty risk across the world markets and to establish the additional benefits from central counterparties towards decreasing counterparty risk. The novelty of the approach is to estimate a figure for counterparty credit risk (CCR) grouping together most of the financial transactions that generate counterparty risk and to analyze the benefit of netting possibilities in reducing the overall risk exposure, using three different scenarios. In the first scenario, counterparty credit risk is calculated assuming that no close-out netting is possible across different contracts. The second scenario assumes bilateral negotiations and netting across contracts. The third scenario contemplates the existence of a central counterparty as the center of transactions. Benefits from netting and central counterparty are assessed by comparing the risk exposure in each scenario.

Results from the model show that netting provides a decrease in world counterparty risk of over $17 trillion. Netting is thus a powerful tool available in the world markets to manage counterparty risk while decreasing systemic risk, and as such policies to facilitate and standardize netting procedures across different jurisdictions should be encouraged. Moreover, results show that the use of central counterparties for settling the outstanding contracts would additionally decrease CCR by over $2 trillion***.

Keywords: Counterparty Credit Risk, Central Counterparty, Close-Out Netting, Systemic Risk
JEL classification: G18, G28

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1 Introduction

The 2007 credit crunch and the subsequent crisis emphasized previously unnoticed facts about financial markets. One of them was the astonishing size of financial institutions when compared to national economies. On the other hand, the tacit insurance provided by governments to financial participants perceived as too big to fail. Society became worried. Suddenly an unwanted guest, recession, came into the scene. Public opinion and leading economists pointed their fingers at the financial industry as the origin of this chaos. Nowadays many topics related to financial markets are being examined, seeking to abolish the practices that may exacerbate risk again. This methodical revision has also included the legal framework that supports financial markets around the world.

Historically, financial markets (and therefore financial market participants) have been provided with a legal framework that is meant to foster a friendly environment and protect financial transactions in case of distress situations. When looking at the interlocking risks associated with financial markets, counterparty credit risk (CCR), i.e., situations where there is the risk that participants in a contract may not fulfill their obligations, is a main source of risk propagation, as it can build into systemic risk when a financial institution fails (i.e., risk that default will propagate to other counterparties). This paper analyses policies that impact on the exposure to counterparty risk and that have been under fire by new pressure groups.

The legal framework protects participants in financial transactions from CCR arising as a result of one or several participants becoming insolvent. Specifically, financial contracts have super senior priority over other creditors in an insolvency situation, with close-out netting (netting the difference of obligations derived from outstanding contracts when an institution fails) facilitating the immediate termination and settlement of outstanding derivative contracts. These protective mechanisms thus aim to

reduce risk exposure and the consequent financial distress of market participants. For example, Mengle (2010) estimates that the loss of netting in derivatives markets would increase exposure by $22 trillion.

In the aftermath of the credit crisis in 2008-2009, the legal protection of participants in financial transactions has been criticized for a couple of reasons. Firstly, the legal protection did not prevent the contagion of risk as intended as it actually reduces incentives for adequate monitoring of counterparty risk by market players. In this case, derivatives and complex financial instruments, until that time supposed to help hedging risk, were accused of causing the cataclysm. Secondly, the super senior priority of financial transactions diminishes other creditors' recoveries when an institution becomes insolvent. In that vein, some scholars point out that policies established to protect financial markets can be fundamentally unfair with society as a whole (Roe, 2010). They argue that they provide a 'financial haven' where special rules apply that prioritize financial market participants at the expense of other stakeholders (e.g., lenders) when an institution turns insolvent. As a result, policies and practices that seem to favor financial markets are now seen with suspect and distrust. However, abolishing the protection of financial transactions would impact a market (both OTC and exchange market) worth more than $700 trillion. It would be anticipated that many insolvency clauses of derivative contracts would not be enforceable, with CCR dramatically increasing. Overall, negotiations would carry more risk and the ease of performing a transaction would decrease, therefore general liquidity would also decrease. The first research question is thus how would CCR exposure be affected by removing legal protection (close-out netting) from participants of all financial transactions?

Awareness of CCR has increased both for companies and policy makers since the credit crisis. Public policy and opinion have turned to the use of central counterparties, i.e., institutions that stand between the transactions of any two participants, as a mechanism to protect financial markets from systemic risk. As such, this paper investigates the impact of further encouraging the use of institutions such as clearing houses and developing models to increase the netting alternatives across different transactions and assets.The second research question is thus how would CCR exposure be affected by introducing settlements through central counterparties for all transactions?

The model used in this paper is built on Duffie and Zhu (2010) and JP Morgan (1997). Instead of a conceptual approach, the aim is to bring in some quantitative values to the discussion by providing estimates for the exposure to counterparty risk, as well as the potential risk reductions derived from the benefits of netting and central counterparties. The results suggest that netting reduces CCR by over $17 trillion. Moreover, the use of central counterparties for settling the outstanding contracts would additionally decrease CCR by over $2 trillion, or an additional benefit of 9% when compared to the current situation,
The results raise the question of whether the overall amount of new risks that would be democratized into the society by eliminating these procedures might be higher than the benefits of democracy per se. Therefore, the special legislation for dealing with financial markets may need to be protected. This legislation mitigates risk exposure in financial markets and increases wealth for society, thus avoiding the spread of unnecessary risks across all market participants.
The paper is organized as follows: Section 2 presents a review of the literature. Section 3 describes the mathematical framework used for running the simulation of credit exposure benefits from netting and using central counterparties. Section 4 discusses the results and the implications derived from them. Section 5 concludes.

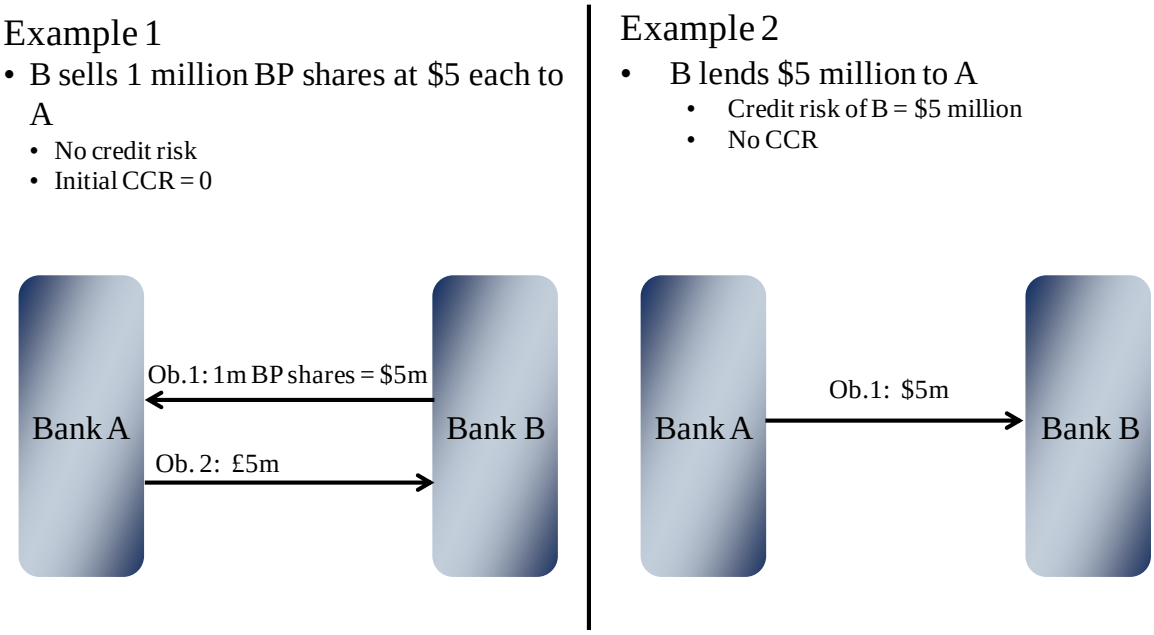
2 Literature Review

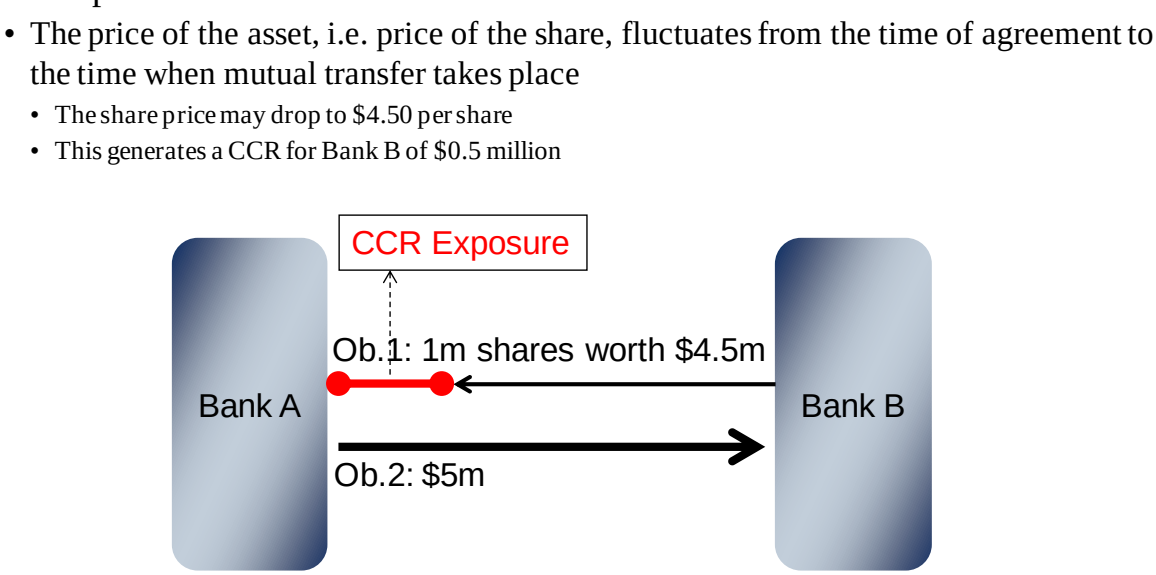
2.1 Operating Concepts

2.1.1 Counterparty Credit Risk

Counterparty risk in its broad sense results from any contract where two or more participants oblige to each other. The risk that any of the participants (counterparty) does not fulfill its obligations is called counterparty risk. For the specific case of financial markets the concept focuses on CCR. CCR is naturally present whenever two parties engage on a financial transaction. CCR risk is thus risk which arises as a result of a financial transaction between two parties of mutual obligations before settlement, where the economic value of the transaction fluctuates (e.g., when the price of the underlying asset fluctuates). For example, suppose Bank A buys 1 million BP shares at $5 each from Bank B. This transaction generates two mutual obligations for each of the participants of the deal.At the time when a financial transaction is agreed, the mutual obligations usually have the same economic value, in which case the initial CCR is nil. It should be noted that CCR is not the same as credit risk. Credit risk arises in transactions which include one unilateral obligation from one counterparty towards another. As soon as the transaction commences, the obliged counterparty generates credit risk towards the other party, e.g., when a bank lends money the borrower has the unilateral obligation to pay it back. As such, the credit risk exposure is equivalent to the value of the loan. The top part of Figure 1 shows these two situations, depicted as Examples 1 and 2, respectively.

Figure 1. Counterparty credit risk versus credit risk





After both parties comply with their obligations, i.e., Bank A has transferred the money to Bank B and Bank B has transferred the shares to Bank A, the transaction finishes and CCR disappears. However, before both parties fulfill their obligations, there is a possibility that one of them does not meet the obligation. To simplify, suppose that a special mechanism is set to guarantee that both transfers occur simultaneously, in such a way that there is no possibility of one counterparty owing the other at any time during the settlement of the transaction (a standard practice of delivery versus payment is an approximation to this situation). Now, suppose Bank A does not meet the obligation to deliver the cash. In this case, what happens is that Bank B will then also refrain from delivering the shares to Bank A and the transaction is never completed. Since neither side gave anything away it seems there was no loss and therefore that CCR risk had no financial effect on the counterparties. However, the reality of financial markets is that most of the times one of the participants makes a loss when the transaction is not completed. In theory, the loss is equivalent to the gain the other counterparty makes when the deal is broken (Hull, 1997).

The reason for this situation is the time gap between the moment when the deal is closed and the moment when it is settled. Since in financial markets stock prices change minute by minute, the buyer of the shares (Bank A) would have made a profit/loss proportional to any price movement during the settlement period. Therefore, Bank A could be the

contractual owner of an asset with less value than what it was paying for. Correspondingly, Bank B would have the obligation to deliver an asset with less value than the money it would receive in exchange. If the transaction fails to settle, Bank B will realize a loss proportional to this price difference. Figure 1 depicts the situation of a 50-cent drop in price, which generates a CCR exposure of $0.5 million for Bank B.

The first lesson from this example is that the risk exposure is proportional to the variation of price from the moment the deal is closed. In case the prices did not change, no risk would arise. The second lesson is that the exposure to CCR does not imply a loss equivalent to the overall amount of the transaction. The loss is related to the fluctuation on the value of the contract.

Two concepts often used when referring to CCR will be introduced. The notional value refers to the total amount of the transaction generating the exposure. The exposure value is what the counterparty that has a positive value contract would lose if the transaction failed to settle. As the example shows, the exposure value is much less than the notional value. The exposure value is closely related to the price fluctuation of the underlying asset of the transaction. The same principles are fundamentally true for most financial transactions. A formal definition of CCR can be found from the Basel Committee on Banking Supervision (2006):

'The counterparty credit risk is defined as the risk that the counterparty to a transaction could default before the final settlement of the transaction's cash flows. An economic loss would occur if the transactions or portfolio of transactions with the counterparty has a positive economic value at the time of default. Unlike a firm's exposure to credit risk through a loan, where the exposure to credit risk is unilateral and only the lending bank faces the risk of loss, the counterparty credit risk creates a bilateral risk of loss: the market value of the transaction can be positive or negative to either counterparty to the transaction. The market value is uncertain and can vary over time with the movement of underlying market factors.' (Basel Committee on Banking Supervision, 2006, p. 19)

Within this context, default means that the counterparty does not live up to meet its contractual commitments. Most spot transactions as the one previously described carry relatively small CCR exposure. Therefore, when compared with other credit commitments, for example the credit risk linked to inter-bank deposits, CCR exposure is much smaller, which means that in these situations counterparty risk is normally ignored.When the time gap between the closing of the deal and the final settlement of the transaction increases the CCR can also increase. In transactions with a greater time gap CCR exposure may build up, as the time to settlement goes by. In these cases the potential risk when the transaction starts is higher. Derivatives are transactions that are normally settled in the future, and the final settlement date in some cases can even extend several years into the future. For this reason, they are considered the biggest source of counterparty risk exposure.

Nevertheless, no matter how big the exposure is, CCR risk only turns into a loss when the counterparty really defaults to meet its obligations settling a transaction. Until recent years, the possibility of default by counterparties with the highest credit scores was perceived to be almost zero. Therefore, in practice many market participants perceived no risk when dealing with these counterparties. However, after the credit crunch and the failure of Lehman Brothers, perception has somewhat changed. Nowadays not even AAA graded national governments are seen as completely safe (Kaso, 2010).

2.2 Settlement Netting

In a practical sense, set-off is the settlement of reciprocal obligations between two counterparties by transferring the net difference. From a legal point of view, each debtor uses its claims to settle its debt instead of using cash. In other words, '...he uses the claim owed to him to pay the claim he owes' (Wood, 2007, p. 4).

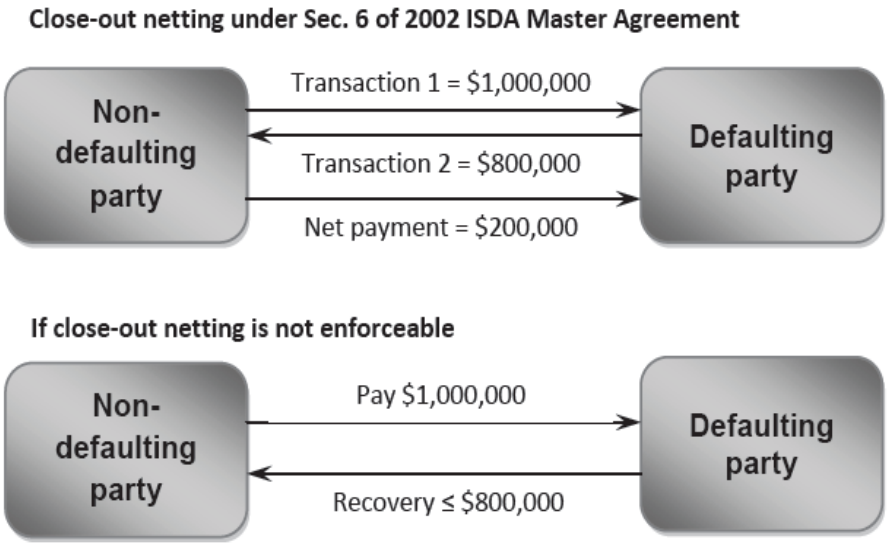
Suppose Bank B has two non-delivery forward contracts with Bank A expiring on the same day. For the first contract, A has the obligation to pay £100,000 to Bank B. For the second contract, Bank B is obliged to pay £100,000 to Bank A. For settlement purposes, no counterparty transfers money and the obligations offset each other. Notice that the possibility of set-off is crucial for the CCP efficiency.

The implication of no set-off is that the exposure to the counterparty is always equivalent to the total gross amount of obligations that the counterparty has towards the participant. Any offsetting obligation towards the counterparty will not diminish the amount.

2.3 Close-Out Netting

The objective of close-out netting is to reduce the exposure of open contracts still to be performed by both counterparties if one of them becomes insolvent before the maturity date (Wood, 2007). In this type of netting, when a counterparty becomes insolvent outstanding contracts are cancelled at their current market price (negative exposure offsets positive exposure) and the resulting net liability ends up being the final exposure, following Sec. 6 of the 2002 International Swaps and Derivatives Association Inc (ISDA) Master Agreement. Figure 2 depicts an example of close-out netting. Because of the need to cancel the contracts at market prices, the term replacement netting is also used. Regulation about insolvency, a very crucial instance of CCR, is full of specific details and variations across different regulatory jurisdictions.

Figure 2. Close-Out Netting



Source: ISDA Research Notes 2010

2.4 Central Counterparties

Shifting transactions across markets to central counterparty (CCP) clearing houses is one of the regulatory trends that have evolved during the past few years (Glass, 2009). Central counterparties are seen as a key element to decrease CCR risk as central counterparty's activities can enable them to avoid duplicate off-setting transactions. They are neutral to market risk because of their matched positions and spread the default risk from one counterparty to all members. During the settlement of transactions the clearing house is a mechanism to avoid direct credit risk.

When the CCP stands in the middle of the settlement between two counterparties, for example a deal to buy securities, it receives the cash from Bank A and it receives the securities from Bank B. When both counterparties have fulfilled their obligation, so the clearing-house has both the cash and the securities, it closes the deal and transfers the corresponding part to each counterparty. Suppose the trading day starts and Bank B buys 1 million shares issued by company X from Bank A at $3.40, which is actively selling shares. Later in the day, the price rises and Bank B decides to profit from the situation by selling the X shares to Bank C at a price of $3.50. Later on a trader at Bank A notices he was so active selling shares that he actually is 1,000,000 short of X shares to deliver. Bank A calls Bank C to ask if they have any shares. Since Bank C has just bought 1 million of them, they decide to sell them to Bank A at $3.60. The last trade is not profitable for Bank A but it now has enough shares to settle the deal with Bank B. CCP clearing is effective at reducing the spread of risk. Without a CCP, Bank A would inevitably default its $3,400,000 transaction with Bank B. Consequently, unless Bank B had some additional shares, it might also end up defaulting on its transaction with Bank C. With a CCP, all banks would send their trading orders to the CCP which could then cross-reference all transactions. Bank A bought 1 million shares at $3.60 from Bank C and sold 1 million shares at $3.40 to bank B. Bank B bought 1 million shares at $3.40 from Bank A and sold 1 million shares at $3.50 to bank C. Bank C bought 1 million shares at $3.50 from Bank B and sold 1 million shares at $3.60 to Bank A. To settle the transactions the CCP would transfer $100,000 from Bank A's account to Bank C's account and $100,000 from Bank A's account to Bank B's account. This action means that six transactions with a gross value above $18 million were settled by transferring only $200,000, which results in the increase of efficiency and reduction of risk.

Central counterparties may also increase market efficiency by offsetting redundant transactions before settlement. One example is a situation where at the end of the day, after the netting of transactions, A owes $1m to B and B simultaneously owes $1m to C. The central counterparty will increase efficiency by settling the two unrelated transactions by just one money transfer of $1m from A to C.

Clearing of OTC derivative contracts is more sophisticated than clearing of spot transactions (Glass, 2009). The central counterparty in a derivative market stands in the middle of the transaction using the novation (clearing) legal figure, which means that the original derivative contract between the two counterparties A and B is transformed into two contracts. In the first contract, the CCP buys from A and in the second contract the CCP sells to B. The CCP has no market risk since both contracts are netted. However, it now has the CCR risk of the two counterparties. In fact, the CCP carries the risk of all

transactions it is clearing, which implies an enormous amount of risk concentration on the CCP.

In sum, CCP stands between the participants in a transaction. As a result, the effect of an insolvent counterparty spreads among all participants, instead of concentrating on its direct counterparties, thus virtually eliminating CCR for market participants as the risk is concentrated on the CCP. However, systemic risk would arise if the CCP became insolvent.

2.5 Empirical Studies

A report by the Bank for International Settlements (2009) calculates the notional value of derivative contracts to be $693.5 trillion. However, studies about counterparty risk have mostly focused on research related to credit default swaps (CDS). Although this category of derivatives attracts the attention because of the particularity of exposing the buyer to a binary large jump risk exposure (Deutsche Bank, 2009), it represent less than 15% of the market exposure (Comptroller of the Currency Administrator of National Banks 'OCC,' 2009).

Chan-Lau and Li Lian (2007) derive a methodology based on vector auto regression which estimates relative CCR exposure in the CDS market. Institutions are ranked by relative sensitivity but no absolute exposure value is calculated. Barclays Bank (Barclays, 2008) studies the credit derivatives market, estimating that losses could range from $36 to $47 billion. They point out however that these results are not to be extrapolated to other categories. Segoviano and Singh (2008) model cascade effects after a default for the whole spectrum of the derivatives market. They propose a 'Distress Dependence Matrix' to estimate CCR exposure. Their approach is to calculate a weighted average of exposure value by the probability of occurrence, and estimate that the total loss after a cascading effect is in the region of $1.5 trillion.

Two papers provide interesting insights on netting and central counterparties. Some research by International Swaps and Derivatives Association Inc (ISDA) explores the importance of close-out netting for the OTC derivative markets (Mengle, 2010). Based on data from the Bank for International Settlements they estimate that the loss of netting would mean an increase of exposure in the order of $22 trillion. Their estimate is based on a comparison of gross market value to netted credit exposure. They focus specifically on bilateral netting and no estimate of the benefits of central counterparties is made. Duffie and Zhu (2010) present a model which estimates the efficiency of central counterparties in reducing CCR in the derivatives market. They show that as the number of central counterparties increases, the efficiency of the central counterparty as a protector of financial markets decreases. As such, they suggest that the optimal number of central counterparties operating in the derivatives markets is one.

3 Data and Methodology

3.1 Data

One of the objectives of the research was to gather information from data sources that provided an adequate standard. The first criterion was to use information to be publicly available on a periodic basis. The second criterion was to use data published by government or regulated bodies. When information was not directly available from government sources, reports from financial institutions submitted to regulatory bodies (e.g., annual financial reports) were used.

Major clearing-houses were targeted as possible sources of market information. For the US financial markets, the International Derivatives Clearing Group was contacted. For Europe, LCH.Clearnet was contacted, and for Asian markets, HKEX based in Hong Kong. However, public available information from these sources was very limited and most of the historical statistics are available to members only. Therefore, it was not possible to use the valuable data from these companies. Nevertheless, HKEX did provide broad extensive information on daily operation volumes (HKEX, 2010). These data were used for estimating volumes in Asian markets. Values for the OTC market on futures, swap, and option derivatives were taken from the reports from the BIS (BIS, 2009) and (BIS, 2010). The classification of contract types used in this paper is based on the categories defined by reports from the Bank for International Settlements. These data was compared to figures published by the International Swaps and Derivatives Association Inc (ISDA) and Comptroller of the Currency Administrator of National Banks (OCC).

When considering data from different sources, values are not directly comparable since every source uses different grouping categories. Therefore, discretional grouping of some categories needed to be performed. For example, values for swaps and futures were grouped together. The comparison shows that overall, values do vary across different sources however differences are normally less than 10%. This range of differences was to be expected, since each source has a different set of reporting entities and the reporting period is not the same for all institutions (Comptroller of the Currency Administrator of National Banks 'OCC,' 2010; BIS, 2010; International Swaps and Derivatives Association Inc 'ISDA,' 2010).

Data used for the European market is based on the reports from the Bank for International Settlements (BIS, 2010) and historical reports from the International Swaps and Derivatives Association Inc (ISDA, 2010). Data used for the America market is

based on the Federal Financial Institutions Examination Council (FFIEC, 2010), Comptroller of the Currency Administrator of National Banks (OCC, 2010), and the K-10 & Q-10 reports filed by major financial institutions in the US.

3.2 Methodology

The objective of this analysis is to estimate the benefit that netting provides for the overall CCR in the markets, using real world data processed under three different scenarios. The analysis was directed towards the following cases:

1. The benefit derived from a situation where close-out netting is available, compared to a situation where close-out netting is not available to the participants;

2. The benefit derived from a situation where close-out netting is available but there is no CCP, compared to a situation where close-out netting is available and there is a unique CCP that concentrates all contracts.

The measurement of CCR used in this paper builds on Duffie and Zhu (2010) and the document on Credit Risk by JP Morgan (1997). The model from Duffie and Zhu (2010) is especially useful when aggregating the risk of exposure under no netting situations. The interpretation of overall market exposure is based on their definition. A reasonable measure of the overall CCR in a market structure is the sum, across entities, of the total expected absolute counterparty exposures. The document on Credit Risk by JP Morgan (1997) presents a model for risk exposure based on the correlation of the underlying assets. Principles of this model are incorporated in this study for modeling CCR exposure in situations where close-out netting is possible, and therefore the efficiency benefits of correlations across assets are possible. Duffie and Zhu (2010) also discuss central counterparties and present a model that provides evidence that efficiency benefits from central counterparties could be lost due to a fragmentation of clearing services. This work follows the same principles of their methodology and applies it to the latest available data, considering one central counterparty only.

Model. Consider that the market is composed of *N* participants. The financial industry is highly concentrated, with the biggest 14 participants accounting for more than 95% of all transactions of the market (BIS, 2010). Assume that each of these entities is able to engage in transactions with any of the other *N-1* participants, so there are no geographical restrictions. Divide the asset classes in *D* different categories of transactions. Two transactions are classified in the same category if they share the same risk profile. To share the same risk profile the transactions must satisfy the following conditions:

i. The underlying asset should belong to the same asset class

ii. High correlation of assets prices

iii. Similar functional relation between underlying asset price movements and risk exposure

Suppose that participant *i* has a contract *k* that belongs to category *d* with entity *j*. The expression *bre(i,j,k,d)* is the *basic risk exposure* of entity *i* to *j* (from *N* participants), due to the specific contract *k* that belongs to the transaction category *d* (from *D* different categories of transaction). In other words, the amount that *j* owes *i* due to the *k*th agreement in the transaction category *d*. '*bre*' is thus the basic unit of CCR exposure across the participants in the market. If the value of the contract were negative for *i*, such that on a specific date participant *i* owes *j*, the basic risk exposure *bre(i,j,k,d)* would be negative.

Each of the *bre(i,j,k,d)* has an uncertain value because the level of exposure that would exist on a typical trading day cannot be known with anticipation. To deal with this uncertainty, the analysis will be done by modeling each exposure as a random variable following the normal distribution. In the situation where all contracts belong to the same transaction category, say transaction category *d*, the random variables will be driven by the same parameters. As a result, assume that the correlation of the random variables that describe the exposure for the same transaction category will be equal to 1. From the definition of *bre* it can be seen that the expression is symmetrical between the counterparties of the operation, and as such it can be assumed that *E[bre(i,j,k,d)] = 0*. Under these assumptions, the exposure will be related to the standard deviation of the random variable. The measure of the overall CCR in a market structure would be the sum, across the *N* participants of the total counterparty risk exposures *CR(i)*.[1]

Scenario with bilateral close-out netting with no CCP. In situations where close-out netting is possible across all contracts the total exposure can be expressed as the direct sum of the basic risk exposures of all contracts. The aggregate exposure will be relevant only if the value is positive, otherwise it is considered nil. Let *R(i,j,d)* be the *total exposure* due to all *K* contracts within transaction category *d*:

$$R(i,j,d) = \max\left(\sum_{k=1}^{K} bre(i,j,k,d), 0\right) \qquad (1)$$

In the case of close-out netting across all contracts it is possible to net obligations across all types of contracts with the same counterparty. However, obligations with different counterparties would still not be netted. The expression for the *aggregate consolidated risk exposure for counterparty i,CR(i),* is:

[1]The model disregards collateral and data on bilateral counterparty relationships due to availability issues.

$$CR(i) = \sum_{j=1\ j\neq i}^{N} \max\left[\left(\sum_{d=1}^{D}\sum_{k=1}^{K(i,j,d)} bre(i,j,k,d)\right),0\right] \quad (2)$$

The expression to be evaluated for this scenario does not include the maximization function within the inner sum. However the maximization is still present within the last sum. For this situation the framework based on the standard deviation of the random variable was used. Let *NV* represent the *notional value* of the contract, then the exposure can be formulated as the multiplication of this number by the random number *X*. In that case:

$$E[R(i,j,d)] = \max\left[E\left[\sum_{k=1}^{K} NV(i,j,k,d)\times X(i,j,k,d)\right],0\right] = \max\left[\sum_{k=1}^{K} NV(i,j,k,d)\times E[X(i,j,k,d)],0\right] \quad (3)$$

As previously discussed, the exposure will be related to the standard deviation of the random variable. The *aggregate expected risk exposure r(i,j,d)* across the same transaction category *d* is thus:

$$r(i,j,d) = \max\left(c(d)\times\sigma_X \times\left(\sum_{k=1}^{K} NV(i,j,k,d)\right),0\right), \quad (4)$$

Where *c(d)* is the proportionality constant for transaction category *d*; σ_X is the value of the standard deviation of the random variable *X*; *NV(i,j,k,d)* is the notional value of the exposure to transaction category *d* between counterparties *i* and *j*.

It can be seen that for modeling scenarios where netting is possible across different groups of contracts with the same underlying risk, the expected value of the *CCR is proportional to the gross value of the contracts*. Following Duffie and Zhu (2010) who cite BIS data, it is assumed that the net exposures in all asset classes are in the region of 15% of the gross credit exposures, which was found for the derivatives markets. The parameters of the volatility vector and the correlation matrix may be estimated using financial market historical data. With these parameters and information on the notional value of the outstanding deals in the market, an estimation of the overall credit exposure for every market participant is possible.

When netting is allowed, the standard deviation can be approximated using the methodology described in the Credit Metrics document (JP Morgan, 1997). Specifically, the volatility of the overall exposure can be expressed as a linear combination of the standard deviation of the individual variables and correlations between them. Generalizing to *D* different transaction categories the expression can be written as a matrix product. The first component of the matrix product would be the column vector *A* composed of the product of the notional values, the proportionality constants (15%), and the standard deviations. The second component would be a *D*×*D* square matrix *C* with the correlations among the different asset classes (JP Morgan, 1997). Specifically,

$$CCR = [(C\times A)'\times A]^{1/2} \quad (5)$$

Scenario with no close-out netting. The calculation of *R(i,j,d)* depends on the netting alternatives. When netting is not possible the exposure is equivalent to the gross amount owed, and this amount is not offset by obligations towards the counterparty (Woods, 2007). If there is no netting every contract is independent of the others and the same is true of the obligations for each contract. This situation can be modeled using the *rre(i,j,d,k) relevant risk exposure* expression:

$$rre(i,j,k,d) = \max(bre(i,j,k,d),0) \quad (6)$$

And *R(i,j,d)* is thus given by:

$$R(i,j,d) = \sum_{k=1}^{K} rre(i,j,k,d) = \sum_{k=1}^{K} \max(bre(i,j,k,d),0) \quad (7)$$

It can be seen that $R(i,j,d)_{\text{WithoutNetting}} \geq R(i,j,d)_{\text{With Netting}}$.

The expression for the *aggregate consolidated risk exposure for counterparty i,CR(i),* is:

$$CR(i) = \sum_{j=1\ j\neq i}^{N}\sum_{d=1}^{D}\sum_{k=1}^{K(i,j,d)} \max(bre(i,j,k,d),0) \quad (8)$$

This expression was used when establishing the aggregate exposure amount when no possibilities of netting are assumed (Duffie and Zhu, 2010). Excluding close-out netting the expression for aggregate exposure includes the maximization function within the sum, so the expected value cannot be factored out from the expression. For this situation the expression derived from the expected absolute value of the random variable was used. Using the same assumptions of the previous section, *rre(i,j,k,d)* can be expressed as:

$$rre(i,j,k,d) = c(d)\times NV(i,j,k,d)\times X(d) \quad (9)$$

Let *X* represent the random variable and *NV* the notional value of the contract. The expected value of the exposure would be given by the sum of the maximization function of the exposure and *0*. The *aggregate expected risk exposure r(i,j,d)*across the

same transaction category *d* can be represented by the conditional expression:

$$r(i,j,d)=E\left[\sum_{k=1}^{K}\begin{cases}NV(i,j,k,d)\times X(i,j,k,d) & ,if\ (NV\times X)>0\\ 0 & ,if\ (NV\times X)\le 0\end{cases}\right] \quad (10)$$

Assuming symmetry of the probability distribution of *X* then:

$$E[X>0]=E[X<0]=\frac{1}{2}E[|X|] \quad (11)$$

And *r(i,j,d)* can be represented by:

$$r(i,j,d)=\frac{1}{2}E[|X|]\times\sum_{k=1}^{K}|NV(i,j,k,d)| \quad (12)$$

It can be seen that when close-out netting is not allowed across different groups of contracts, the expected value of *CCR is proportional to half the gross value of the contracts*.

The exposure can be calculated using the result for the central absolute moments of the distribution. The central absolute moments of the normal distribution are given by:

$$E\left[|X-\mu|^{p}\right]=\sigma^{p}\times(p-1)!!\times\begin{cases}\sqrt{2/\pi}, & if\ p\ is odd\\ 1, & if\ p\ is even\end{cases} \quad (13)$$

Where '*(p*-1*)!!*' denotes double factorial of *(p*-1*)*, i.e., the product of every odd number from *(p*-1*)* to 1. The first moment can thus be computed as:

$$E[|X|]=\sigma\times\sqrt{2/\pi} \quad (14)$$

In the general case of a no-netting scenario, a closed-form analytical solution is not possible. The assumption is that the aggregate result for say two random variables, *a* and *b*, has a lower bound given by:

$$r(i,j)(a,b)\ge\frac{1}{2}\sqrt{\frac{2}{\pi}}\sigma(Sa)+\frac{1}{2}\sqrt{\frac{2}{\pi}}\sigma(Sb) \quad (15)$$

This expression stands for the *aggregate expected counterparty credit exposure* of two transaction types. In order to evaluate the exposure to more transaction types, an iterative use of the equation may be applied. Notice that in this case the correlation between the asset classes has no effect on the final value. Generalizing the expression to all *D* assets gives the *aggregate expected risk exposure r(i,j):*

$$r(i,j)=\frac{1}{2}\sigma\times\sqrt{\frac{2}{\pi}}\times\sum_{d=1}^{D}|NV(i,j,d)| \quad (16)$$

And CCR is given by the sum of all *r(i,j)* exposures.

Scenario with close-out netting and a CCP monopoly of the market. The central counterparty activity within the market can be modeled as a new participant *N*+1. The CCP is engaged in transactions with all the other counterparties. In this case, through the novation of existing contracts between every two counterparties A and B, each previous contract will be transformed into a pair of contracts. In the first one the central counterparty is say the buyer to counterparty A and in the second one the central counterparty is the seller to counterparty B. For the CCP it is not possible to use the close-out bilateral netting to offset its exposure across the counterparties because each is a different counterparty. However for the rest of market participants, all contracts previously agreed with different counterparties are now grouped in a unique set of contracts with only one counterparty, the central counterparty.

According to Duffie and Zhu (2010), the average counterparty *i* expected exposure in the presence of one CCP for one class of assets (derivatives) has two components. Firstly, the expected exposure to the other *N*-1 counterparties for the remaining *K*-1 asset classes. Secondly, the exposure to the CCP for the *K* contracts in category *D* novated to the CCP. In this case where all contracts and categories are novated by the same CCP the overall CCR is given by the CCP exposure:

$$CCR=\sum_{i=1}^{N}\max\left(\sum_{j=1\ j\neq i}^{N}\sum_{d=1}^{D}\sum_{k=1}^{K(i,j,d)}bre(i,j,k,d),0\right) \quad (17)$$

The framework for the computation will be based on the expected absolute value of the random variable, similarly to the no close-out netting scenario.

4 Results

4.1 Data Analysis

CCR in financial markets is mostly driven by derivative transactions, essentially because derivative contracts have longer maturities than spot contracts. Correspondingly, greater changes in the underlying asset prices may drive the value of the contracts away

from equilibrium. When the value of the contract is not zero, or the value to replace an existing contract is not zero, one of the counterparties (the one with the positive value of contract) is exposed to CCR from the counterparty with negative value.

Data gathered for the aggregate global market in the last quarter of 2009 is presented in Table 1. The information is divided by contract type and also by the OTC or Exchange Markets. The value of the overall gross notional amount of contracts, including those traded on the most relevant Exchanges is $701.4 trillion. Although the OTC market has the biggest share of the overall market, in some cases the distribution is fairly equitable, e.g., option contracts on equity are almost evenly distributed. For this type of contracts the Exchange market share is 50.2% while the OTC share is 49.8%. Another example is with option contracts on commodities, where Exchanges have a clear advantage on the market share with 69% of the $2.7 trillion commodity options market. However these are the only two exceptions. The dominance of the OTC market over the Exchange market is evident. This situation may also be seen as a source of concern, since most Exchanges incorporate the figure of a central clearing house to mitigate CCR risk. However, values show that most transactions concentrate on OTC, the riskier environment.

Table 1. Gross value of transactions exposed to CCR (Q4 2009) (Thousands of Dollars)

Underlying Asset	Contract Type	Gross OTC Value	Exchange	Total
Interest Rate	Futures and Swaps	400,485,000	20,628,000	421,113,000
Currency	Futures and Swaps	39,638,298	164,000	39,802,298
Equity	Futures and Swaps	1,829,872	965,000	2,794,872
Commodity	Futures and Swaps	2,098,091	360,000	2,458,091
Interest Rate	Options	48,807,609	46,429,000	95,236,609
Currency	Options	9,558,071	3,610,000	13,168,071
Equity	Options	4,761,575	4,807,000	9,568,575
Commodity	Options	845,923	1,880,000	2,725,923
Bonds	Repo Agreements	8,350,000	-	8,350,000
Bonds	Credit Protection	32,692,694	-	32,692,694
Various	Other	73,456,382	-	73,456,382
		622,523,515	78,843,000	701,366,515

Sources: Office of the Comptroller of the Currency in the US, Bank for International Settlements, Central Banks

The table shows that most of the derivatives market transactions are concentrated in derivative contracts related to interest rates. These contracts represent nearly $450 trillion of the outstanding gross volume in the OTC market, or 72.2%. These contracts also account for a big share of the transactions in Exchanges amounting to nearly $67 trillion, representing 85.1% of the Exchange market derivatives. There is however a difference on the specific type of contract that dominates across markets. In the case of the OTC markets, the main contract type is related to Interest Rate Swaps (IRS). IRS makes for 89% of the total interest rates related contracts. On the other hand, in the Exchanges the main contract type is tied to options on interest rates, representing 69% of the total volume.

Detailed information on the derivative exposure from OTC and Exchange Traded contracts for each specific participant is only available from the Office of the Comptroller of the Currency in the US. The Bank for International Settlements provides data on OTC derivatives exposures of dealers in the most relevant asset classes. Though the information does not incorporate the add-on exposure implications of marking to market, it still gives an approximate value of outstanding volumes. The overall gross exposure amount is calculated before netting and collateral, and grouped by each of the basic underlying asset classes (transaction categories).

Information for the exposure to the Repo market was collected from Central Banks websites in different countries. In the US the market capitalization for the Repo market has an estimate value of around USD $5 trillion, which is slightly above 30% of the US GDP. While the US Repo market is dominated by US Treasuries as the main collateral, other collaterals are also actively used such as bonds issued by government-sponsored agencies, agency mortgage-backed securities (MBS), and corporate bonds.

In Europe, the Repo market has been growing to reach more than $3 billion of market capitalization: 66% of collateral comes from central government bonds from the Euro area countries, 16% from other Euro area entities, and 12% from other OECD countries. German collateral represents 25% of the market, followed by Italian and French collateral.The UK Repo market is substantially smaller than its overseas equivalent in the US, with an estimated size of about $450 billion. In this case, gilts are the main collateral. Whereas maturities are evenly concentrated among shorter and longer than 1 month, repo markets

turnover of deals are highly concentrated in short maturities, with only 5% being longer than one month.

For the derivatives contract analysis, information from the US market was grouped into the same categories of major underlying assets used by the BIS. The analysis was performed using information for the US five biggest banks and a Dummy Bank, which summarizes the positions from the rest of US participants. Since US banks are the only ones with detailed information per transaction category, the model for non-US participants was modeled based on assumptions extrapolated from the US banks. The procedure was to spread the difference between the values for the whole world and the values for the US markets. The values for banks outside the US were spread across another five big dealers though they were not evenly distributed to each non-US dealer. Instead, the distribution followed the same ratios of the US banks. Using these assumptions all ten banks and the Dummy Bank were included in the model.

Therefore, the world exposure is assumed to be concentrated on the top ten dealers (banks) in the financial markets, with the remaining exposure being fragmented across the rest of the market participants. Table 2 shows the summary of the assumed market share per transaction for the 11 modeled entities.

Table 2. Assumptions on gross exposures of market participants (Millions of Dollars)

Underlying Asset	Contract Type	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Interest Rate	Futures and Swaps	51,007	30,197	35,188	23,176	2,275	60,128
Currency	Futures and Swaps	9,143	5,557	117	4,439	1,137	628
Equity	Futures and Swaps	361	633	192	144	64	75
Commodity	Futures and Swaps	324	3	6	27	33	526
Interest Rate	Options	9,852	3,260	4,330	6,143	426	15,290
Currency	Options	766	253	337	478	33	2,656
Equity	Options	1,020	338	448	636	44	1,509
Commodity	Options	399	132	175	249	17	331
Bonds	Repo Agreements	1,000	1,000	1,000	500	500	853
Bonds	Credit Protection	5,998	3,946	809	2,281	181	1,841
Various	Other	7,346	7,346	7,346	7,346	7,346	7,479
Underlying Asset	**Contract Type**	**Bank 7**	**Bank 8**	**Bank 9**	**Bank 10**	**Other**	**Total**
Interest Rate	Futures and Swaps	36,308	34,435	31,312	8,311	108,776	421,113
Currency	Futures and Swaps	379	360	327	87	17,628	39,802
Equity	Futures and Swaps	45	43	39	10	1,188	2,795
Commodity	Futures and Swaps	317	301	274	73	575	2,458
Interest Rate	Options	9,233	8,756	7,962	2,114	27,870	95,237
Currency	Options	1,604	1,521	1,383	367	3,770	13,168
Equity	Options	911	864	786	209	2,804	9,569
Commodity	Options	200	190	173	46	814	2,726
Bonds	Repo Agreements	515	488	444	118	1,932	8,350
Bonds	Credit Protection	1,112	1,055	959	255	14,257	32,693
Various	Other	4,516	4,283	3,895	1,034	15,520	73,456

Sources: Table 1 and authors' calculations

Volatility of the underlying assets was calculated using historical information of financial markets available from Bloomberg. A common characteristic of the analyzed indices was that the standard deviation (the statistical measurement of the volatility) was not uniform across time. Furthermore, during periods of financial distress, volatility drastically increased relative to periods of no distress. For example, Figure 3 shows how the CDS index volatility evolved during the financial turmoil of 2007 and 2008. The graph shows an increase of nearly 300% compared to the same period in the previous year and nearly 600% when compared to historical levels observed from 2005 onwards. From these numbers, the relevant observation is that the CCR exposure has a natural tendency of dramatically increasing at times of distress. This claim follows from the observation that in periods of distress volatility increases, and therefore the exposure to counterparties also increases due to wild swings in prices of the underlying securities.

Figure 3. CDS spreads for Government debt since 2004

Source: Bloomberg 19/08/2010

An estimation of the amount of CCR that transactions originate is based on the daily fluctuations of price of the underlying assets. A common statistic to characterize fluctuations is given by the standard deviation of the historical differences. The standard deviation is especially useful with fluctuations that follow the normal distribution, since this type of distribution may be described by this parameter. However, many financial variables show other types of distributions, and estimates near extreme values using the standard deviation approximation are not appropriate. For the extreme cases, a better approach is to use high percentiles based on the historical variation. The aim of this paper is to establish a value for the benefit from netting in financial markets. A reasonable assumption is that when a counterparty defaults the market gets into a distress situation. Therefore, instead of using the standard deviation as an input parameter for the calculations, the value used was based on the top 99% percentile of variation of the indices. Table 3 shows the result for the volatility (standard deviation) of the main assets used in the model.

Table 3. Volatilities for main underlying assets of derivative contracts

Asset	Volatility	95% Percentile	99% Percentile
Bonds	0.14%	0.22%	0.37%
GBPUSD	0.67%	1.10%	1.57%
EURUSD	0.63%	1.01%	1.62%
Commodities	2.10%	2.98%	3.26%
Equity	1.18%	1.93%	3.45%
Repo (Bond 30 days)	0.77%	1.20%	2.03%
Interest Rate	1.55%	1.94%	4.21%
Equity 6 month	12.40%	19.20%	29.30%
Bonds 6 month	2.00%	5.63%	7.55%
Commodities 6 month	13.30%	19.20%	24.00%
Currency	8.01%	12.80%	15.70%
CDS spreads	6.64%	8.33%	20.30%

Source: Bloomberg

4.2 CCR Estimates

For the scenario assuming no netting, the result for the overall exposure was calculated using the equations presented in the Methodology Section of this paper. In this case, the estimate for the lower bound of overall exposure was $22.173 trillion. Most of the risk is concentrated in interest rate related products, followed by currency related products, and exotic products.

The estimate for the scenario with bilateral netting assumes that close-out netting is available across all different asset classes. Since this is not always the case, the calculated value yields a figure for an optimized scenario that includes more netting benefits than the current situation. However, it reflects an estimate of the possible efficiencies that could be achieved by pure netting without the participation of central counterparties. For the described scenario where bilateral netting is possible the expected exposure is of $5.019 trillion. The scenario was modeled with an average correlation across assets of 0.2. The last crisis showed that during a distress situation, asset classes can behave in a more correlated way than in other times.

Comparing with the no netting scenario, it can be seen that the benefit from netting is of over $17 trillion, thus equivalent to 77% of the exposure under bilateral netting. In other words, if netting were suppressed, CCR exposure would increase by 77% as a consequence.

Sensitivity analysis shows that the aggregate exposure may vary from $3.756 trillion, assuming no correlations across assets, to an exposure of $6.466 trillion for a correlation of 0.5. In either case, the gain due to the possibility of bilateral netting is evident.

The final scenario that was modeled is the one including a unique CCP. For the calculation, the assumption is that the central counterparty would inherit all the outstanding contracts from the previous scenario. This is a best-case scenario, mostly theoretical, since in the real world a holistic central counterparty would not be feasible (Chance, 2010). However, the scenario may be examined as a reference to establish benefits from the use of a single central counterparty.The obtained value of CCR exposure with the central counterparty is $2.997 trillion. This value is 9% below the value with direct bilateral exposure.

Figure 4. CCR exposure under the three modeled scenarios (Trillions of Dollars)

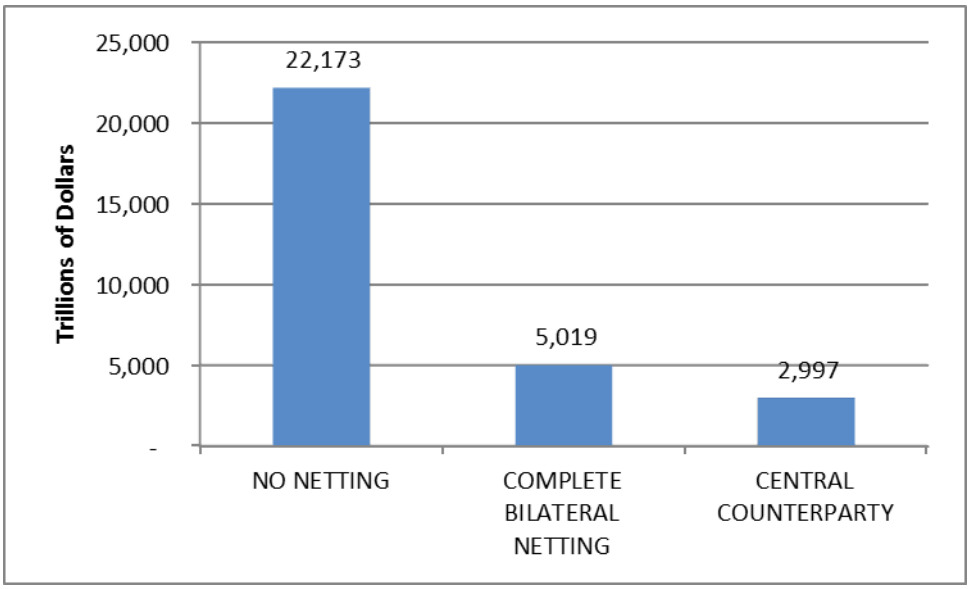


Figure 4 presents a summary of the results under the three scenarios. The lowest exposure is achieved with the CCP and close-out netting. The highest exposure is the one with no netting. Relative to the ideal scenario, the CCR increased exposure when shifting to a scenario with no netting is over $19 trillion.

5 Conclusions

This paper provides an estimate of the effect that close-out netting has on the counterparty credit exposure in financial markets. Results show that in a situation where bilateral netting would not be available as a tool to offset obligations between counterparties, CCR would increase by 77% compared to the netting situation, i.e., an increase of over $17 trillion compared to the current situation.

The paper also develops a theoretical scenario where all market transactions are cleared through one central counterparty. The objective is to capture the effect of increased netting possibilities across different counterparties due to the novation of all contracts between market participants to a CCP. The results suggest that further efficiencies would reduce the current exposure by approximately 9%.

The results suggest that current and future policies that encourage the use of central

counterparties are beneficial towards decreasing the amount of counterparty risk exposure. The context of this paper is related only to Central Counterparty efficiencies introduced by enhanced netting across market participants. Results of this research provide a broad estimate on the overall benefit that a central counterparty can bring into decreasing counterparty risk. Besides these specific results, central counterparties generate additional benefits for financial markets such as increasing transparency, improving information on transactions, and adding liquidity to markets (Segoviano and Singh, 2008).

Additionally, cross-margin and netting possibilities across product silos could be fostered. For example, allowing cross-compensation across market participants for the CDS, Repo, and other types of contracts. It is therefore important to foster a legal framework that enables cross-netting. At the same time, the technical details of pricing and margin adjustments across contract silos have to be further improved by market participants.

Despite the benefits that a compulsory use of a central counterparty can bring, some negative issues should also be carefully addressed. Irrespective of the efficiency achieved by centralized clearing of contracts, the resulting concentration of obligations on the same counterparty (the central counterparty) would be much higher than in normal circumstances. A central counterparty defaulting would immediately generate a domino effect. The biggest the central counterparty, the worse effect it could have. It is clear from the beginning that truly central counterparties would be born 'too big to fail.' Adequate structure, governance, regulation, and control of these institutions would be as important as financial and risk models.

Margining requirements for out-of-the-money contracts are the first line of defense for a clearing house to manage its risk. Contracts need to be marked to market prices daily (or even intraday under volatile situations) to guarantee that participants post the required collateral when the contract's value has declined. Careful attention should be devoted to the mechanisms and models to guarantee the adequate margining levels for all participants.

An adequate legal framework is the foundation for the benefits of netting or central clearing. Forward looking policies should strive to preserve and enhance the benefits of netting. For example, seeking standards across different legal jurisdictions that protect international market participants from legal gray zones or requirements seeking to encourage OTC activity to clearing houses support this path. On the other hand, policies that compromise benefits of netting could end up increasing systemic risk. For example, some authors suggest a review of legislation attempting to drive derivative transactions to be subject to the traditional bankruptcy procedures (Roe, 2010). These initiatives might end up making it difficult to enforce netting in some jurisdictions, thus increasing the systemic risk in the financial system.

Efforts to increase the use of clearing houses for settlement of OTC derivatives are welcomed. Much of the emphasis has been directed specifically at credit protection products, e.g., Credit Default Swaps. As an example, the ICE Trust funded in March 2009, is a clearing house sponsored by the major dealers that specializes in CDS products. Following Duffie and Zhu (2010), central clearing efforts should however be extended to all derivative types, increasing the overall efficiency and providing a safer trading environment for the financial system.

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THE PORTFOLIO RISK MANAGEMENT AND DIVERSIFICATION BENEFITS FROM THE SOUTH AFRICAN RAND CURRENCY INDEX (RAIN)

F.Y. Jordaan, J.H. Van Rooyen***

Abstract

This study attempts to explain the source of risk management and diversification benefits that investors may gain from the South African Rand Currency Index (RAIN) as it relates to an equity portfolio with stock market exposure (locally or international). These diversification benefits may result from the negative correlation between RAIN and the South African All Share Index (ALSI).
To explain and fully exploit the benefits of RAIN, the main variables that represent South Africa's trading partner equity and bond markets movements, were identified. To account for the interaction of RAIN with the ALSI, the latter was firstly decomposed into its economic groups and secondly into its various sub-sectors. Various analyses were carried out to determine which variables describe the relationship between the ALSI and RAIN.
The variables that describe the relationship with a high adjusted R^2, were identified. The findings suggest that when the ALSI is decomposed into its ten economic groups and thirty-seven sub-groups, the quadratic as opposed to linear models using response surface regressions, explained the majority of the variation in RAIN over the entire period. The linear models, however, explained more of the variation in RAIN during the recent 2008/2009 financial crisis.

Key words: RAIN, Unit-Root Tests, Co-Integration, Principal Component Factor Analysis, ALSI, Response Surface Regressions

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1 Introduction

Portfolio managers with large positions in stock or significant exposure to stock markets may identify financial products that can provide risk management benefits to their portfolios during periods of market uncertainty. These benefits, mainly usually diversification benefits where an instrument usually correlates negatively in the long-term with the JSE are sought. A financial product with such qualities was introduced on 8 November 2010 by the Johannesburg Stock Exchange (JSE) is the South African Rand Currency Index (RAIN). The RAIN is calculated as an inverse arithmetic trade-weighted rand currency index relative to South Africa's main trading partners (see Table 1 below). Due to the RAIN's inverse relationship with the trading partners, it may, apart from hedging benefits as a hedgeable instrument, also exhibit diversification benefits in relation to some sub-sectors listed on the JSE.

Table 1. The RAIN is inversely related to the rand value per foreign currency unit

Date	R/€	$/R	CNY/R	£/R	¥/R	RAIN
2006/01/02	R7,5013	R6,3422	R0,7859	R10,9109	R0,0538	10 680,33
2006/02/17	R7,1670	R6,0225	R0,7483	R10,4848	R0,0510	10 182,03
ZAR strengthens against all 5 currencies and the index goes down						
2008/10/22	R14,9784	R11,5650	R1,7046	R18,9508	R0,1193	21 339,82
ZAR weakens against all 5 currencies and the index goes up						

Understanding what affects the underlying RAIN exchange rates, can be used by a trader to accurately hedge. If the trader expects a decrease in the future value of the index, he may decide to, say, short ten index futures today and long the 10 futures of each of the underlying constituents of the RAIN index if it is assumed that he wants to hedge his currency position. Intuitively, the trader therefore expects the rand to

strengthen against the trading partner currencies. On closing out date, if the index did in fact decrease as expected, the profit is calculated as [10 x (index price on day 0 – index price on closing out date)]. The profits and losses of the individual contracts (in their respective ratios) should, given the new individual exchange rates on expiry date, equal the profit on the RAIN index, assuming no mispricing of any futures contracts.

Apart from the above where the trader wants to hedge his position, speculative profits can also be realized if a trader sets up an open short RAIN index futures position if a decrease in the index is expected. On closing out date, the trader will then close out the RAIN index future at the new lower spot price. The RAIN selling price minus the closing out price will leave the dealer with a profit due to an expected appreciation of the rand against the currencies of the main trading partners. This will then offset the currency loss where, say, income or funds from the sale of stock is converted from a foreign currency to rand. The number of contracts sold or longed will depend on the monetary value of the funds involved.

Apart from the hedging benefits, RAIN also, due to its negative correlation with the ALSI, may offer diversification benefits. This aspect of RAIN is dealt with in this research.

2 Objectives of the study

The main objectives of this study are to determine which equity markets and bond yield magnitudes are responsible for the negative correlation of RAIN relative to the ALSI around the recent period of market uncertainty. In addition to this, an attempt will also be made to determine the long-term co-integration and causality of RAIN.

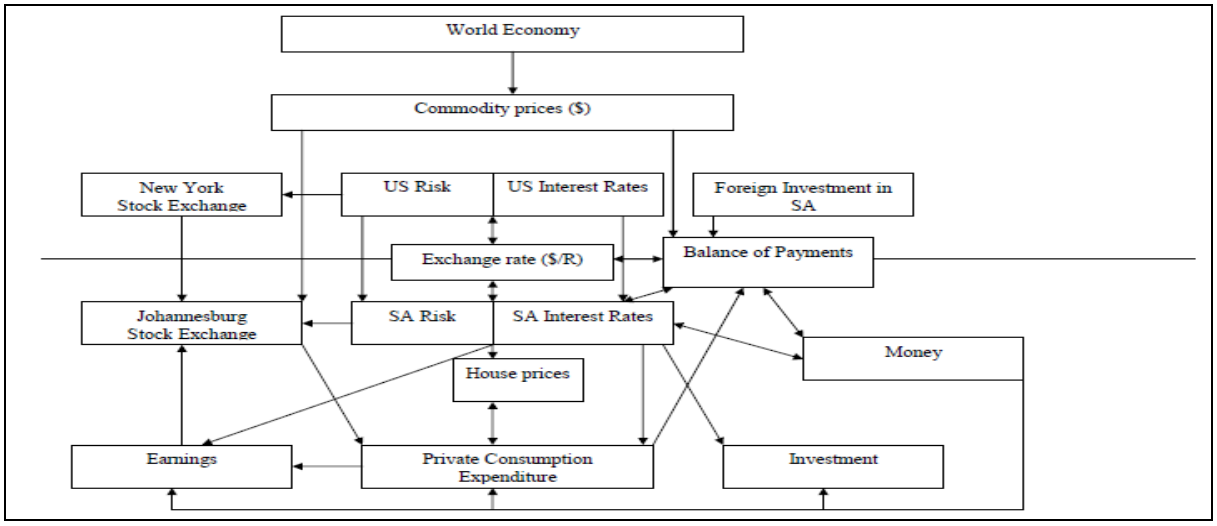
This study may have important benefits for investors, namely:

- Observing the effect of international bond and equity flows on RAIN may provide investors with valuable information on how to formulate a hedging strategy or trading strategy/framework with RAIN. Institutional investors with ALSI and global stock market exposure can hedge rand foreign currency exposure in relation to its main foreign trading partners.
- Investigating and understanding correlations during different economic cycles (especially during a financial crisis) may also contribute to a further understanding of market factors responsible for spurious correlations.

3 The relationship between the ALSI and other Bond and Equity Markets

To account for the interaction of RAIN with the ALSI, the latter is decomposed into the various economic groups and its numerous sub-sectors. This allows the correlation relationship between RAIN and ALSI to be studied over time complemented by the bond and equity flows of South Africa's main trading partners. Barr and Kantor (2002:6) provided one of the earlier econometric models of the South African Economy together with its various feedback loops (see Figure 1). It shows how SA risk and returns are impacted on by US cross border investment flows via the economy and eventually resulting in the ZAR/USD (and other) exchange rate levels. The levels of exchange rates in turn reflect the level of economic activity between SA and its trading partners.

Figure 1. Schematic Representation of the South African Economy with its Feedback Loops



Source: Barr and Kantor (2002:59) Source: JSE (2010b)

When studying the relationship between stock prices/stock indices and exchange rates, two theories may be considered. The first is the "goods market approach" introduced by Dornbusch and Fischer (1980) and the second is the "portfolio balance approach" introduced by Frankel (1993). These two approaches are used when developing models that account for change in macroeconomic variables such as exchange rates. All studies modeling the relationship between stock markets and the exchange rates influencing these stock markets incorporate one of the approaches mentioned above.

As the foreign currencies used in the RAIN cannot be used to explain changes in RAIN itself, other variables have to be used. Although not the only important variable, interest rates were used to explain the bond flows and exchange rates between South Africa and its different trading partners. Moolman (2003) used short term interest rates and yield spreads to predict turning points in the business cycles. Some conclusions that she made when including interest rates were that (1) it helps predict any structural breaks in the economy; (2) interest rate data is more readily available; (3) interest rates provide true change signals and (4) the prediction power of interest rates improves with an increase in the sample period. Moolman and Du Toit (2005) later developed a long-term intrinsic econometric model of the South African economy which accounted for the short-term fluctuations around the intrinsic value. They found that (1) interest rates; (2) the risk premium; (3) exchange rates and (4) foreign stock markets were mostly responsible for these short-term fluctuations around the intrinsic value.

Ocran (2010) studied the relationship between two price indices and the USD/ZAR exchange rate. These two indices included the Standard & Poor 500 Index and the ALSI index.

The construction and pricing of the RAIN is briefly dealt with next. RAIN is calculated as an inverse arithmetic trade-weighted average of South Africa's five trading partners' exchange rates. This inverse quotation of the South African Rand to the RAIN indicates that when the majority of the currencies (included in the RAIN) strengthen, the index declines and vice versa (JSE, 2010b). The formula used to calculate the RAIN at time t is shown below, from the rebalancing date at time T (JSE, 2010b):

$$RAIN_t = \sum_{i=1}^{N} SX_{i,t} \times ContZ_i \times NCont_i \qquad (1)$$

$SX_{i,\,t}$ is the spot exchange rate of currency i at time t. $ContZ_i$ is the number of currency units traded for each futures contract. The more actively traded a currency, the smaller the contract size. This small contract size also serves as a trading incentive in the retail sector. For example, the contract sizes of the EURO, USD and GBP are 1, 000. Whereas for CHY the contract size is 10 000 and for JPY the contract size is 10 000 (JSE, 2010b). The formula used to calculate the number of contracts traded ($NCont_i$) is shown below (JSE (2010b**)**:

$$NCont_i = \frac{(RAIN_T \times W_{i,T})}{SX_{i,T} \times ContZ_i} \qquad (2)$$

$RAIN_T$ is the currency index at rebalancing date, usually at year end. $W_{i,\,t}$ is the weights in the index, calculated based on imports and exports of each trading partner with South Africa. $SX_{i,T}$ is the spot exchange rates of the trading partners of South Africa at rebalancing date (JSE, 2010a; c). On consultation with market participants, it became clear that it was more appropriate to use arithmetic rather than a geometric weighting approach. This weighting approach allows investors using the RAIN as a hedging instrument to enter into static hedge positions in contrast to dynamic hedge positions[2]. Some reasons mentioned by the JSE (2010, a; b) for using RAIN include:

1. It can be used to measure international financial pressure on the South African Rand using RAIN to match a portfolio or basket of foreign currencies.
2. It can be used as a measure of the volatility of the South African Rand versus its prominent international trading partners.

4 Research Methodology

In this research an attempt is made to explain or determine the variables responsible for the negative correlation of the RAIN with the ALSI. In order to achieve this objective, the ALSI has been decomposed into the main economic currency groups and each group further decomposed into the main sub-sectors. This decomposition was used in conjunction with the bond and equity flows of South Africa's main trading partners.

The two primary variables tested in this study is the relationship between the ALSI and RAIN during three time periods shown in Table 2 below.

[2] See Thong (1996) for a detailed examination of dynamic hedging.

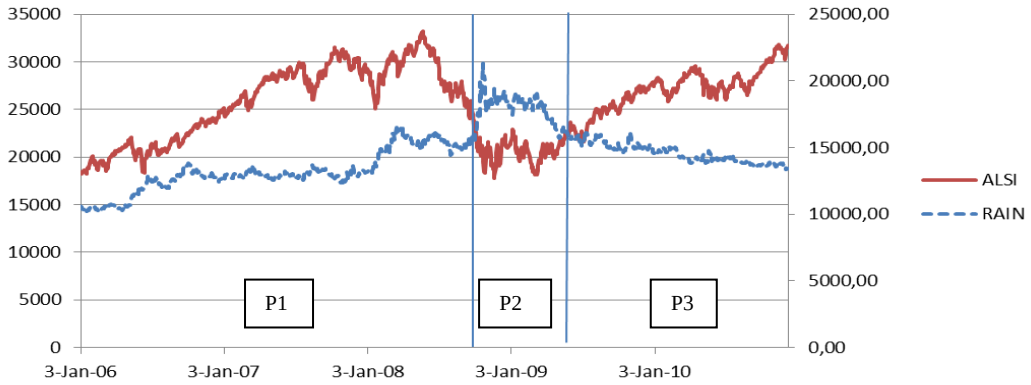
Table 2. Time Periods Chosen in this Study

Date of Time period	Variable Name in each Period
03 January 2006 – 23 October 2008	P1
23 October 2008 - 23 October 2009	P2
23 October 2009 – 17 December 2010	P3

These time periods were selected from the intersection of RAIN with the ALSI as indicated in Figure 2 below. A reason for the stratification of the data into the time periods is to account for shocks in the market and to analyze which sub-sectors of the ALSI strengthen or weaken in relation to the RAIN. Daily ALSI data were obtained from the McGregor BFA (2005) database, while daily RAIN data were obtained from the JSE (2010c).

The first set of variables used in this study was the ALSI decomposed into ten economic groups. The ALSI is also affected by international equity and bond flows. As a result of the RAIN computation, the equity and bond flows of South Africa's five main trading partners were also included in this study, together with the ten economic groups. The second set of variables included was the further decomposition of the ALSI into thirty-four ALSI sub-sectors with three additional sub-sectors. These sub-sectors were also included with the bond and equity flows of South Africa's main trading partners. For data sets P1 and P2, the five main trading partners include: USA, UK, Europe, China and Japan.

Figure 2. Relationship between ALSI and RAIN before, during and after the financial crisis



Source: McGregor (2005); JSE (2010c)

Daily data on the economic groups and sub-sectors comprising of the all share index as well as data on the bond and equity flows were obtained from Inet-bridge. Data were collected for each time period as shown in Table 2. Due to data limitations, J151, J376, J863, J867 and J957 were not included. As a proxy for the bond flows of South Africa's five trading partners, the three month LIBOR rate of each trading partner was used. Some advantages of using these three month yield curves include: (1) These rates are reflective of current economic conditions, in contrast to longer term yields; (2) The cumulative biases of issuers could be removed; (3) These yields are more actively traded than the R153 bond; (4) The bond yields are the most significant variable affecting bond indices. As no three month LIBOR market is created for South Africa and China, the three month JIBAR was used for the former and the short term Chinese interest rate for the latter.

The vast array of variables comprising of international equity and bond flows from South Africa's trading partners which affect the ALSI has resulted in multi-collinearity problems. To overcome these problems and identify significant variables affecting RAIN, principal component factor analyses[3], correlation matrices with significant p-values, cluster analysis (Ward's Method with 1-Pearsons correlation coefficient) and lastly multi-explanatory sub group analyses were used.

In all three sets of variables tested on RAIN, response surface regressions with multi-explanatory forward stepwise characteristics were used to identify the quadratic and interaction amongst variables. This has been compared to the linear regressions with multi-explanatory forward stepwise characteristics and the model with the highest R^2 was chosen.

Once the appropriate model was selected, unit-root tests and co-integration tests were carried out on the All Groups samples from the interaction of firstly, the economic groups and secondly the sub-groups.

[3] Refer to Eichler, Motta and Sachs (2011) for an approach to fit dynamic factor analysis on non-stationary time-series data.

This was done to determine if positive or negative long-term correlation relationships exist. Where long-term relationships exist, both models were fitted on the error terms of the regressions.

5 Research findings

In Figure 2, three periods (P1 to P3) were identified around the sub-prime financial crisis as a lot of market uncertainty existed during this period. From the Figure 2, it is evident that the RAIN predicts the financial crisis with a sharp increase during period two (P2) and the RAIN intersects with the ALSI in 2008. Hereafter, the RAIN intersects the ALSI again in period 3 (P3) and reverts back to its mean value of around 15 000 points thereafter.

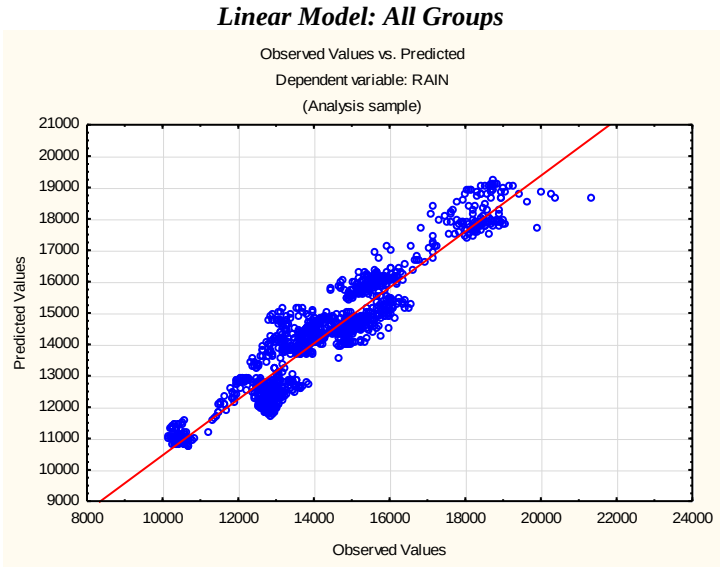
Using the approaches mentioned before, the variables were identified for all groups as shown in Table 3 below. The highest eigenvalue was selected from each factor using principal component analysis. By selecting the highest eigenvalue from each factor, the problem of multi-collinearity could be overcome. Due to the interaction amongst the various equity markets, response surface regressions with multi-explanatory forward stepwise characteristics were used to account for interaction of explanatory variables and their quadratics terms. Table 3 below compares the linear and quadratic models. The model with the higher adjusted R^2 was selected. The multi-explanatory forward stepwise characteristics removed the interaction terms which were not significant. This approach was repeated for periods P1 to P3 (see Tables 3 to 7 below).

Table 3. Variables Affecting the RAIN and Economic Groups: All Groups

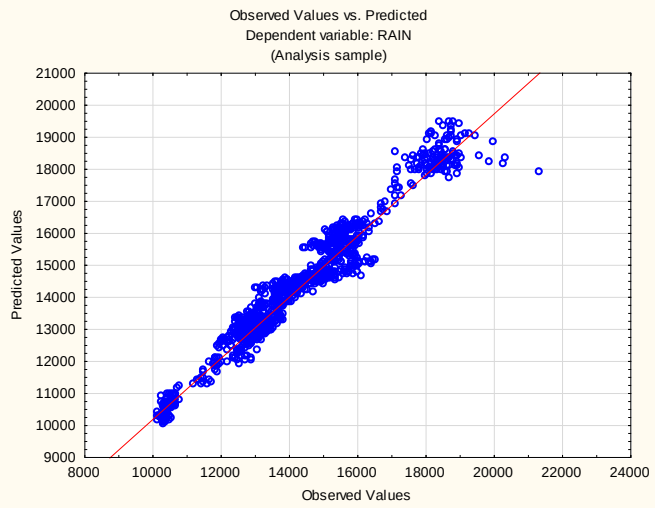
Economic Groups Variable Code: All Groups (Linear)		**Linear Model**		**Economic Groups Variable Code: All Groups (Quadratic)**			**Quadratic Model**	
Variable	**Factor**	**Variable**	**Value**	**Variables**			**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	FTSMC*J530	NK300*LJPY3M		
FTSMC	1	Multiple R^2	0.89134	FTSMC	J530*J500	J520*LJPY3M	Multiple R^2	0.954165
J530 OR DJCBI	2	Adjusted R^2	**0.89081**	FTSMC^2	J530*NK300	-	Adjusted R^2	**0.953604**
J500 OR JIBAR3M	3	SS Model	4.55952	J530	J500*NK300	-	SS Model	4.880898
NK300	4	SS Residual	5558364	J530^2	FTSMC*J520	-	SS Residual	2344633
J520	5	F	1687.083	J500	J500*J520	-	F	1700.081
LJPY3M OR LEUR3M	6	P	0.00	LJPY3M	J530*LJPY3M	-	P	0.00

Figure 2 below graphically compares the observed values in relation to the predicted values of both the linear and quadratic models. From the figure it can be seen that the data points were more scattered in the case of the linear model and more clustered around the line in the case of the quadratic model. The quadratic model therefore suggests a better fit with more explanatory power.

Figure 2. Observed versus Predicted RAIN Errors: All Groups (Economic Groups of the JSE)



Quadratic Model: All Groups



The variables identified under the quadratic model were substituted into the E-views software program which provided the regression output as shown in Table 4 below.

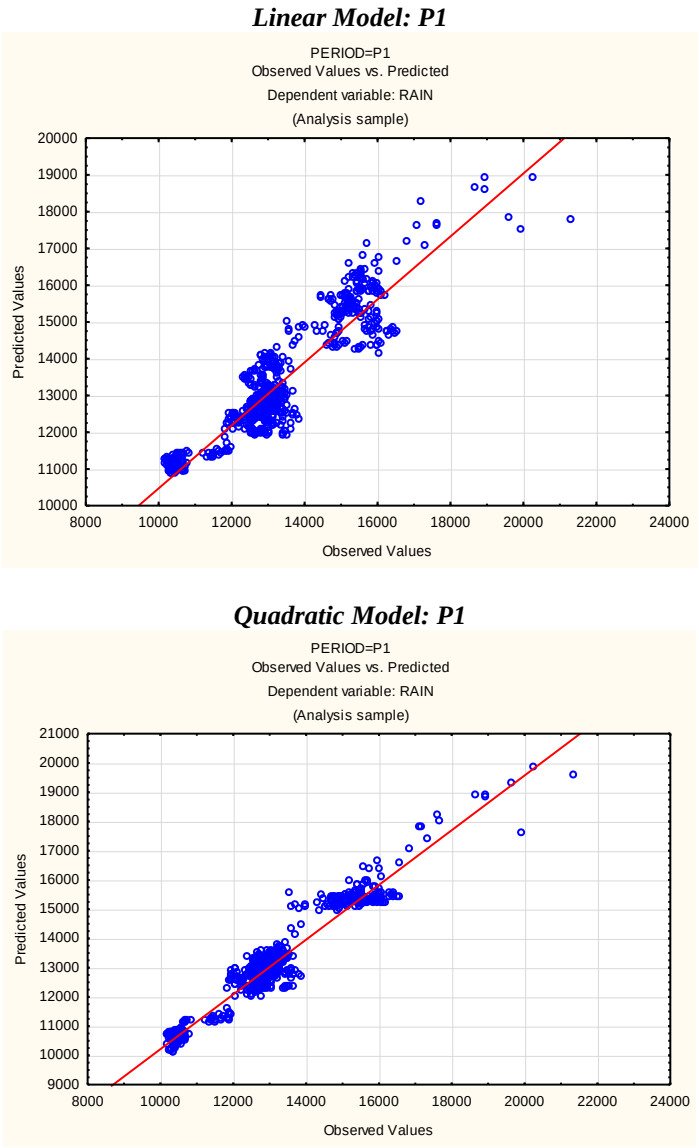
Firstly, it was tested if the variables identified were co-integrated with RAIN. These residuals were found to fluctuate around the mean of 0 with the residuals or error terms not being rejected, thus co-integrating with RAIN. Secondly, a model was needed that investors could apply to period P1 to P3 when considering the interaction of RAIN with the economic groups or sub-groups of the ALSI. For this model to be identified, the residuals underlying the model must be white noise estimates. When analyzing the error terms, it was found that an AR (1), AR (6) and AR (7) could be fitted to the residuals to provide white noise estimates. This resulted in a R^2 of 0.99 and a Durbin-Watson of 2.05. Thus, serial correlation was not a problem in this model. Other models were also considered and tested on the error terms. The first of these was moving average terms, due to the high AR (n) terms. The second of these was an ARCH/GARCH (1, 1) model. Both were found to be insignificant with the GARCH (1, 1) model providing a negative coefficient which was also a signal of an over fitted model. This illustrated that the fitted AR (1), an AR (6) and AR (7) models on the error terms were the most significant.

For periods P1 to P3 below, the most significant variables were identified together with the degree of variation explained by the linear versus quadratic models. Lastly, models were also tested for co-integration with RAIN. Co-integrated will allow investors to fit models to the error terms during similar periods for forecasting purposes.

Table 4. Variables Affecting the RAIN and Economic Groups: P1

Economic Groups Variable Code: P1 (Linear)		**Linear Model**		**Economic Groups Variable Code: P1 (Quadratic)**		**Quadratic Model**	
Variable	**Factor**	**Variable**	**Value**	**Variables**		**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	J590		-
FCAC40	1	Multiple R^2	0.856	FCAC40	J590^2	Multiple R^2	0.967
JIBAR3M	2	Adjusted R^2	**0.855**	FCAC40^2	FCAC40*JIBAR3M	Adjusted R^2	**0.9357**
VIXI	3	SS Model	1.959	JIBAR3M	FCAC40*VIXI	SS Model	1.794
DJTRPI	4	SS Residual	134497070	JIBAR3M^2	VIXI*DJTRPI	SS Residual	299909
J590	5	F	832.6778	VIXI	VIXI*J590	F	771.015
-	6	P	0.00	VIXI^2	DJTRPI*VIXI	P	0.00

Figure 3. Observed versus Predicted RAIN Errors: P1



In period 2, the linear model contains two different variables under factor 5. The reason for this is that the principal component factor analysis provides two variables with high eigenvalues. These two variables are DJUTLI (Dow Jones Utilities Index) and SAPSML (S & P: Small Cap Index). The identification of these two linear variables under factor 5 resulted in the response surface regressions providing different interaction and quadratic terms for P2(1) and P2(2) as shown in Table 5 and 6 below.

Table 5. Variables Affecting the RAIN and Economic Groups: P2 (1)

Economic Groups Variable Code: P2 (Linear)		**Linear Model**		**Economic Groups Variable Code: P2 (Quadratic)**		**Quadratic Model**	
Variable	**Factor**	**Variable**	**Value**	**Variables**		**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	NK300*J500		
FCAC40	1	Multiple R^2	0.9068	LEUR3M	DJUTLI*J500	Multiple R^2	0.916505
LEUR3M	2	Adjusted R^2	**0.9049**	FCAC40*LEUREM	-	Adjusted R^2	**0.914079**
R157	3	SS Model	5128937	FCAC40*R157	-	SS Model	518361937
NK300	4	SS Residual	52692044	LEUR3M*DJUTLI	-	SS Residual	47223842
DJUTLI	5	F	473.0626	NK300*DJUTLI	-	F	377.9121
J500	6	P	0.00	LEUR3M*J500	-	P	0.00

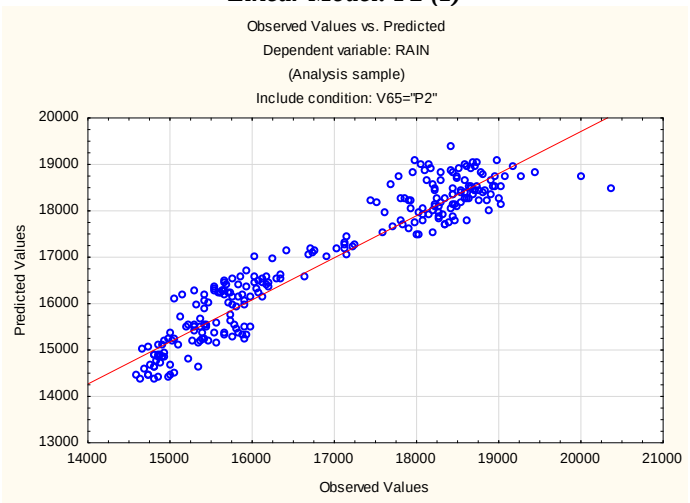
Table 6. Variables Affecting the RAIN and Economic Groups: P2 (2)

Economic Groups Variable Code: P2 (Linear)		Linear Model		Economic Groups Variable Code: P2 (Quadratic)	Quadratic Model	
Variable	**Factor**	**Variable**	**Value**	**Variables**	**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT		
FCAC40	1	Multiple R^2	0.912455	LEUR3M	Multiple R^2	0.916894
LEUR3M	2	Adjusted R^2	0.910284	FCAC40*LEUREM	Adjusted R^2	**0.914834**
R157	3	SS Model	86011900	FCAC40*R157	SS Model	518582405
NK300	4	SS Residual	49514378	LEUR3M*J500	SS Residual	47003375
SAPSML	5	F	420.3805	LEUR3M*SAPSML	F	444.9927
J500	6	P	0.00	NK300*SAPSML	P	0.00

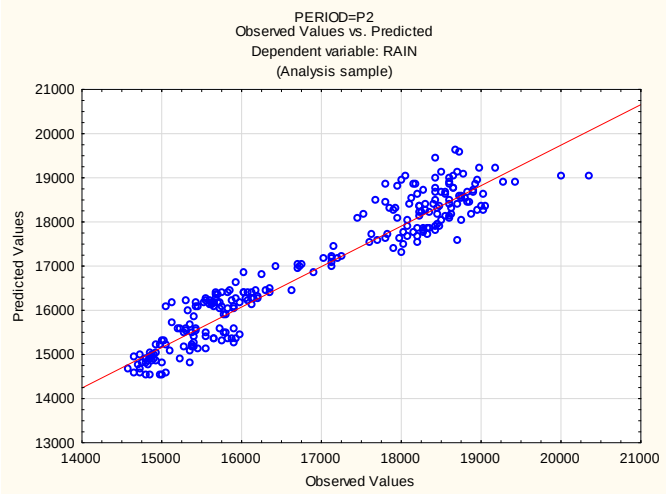
This effect of the different variables identified in explaining RAIN is shown below in figure 4.

Figure 4. Observed versus Predicted RAIN Errors: P2 (1) and P 2(2)

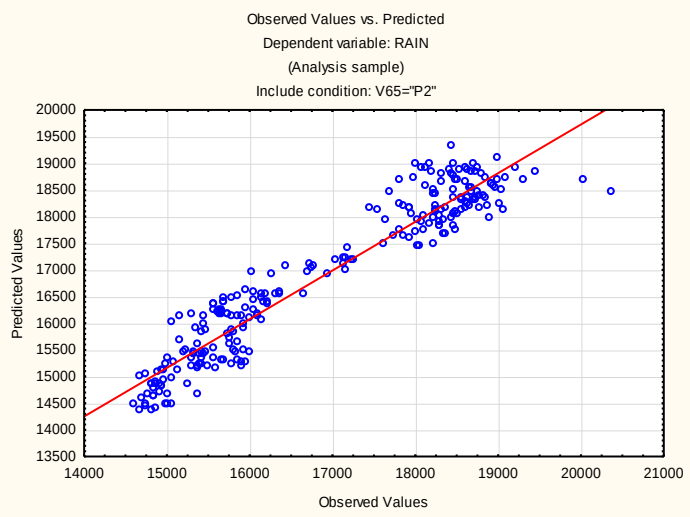
Linear Model: P2 (1)



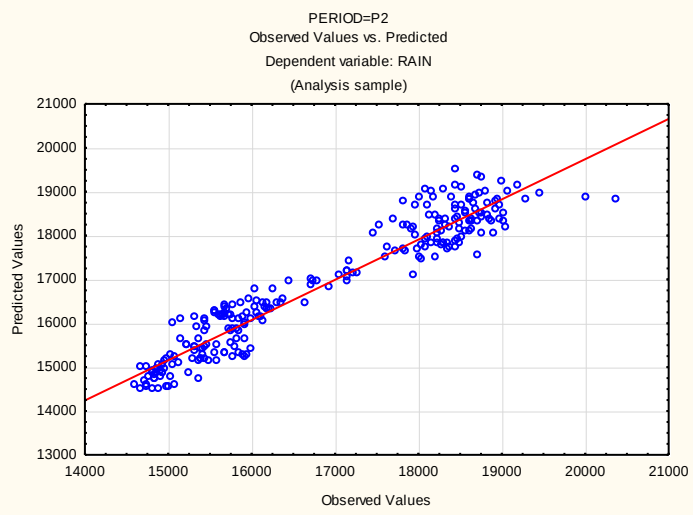
Quadratic Model: P2 (1)



Linear Model: P2 (2)



Quadratic Model: P2 (2)

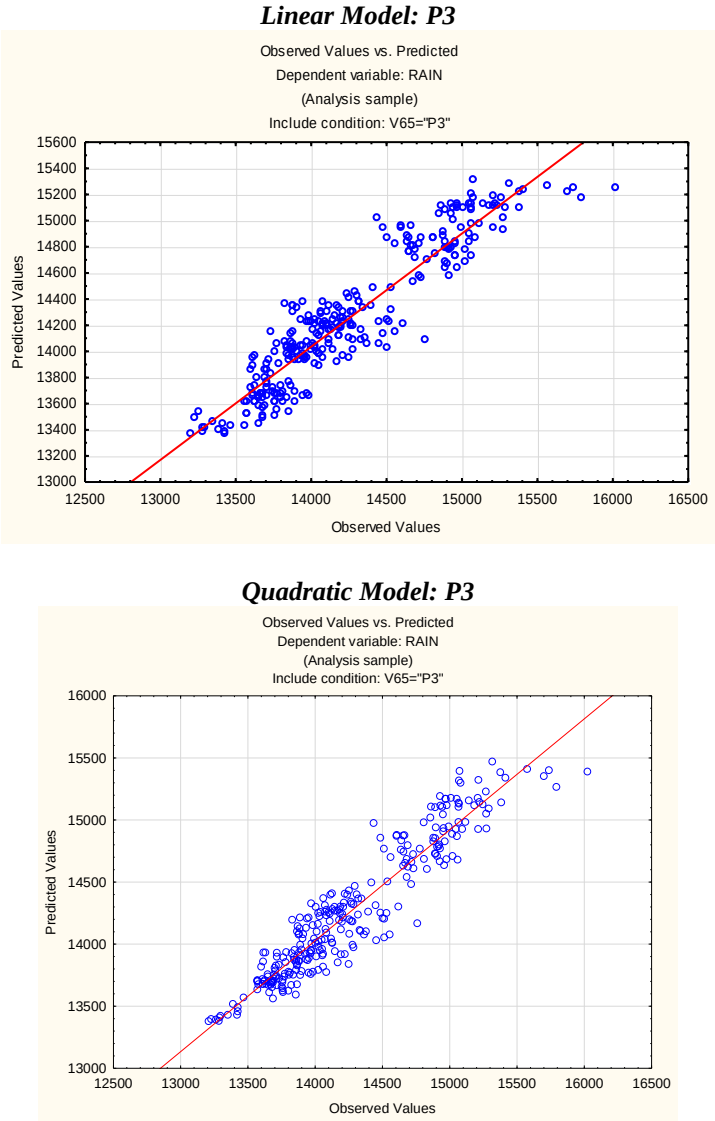


From Table 7 and 8, it can be seen that there is approximately a 1% increase when a quadratic model with interaction terms is used opposed to a linear model. When examining this visually, there is a small improvement in the error terms. There are, however, two periods when the data clusters as shown in Figure 4 above. The variables identified during period P3 are also shown below, with the observed and predicted rain errors.

Table 7. Variables Affecting the RAIN and Economic Groups: P3

Economic Groups Variable Code: P3 (Linear)		**Linear Model:**		**Economic Groups Variable Code: P3 (Quadratic)**	**Quadratic Model**	
Variable	**Factor**	**Variable**	**Value**	**Variables**	**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	-	-
SAPMID	1	Multiple R^2	0.86034	SAPMID	Multiple R^2	0.893622
CNSHI	2	Adjusted R^2	**0.863675**	DJCBI	Adjusted R^2	**0.891366**
DJCBI	3	SS Model	7856631	J500^2	SS Model	81069135
J500	4	SS Residual	12153402	SAPMID*DJCBI	SS Residual	9650598
DJUTLI	5	F	367.1867	SAPMID*J500	F	396.2201
-	6	P	0.00	CNSHI*DJUTLI	P	0.00

Figure 5. Observed versus Predicted RAIN Errors: P3



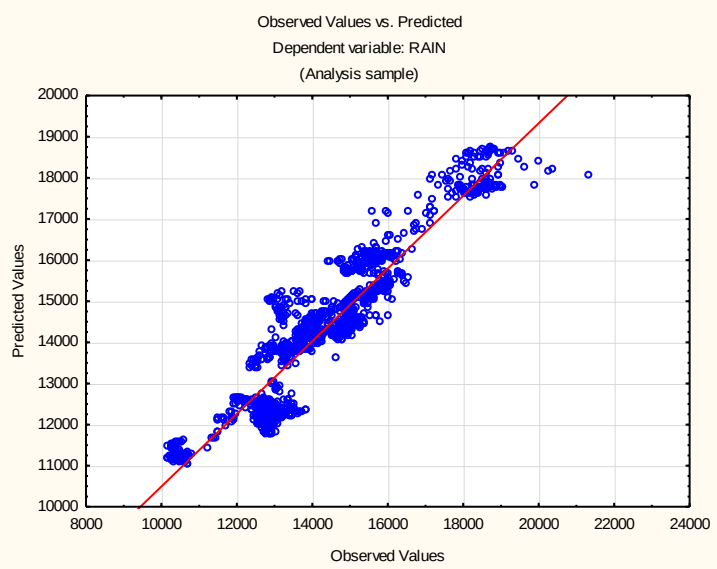
When considering the interaction of RAIN with the ALSI sub-groups over the entire time period, four factors were identified, namely FTSMC (FTSE Small Cap Ex Investment Trusts), J272 (FTSE/JSE:AFR General Industrial Sector), J177 (FTSE/JSE:AFR Mining Sector) and LJPY3M (3 Month Libor Rate: Japan). Using response surface regressions, the interaction amongst these variables were also identified in Table 8 below. This has been provided together with the observed and predicted rain errors for all the groups of RAIN in Figure 6.

Table 8. Variables Affecting the RAIN and Sub-Groups: All Groups

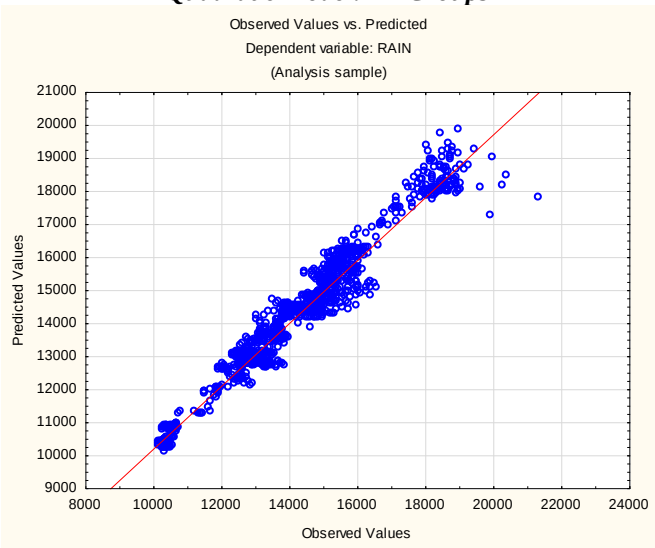
Sub-sectors Variable Code: All Groups (Linear)		**Linear Model:**		**Sub-sectors Variable Code: All Groups (Quadratic)**			**Quadratic Model**	
Variable	**Factor**	**Variable**	**Value**	**Variables**			**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	LJPY3M	J177*LJPY3M		
FTSMC	1	Multiple R^2	0.882993	FTSMC	LJPY3M^2	-	Multiple R^2	0.951298
J272	2	Adjusted R^2	**0.882614**	FTSMC^2	FTSMC*J272	-	Adjusted R^2	**0.951298**
J177	3	SS Model	4.516826	J272	FTSMC*J177	-	SS Model	4.868844
LJPY3M	4	SS Residual	598534767	J272^2	J272*J177	-	SS Residual	246517210
-	5	F	2331.860	J177	FTSMC*LJPY3M	-	F	1864.145
-	6	P	0.00	J17^2	J272*LJPY3M	-	P	0.00

Figure 6. Observed versus Predicted RAIN Errors: All Sub-sectors (Sub-sectors of the JSE)

Linear Model: All Groups



Quadratic Model: All Groups



A model has been fitted to the RAIN error estimates of the quadratic model as opposed to the linear model as a result of the high R^2. To find a model that fits, the error terms must be white noise estimates. Firstly, AR (n) estimates have been regressed on the residual series created from the co-integrated errors of the explanatory variables identified to explain RAIN. AR (1), AR (3), AR (5), AR (6) and AR (7) terms were found to be significant at a 5 % level of significance, which were then fitted to the error terms. Hereafter, the AR (N) terms identified as significant are applied to the original explanatory variables identified. This resulted in several explanatory variables being excluded as well as AR (5) and AR (7). The end model with the interaction shown below has a Durban Watson statistic of 1.97 and a R^2 of 0.99. This showed that autocorrelation was not a problem.

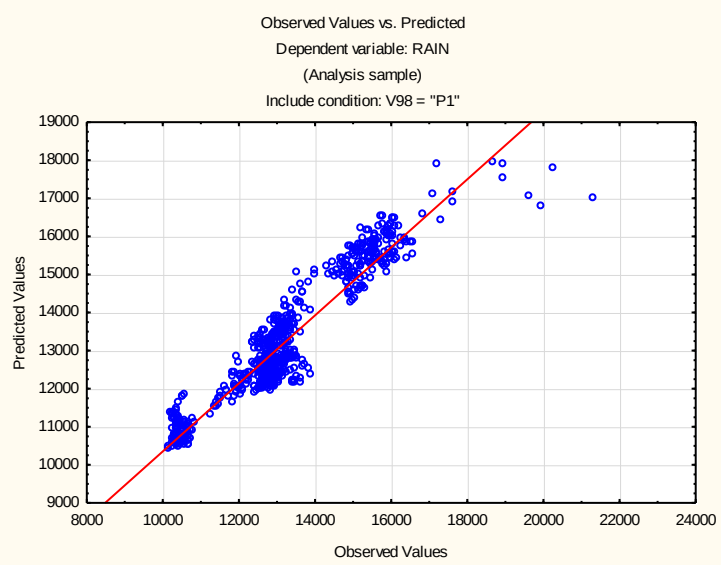
The variables identified during periods P1 to P3 with the interaction of the ALSI sub-sectors and RAIN have been shown in Table 9 to 11. For each of these periods, the observed versus the predicted errors have been shown graphically (Figure 7 to 9) under both the linear and quadratic models.

Table 9. Variables Affecting the RAIN and Sub-Groups: P1

Sub-sectors Variable Code: P1 (Linear)		Linear Model		Sub-sectors Variable Code: P1 (Quadratic)			Quadratic Model	
Variable	**Factor**	**Variable**	**Value**	**Variables**			**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	VIXI	JIBAR3M*VIXI	-	-
FCAC40	1	Multiple R^2	0.892746	FCAC40	VIXI^2	DJTRPI*VIXI	Multiple R^2	0.952385
JIBAR3M	2	Adjusted R^2	**0.891975**	FCAC40^2	FCAC40*JIBAR3M		Adjusted R^2	**0.951344**
DJTRPI	3	SS Model	1.869347	JIBAR3M	JIBAR3M*DJTRPI		SS Model	1.994229
J457	4	SS Residual	224583299	JIBAR3M^2	FCAC40*J457		SS Residual	99701953
VIXI	5	F	1158.649	J457	JIBAR3M*J457		F	914.7537
-	6	P	0.00	J457^2	FCAC40*VIXI		P	0.00

Figure 7. Observed versus Predicted RAIN Errors: P1 of Sub-sectors

Linear Model: P1



Quadratic Model: P1

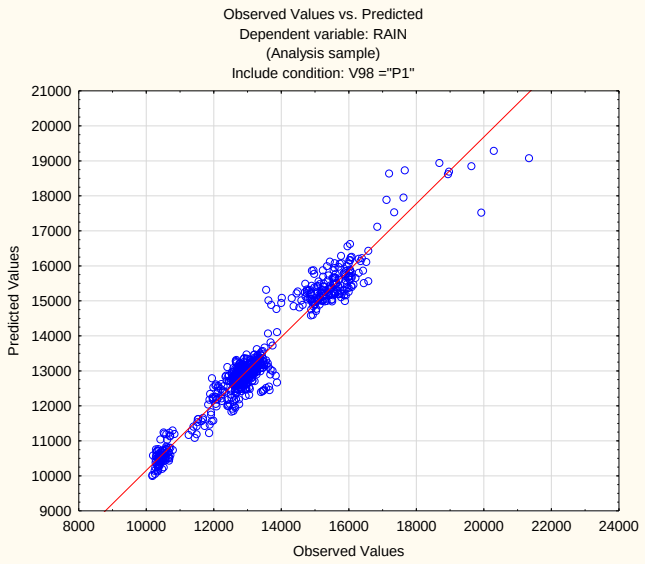
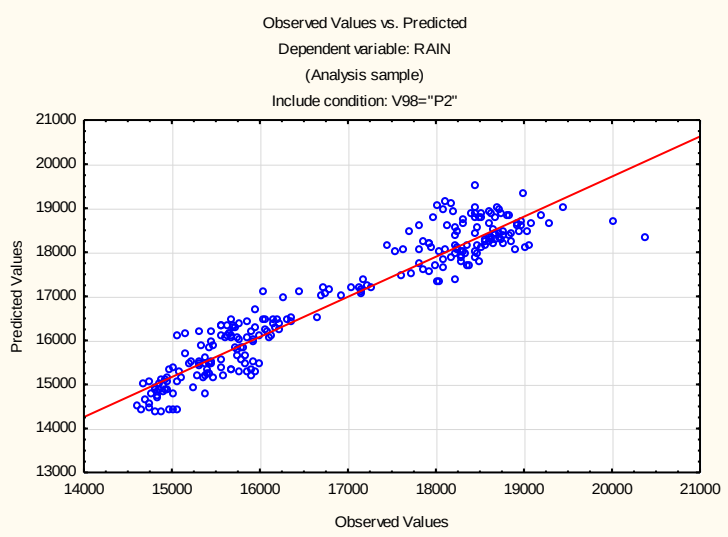


Table 10. Variables Affecting the RAIN and Sub-Groups: P2

Sub-sectors Variable Code: P2 (Linear)		Linear Model:		Sub-sectors Variable Code: P2 (Quadratic)	Quadratic Model	
Variable	**Factor**	**Variable**	**Value**	**Variables**	**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	-	-
FCAC40	1	Multiple R^2	0.910154	LEUR3M	Multiple R^2	0.907330
LEUR3M	2	Adjusted R^2	**0.908306**	FCAC40*R157	Adjusted R^2	**0.905811**
R157	3	SS Model	514770378	LEUR3M*SAPSML	SS Model	513172888
NK300	4	SS Residual	50815402	NK300*SAPSML	SS Residual	52412892
SAPSML	5	F	492.3279	-	F	597.2490
-	6	P	0.00	-	P	0.00

Figure 8. Observed versus Predicted RAIN Errors: P2 of Sub-sectors

Linear Model: P2



Quadratic Model: P2

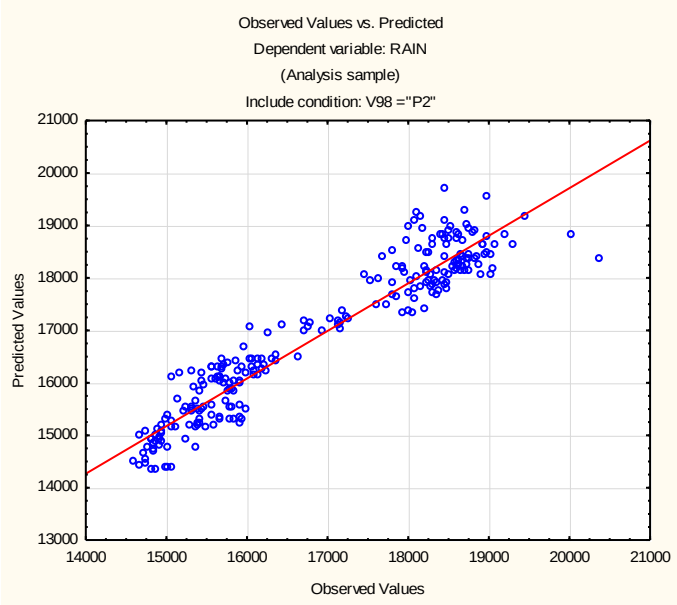
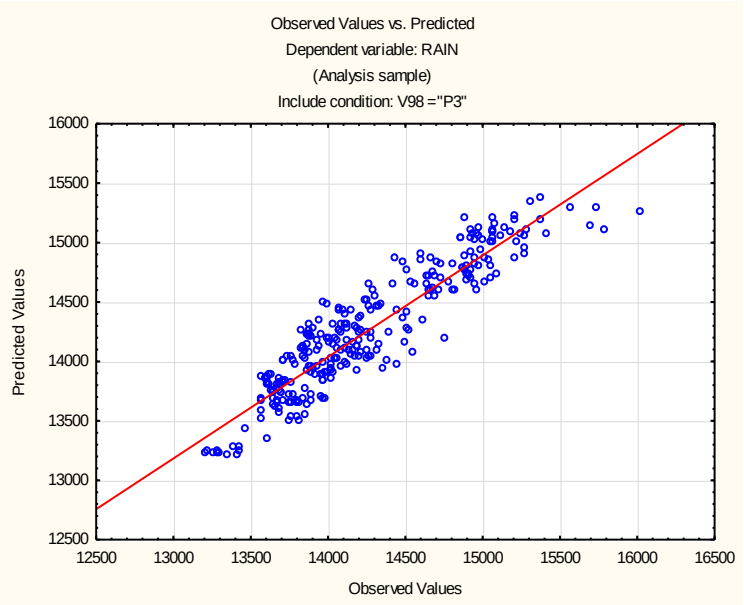


Table 11. Variables Affecting the RAIN and Sub-Groups: P3

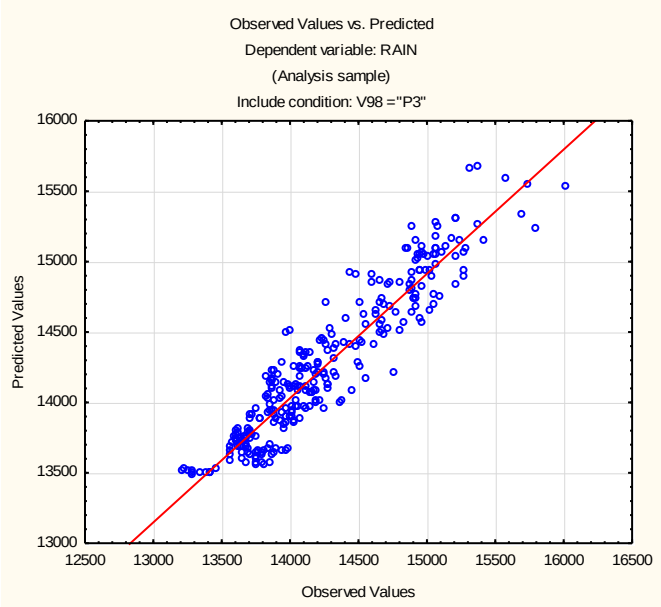
Sub-sectors Variable Code: P3 (Linear)		Linear Model:		Sub-sectors Variable Code: P3 (Quadratic)	Quadratic Model	
Variable	**Factor**	**Variable**	**Value**	**Variables**	**Variable**	**Value**
INTERCEPT	0	-	-	INTERCEPT	-	-
MDAXI	1	Multiple R^2	0.854096	MDAXI	Multiple R^2	0.883003
CNSHI	2	Adjusted R^2	**0.852048**	MDAXI^2	Adjusted R^2	**0.881361**
FJAP	3	SS Model	77483357	CNSHI	SS Model	80105820
J150	4	SS Residual	13236376	CNSHI^2	SS Residual	10613913
-	5	F	417.0846	-	F	537.7413
-	6	P	0.00	-	P	0.00

Figure 9. Observed versus Predicted RAIN Errors: P3 of Sub-sectors

Linear Model: P3



Quadratic Model: P3



6 Summary and conclusions

In this study, the equity and bond market variables of South Africa's main trading partners which could have an effect on the RAIN, were identified. To try and account for South Africa's interaction with these international bond and equity markets, the ALSI was firstly decomposed into its ten economic groups and secondly into its sub-sectors. This decomposition was used to identify the variables which may significantly affect RAIN during the three economic periods (P1 to P3) identified for the sake of this research (see Table 1). An advantage of this approach is that any macroeconomic shocks could be accounted for especially also due to the use of interest rates as one of the independent variables. In each of these periods, both linear and quadratic regression equations were fitted to the data.

As a result of the high adjusted R^2, the quadratic model was chosen (as opposed to the linear model) for the All Groups sample periods. Hereafter, a model was fitted on the error terms from all the groups sample regression equations (All Groups refer to all periods P1 to P3). The eventual model is shown in Appendix 2 and 3 with the explanatory variables shown in Tables 12 and 13 below.

Table 12. Variables Identified for Economic Groups: All Groups

Variables Identified	Coefficient	Standard Errors	T-Statistic	P-Values
FTSMC	4.074443	1.005701	4.051345	0.0001
FTSMC^2	-0.000675	0.000159	-4.246801	0.0000
LJPY3M	-2655.291	783.0269	-3.391060	0.0007
J500*NK300	-4.39E-05	9.07E-06	-4.840687	0.0000
J530*LJPY3M	0.159823	0.035133	4.549124	0.0000
NK300*LJPY3M	1.2333301	0.254029	4.854964	0.0000

Table 13. Variables Identified for Sub-Sector Groups: All Groups

Variables Identified	Coefficient	Standard Errors	T-Statistic	P-Values
FTSMC	4.416587	1.102378	4.006417	0.0001
FTSMC^2	-0.000816	0.000161	-5.054682	0.0000
LJPY3M	-3842.495	1547.382	-2.483223	0.0132
FTSMC*LJPY3M	1.507796	0.512652	2.941170	0.0033

From the tables above, the variables that may explain the effect of SA's main trading partner's equity and bond movement on the JSE, were identified as FTSMC, FTSMC^2, LJPY3M, J500*NK300, J530*LJPY3M. The variables that may explain all groups and sub-sector groups are FTSMC, FTSMC^2, LJPY3M AND FTSMC*LJPY3M. From the tables is it clear that the linear variables provide larger coefficients than the quadratic and interaction variables. For instance, for a one unit increase in FTSMC, RAIN increases by 4.07 units.

For each of the economic periods, the explanatory variables have been identified. In P1, the ALSI was in an upswing phase or bull market with any variations in the ALSI being negatively related to RAIN. Table 14 compares the adjusted R^2 of the linear and quadratic models fitted for each time period and shows that the quadratic models explain more of the variation in RAIN during P1.

Table 14. Comparisons of Adjusted R^2

Adjusted R^2 of Different Models				
Period	**Economic Groups**		**Sub-sectors**	
	Linear	**Quadratic**	**Linear**	**Quadratic**
All Groups	0.8908	0.9536	0.882614	0.951298
P1	0.855	0.9357	0.89197	0.951344
P2 (1)	**0.9049**	**0.91407**	**0.908306**	**0.905811**
P2 (2)	**0.91028**	**0.91483**		
P3	0.86367	0.891366	0.852048	0.881361

P2 on the other hand was characterized by the financial crisis. During this period, there was a negative correlation between RAIN and the ALSI. This may provide hedging benefits to investors that included the tradable RAIN in the portfolios that contained stock market exposure. Another advantage of studying the RAIN in relation to the ALSI is the leading indicator ability of RAIN that may be used to

predict periods of extreme market uncertainty. This may be possible due to intersection of RAIN with the ALSI as shown in Figure 1. Table 14 shows that the adjusted R^2 of the linear and quadratic models are similar. A possible reason why they are similar is that the interactions amongst variables in quadratic regression equations break down to such an extent that when economic groups or sub-sectors are used as interaction variables of JSE with RAIN, it does not matter if linear or quadratic models are used. Investors can therefore use linear models to explain and predict variations in RAIN. In period P2, two variables were considered, namely P2(1) and P2(2) in order to reduce selection bias. A possible limitation introduced in this study is selection bias, interpretation of factorials in factor analysis with the highest eigenvalue. The variables selected under P(1) are DJUTLI as factor 5 and the SAPSML in P(2) as factor 5.

In P3, the ALSI is characterized by a bull market with the intersection of the RAIN reverting back to its mean around 15 000 points. P3 is similar to P1, when the ALSI is in a bull market, investors should use quadratic models to study the variation in RAIN.

Variables have been identified using various statistical techniques. Investors can use the analysis in this research as a framework at a time when the ALSI is in a similar business cycle as described above. Other possible uses are the forecasting of variables identified in this research, for time periods similar to the ones described in this research. Investors could also use this research as a framework to study the interaction of variables for numerous financial exchanges.

7 Recommendations for further research

Some recommendations for further research may be considered. These are:

- Forecasting the RAIN for periods P1 to P3 and compare to ex-post data.
- Investigating RAIN's relationship with secondary market indices, derivative market indices and vice versa.
- Including the economic variables from each of the five underlying foreign currencies as explanatory variables of RAIN may further extend the realism of the research.
- Considering the spreads of the short-term interest rates of South Africa's five main trading partners as explanatory variables of RAIN.

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Appendix A

Table A.1 Variable Codes: South Africa's Trading Partners

Code	South African Equity Market Index (ALSI)	Code	Decomposed into Sub-sectors
J203	FTSE/JSE:AFR All Share Index	J055	FTSE/JSE:AFR Oil Producers index
		J135	FTSE/JSE:AFR Chemical
Code	**Headline Index**	J151	FTSE/JSE:AFR Coal
J200	FTSE/JSE:AFR Top 40	J150	FTSE/JSE:AFR Gold Mining
J201	FTSE/JSE:AFR Mid Cap	J153	FTSE/JSE:AFR Platinum
J202	FTSE/JSE:AFR Small Cap	J154	FTSE/JSE:AFR General Mining
J204	FTSE/JSE:AFR Fledging Index	J173	FTSE/JSE:AFR Forestry
		J175	FTSE/JSE:AFR Ind Met
Code	**Economic Groups**	J177	FTSE/JSE:AFR Mining
J258	FTSE/JSE:AFR Resources	J235	FTSE/JSE:AFR Construction
J500	FTSE/JSE:AFR Oil and Gas	J272	FTSE/JSE:AFR General Industrial
J510	FTSE/JSE:AFR Basic Materials	J273	FTSE/JSE:AFR Electricity Sector
J520	FTSE/JSE:AFR Industrials	J275	FTSE/JSE:AFR Industrial Engineering
J530	FTSE/JSE:AFR Construction Goods	J277	FTSE/JSE:AFR Industrial Transport
J540	FTSE/JSE:AFR Health Sector	J279	FTSE/JSE:AFR Support
J550	FTSE/JSE:AFR Construction Services	J335	FTSE/JSE:AFR Auto
J560	FTSE/JSE:AFR Telecommunications	J353	FTSE/JSE:AFR Beverages
J580	FTSE/JSE:AFR Financials	J357	FTSE/JSE:AFR Food Producers
J590	FTSE/JSE:AFR Technological Sector	J372	FTSE/JSE:AFR House
		J376	FTSE/JSE:AFR Personal Goods
		J453	FTSE/JSE:AFR Health
		J457	FTSE/JSE:AFR Pharmaceutical
		J533	FTSE/JSE:AFR Drug Retail
		J537	FTSE/JSE:AFR General Retail
		J555	FTSE/JSE:AFR Media
		J575	FTSE/JSE:AFR Travel
		J653	FTSE/JSE:AFR Fixed Telecom
		J657	FTSE/JSE:AFR Mobile Telecom
		J835	FTSE/JSE:AFR Banks
		J853	FTSE/JSE:AFR Non Life Insurance
		J857	FTSE/JSE:AFR Life Insurance
		J863	FTSE/JSE:AFR Real Estate Development Serv
		J867	FTSE/JSE:AFR Real Estate Investment Trusts
		J877	FTSE/JSE:AFR General Financial
		J898	FTSE/JSE:AFR Equity Investment
		J953	FTSE/JSE:AFR Software
		J957	FTSE/JSE:AFR Technical Hardware & Equipment
Code	**International Equity Flows: Europe**	**Code**	**International Equity Flows: Japan**
FBEL20	Belgium: Brussels 20 Index	FJNK	Nikkei 225 Index
FHEX	Finland: Helsinki Index	NK300	Nikkei 300 Index
FCAC40	Paris: CAC 40 Index	FJAP	Tokyo Stock Exchange Index (TOPIX)
CDAX	Germany : Composite Dax Index		
MDAXI	Germany: Mid-Cap Index	**Code**	**International Equity Flows: USA**
DAXXIN	Germany: Xetra Dax Index	MMIS	AMEX major market Index
FATHEN	Greece: Athens Composite Index	BARCON	Barons Confidence Index
FDUBLIN	Ireland: Dublin Index	VIXI	CBOE Volatility Index
FMIALL	Italy: FTSE Italy Index	DJ65IN	DJ65 Stock Index
FAMEX	Netherlands: Amsterdam Index	DJSX50	Dow Jones Euro Stock 50 Index
IBEX35	Spain: IBEX 35 Index	DJGTI	Dow Jones Global Titans Index
PSI20I	Portugal: Lisbon PSI 20 Index	FDDY	Industrial Dividend Yield Index
		FDEY	Industrial Earnings Yield

Table A.1 Variable Codes: South Africa's Trading Partners (continuation)

Code	**International Equity Flows: China**
FCHINA	Shanghai A Share Index
FSHAI	Shanghai B Share Index
CNSHI	Shanghai Composite Index
Code	**International Equity Flows: UK**
FT100	FTSE 100 Index
FT250X	FTSE 250 Ex IT Index
FT250	FTSE 250 Index
FT350X	FTSE Ex IT Index
FT350H	FTSE Higher Yield
FT350	FTSE 350 Index
FT350L	FTSE 350 Lower Index
FTALL	FTSE All Share Index
FTALLX	FTSE All Share Index Ex IT
GBFTOT	FTSE Euro Top 100 Index
FTFLX	FTSE Fledging EX IT Index
FTSMCX	FTSE Small Cap Index
FTSMC	FTSE Small Cap Ex IT
Code	**Bond Flows: SA**
R153	Short term SA Bond
R157	Medium Term SA Bond
R207	Long Term SA Bond
JIBAR3M	3 Month: Johannesburg Interbank Agreed Rate
Code	**International Bond Flows: UK**
LGBP3M	3 Month LIBOR Rate: UK
Code	**International Bond Flows: Europe**
LEUR3M	3 Month LIBOR Rate: Europe
Code	**International Bond Flows: Japan**
LJPY3M	3 Month Libor Rate: Japan
Code	**International Bond Flows: China**
CHINT	China Short Term Interest Rate

DJINDI	Dow Jones Industrial Index
DJIFUT	Dow Jones Industrial Index – Near Futures
DJTRPI	Dow Jones Transportation Index
DJUTLI	Dow Jones Utilities Index
NASFUT	NASDAQ 100 Index – Near Futures
NASDAQ	NASDAQ Market Index
NYECOM	NYSE Composite Index
RUSS2	RUSSELS 2000 Stock Price Index
RUSSM	RUSSELS Mid Cap Index
PSPI	S & P: Composite Index
SAPIND	S & P: Industrial Composite Index
SAPMID	S & P: Mid Cap Index
SAPSML	S & P: Small Cap Index
Code	**International Bond Flows: USA**
DJCBI	DJ Corporate Bond Index
LBNDGL	Lehman Bond Composite Index
LUSD3M	US Dollar LIBOR 3 Month Rate

Appendix B

Table B.1. Fitting a Quadratic Model to the Economic Groups

Dependent Variable: RAIN
Method: Least Squares
Sample: 1/03/2006 - 12/17/2010
Included observations: 1241

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14543.07	845.4841	17.20088	0.0000
FTSMC	-6.290504	0.275537	-22.83000	0.0000
FTSMC^2	0.001016	5.26E-05	19.32728	0.0000
J530	1.522235	0.060172	25.29798	0.0000
J530^2	-5.88E-05	2.11E-06	-27.90559	0.0000
J500	-0.524073	0.050289	-10.42125	0.0000
LJPY3M	15734.91	613.2665	25.65755	0.0000
FTSMC*LJPY3M	-0.838208	0.134781	-6.219013	0.0000
J530*J500	4.09E-05	2.80E-06	14.60237	0.0000
J530*NK300	0.000174	7.61E-05	2.293443	0.0220
J500*NK300	-0.000214	6.17E-05	-3.469945	0.0005
FTSMC*J520	-4.15E-05	4.50E-06	-9.238860	0.0000
J530*LJPY3M	-0.778010	0.036378	-21.38669	0.0000
NK300*LJPY3M	2.697098	0.673417	4.005091	0.0001

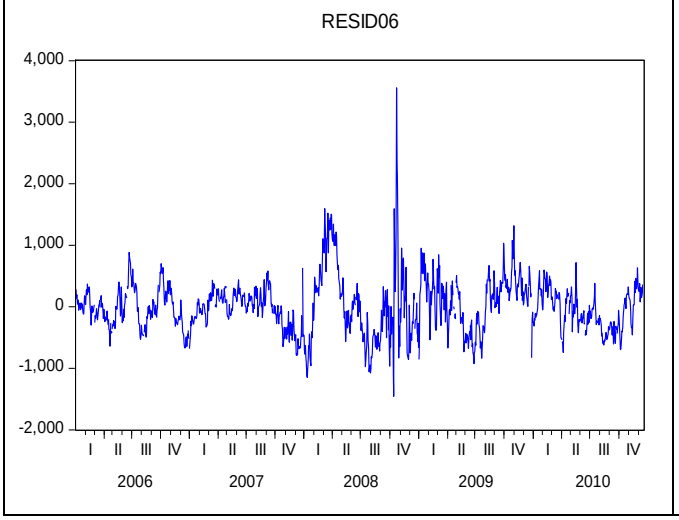
R-squared	0.952314	Mean dependent var	14246.97
Adjusted R-squared	0.951809	S.D. dependent var	2031.081
S.E. of regression	445.8732	Akaike info criterion	15.04916
Sum squared resid	2.44E+08	Schwarz criterion	15.10696
Log likelihood	-9324.006	Hannan-Quinn criter.	15.07090
F-statistic	1884.909	Durbin-Watson stat	0.284443
Prob(F-statistic)	0.000000		

Dependent Variable: RAIN
Method: Least Squares
Sample (adjusted): 1/12/2006 - 12/17/2010
Included observations: 1234 after adjustments
Convergence achieved after 31 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8983.883	1988.291	4.518394	0.0000
FTSMC	4.074443	1.005701	4.051345	0.0001
FTSMC^2	-0.000675	0.000159	-4.246801	0.0000
LJPY3M	-2655.291	783.0269	-3.391060	0.0007
J500*NK300	-4.39E-05	9.07E-06	-4.840687	0.0000
J530*LJPY3M	0.159823	0.035133	4.549124	0.0000
NK300*LJPY3M	1.233301	0.254029	4.854964	0.0000
AR(1)	0.988249	0.015012	65.82882	0.0000
AR(6)	-0.064270	0.031414	-2.045870	0.0410
AR(7)	0.071256	0.028723	2.480752	0.0132

R-squared	0.991176	Mean dependent var	14268.54
Adjusted R-squared	0.991111	S.D. dependent var	2016.465
S.E. of regression	190.1111	Akaike info criterion	13.34117
Sum squared resid	44238094	Schwarz criterion	13.38264
Log likelihood	-8221.499	Hannan-Quinn criter.	13.35677
F-statistic	15276.99	Durbin-Watson stat	2.057730
Prob(F-statistic)	0.000000		

Inverted AR Roots	1.00	.56+.34i	.56-.34i	-.01-.64i
	-.01+.64i	-.56+.32i	-.56-.32i	



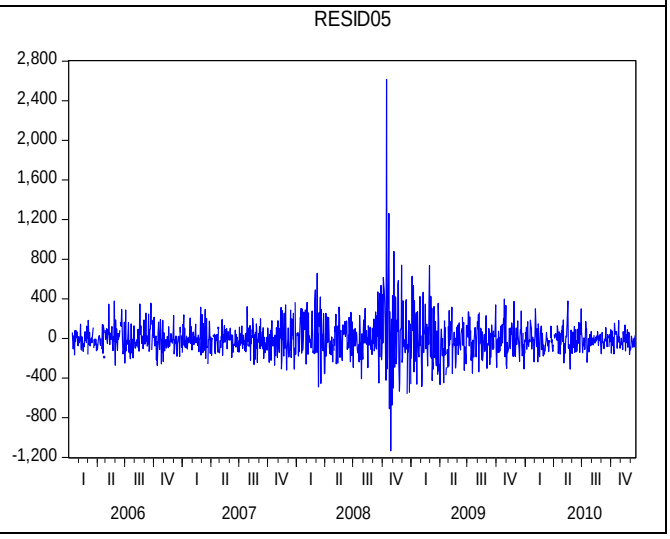


Table B.1. Fitting a Quadratic Model to the Economic Groups (continuation)

Null Hypothesis: RESID06 has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=22)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.598290	0.0000
Test critical values:	1% level	-2.566831	
	5% level	-1.941079	
	10% level	-1.616527	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID06)
Method: Least Squares
Date: 06/08/11 Time: 12:05
Sample (adjusted): 1/06/2006 - 12/17/2010
Included observations: 1238 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID06(-1)	-0.117885	0.015515	-7.598290	0.0000
D(RESID06(-1))	-0.090537	0.028789	-3.144860	0.0017
D(RESID06(-2))	-0.109631	0.028293	-3.874825	0.0001

R-squared	0.086495	Mean dependent var	0.090861
Adjusted R-squared	0.085016	S.D. dependent var	236.7986
S.E. of regression	226.5093	Akaike info criterion	13.68587
Sum squared resid	63363495	Schwarz criterion	13.69828
Log likelihood	-8468.553	Hannan-Quinn criter.	13.69054
Durbin-Watson stat	1.997300		

Dependent Variable: RAIN
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 06/08/11 Time: 12:07
Sample (adjusted): 1/12/2006 12/17/2010
Included observations: 1234 after adjustments
Convergence achieved after 99 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	25251.48	3353857.	0.007529	0.9940
FTSMC	4.733019	1.275876	3.709624	0.0002
FTSMC^2	-0.000760	0.000186	-4.075419	0.0000
LJPY3M	-1175.081	942.0860	-1.247318	0.2123
J500*NK300	-4.36E-05	1.20E-05	-3.629657	0.0003
J530*LJPY3M	0.105228	0.040451	2.601374	0.0093
NK300*LJPY3M	1.257744	0.315205	3.990246	0.0001
AR(1)	0.984627	0.016834	58.48938	0.0000
AR(6)	-0.021401	0.040781	-0.524779	0.5997
AR(7)	0.036792	0.039394	0.933944	0.3503
Variance Equation				
C	297766.4	16579.29	17.96014	0.0000
RESID(-1)^2	0.005087	0.001297	3.923148	0.0001
GARCH(-1)	-0.999668	4.71E-05	-21224.24	0.0000

R-squared	0.991092	Mean dependent var	14268.54
Adjusted R-squared	0.991026	S.D. dependent var	2016.465
S.E. of regression	191.0196	Akaike info criterion	13.79646
Sum squared resid	44661912	Schwarz criterion	13.85037
Log likelihood	-8499.414	Hannan-Quinn criter.	13.81674
Durbin-Watson stat	2.036258		

Appendix C

Table C.1. Fitting a Quadratic Model to the Sub-Sectors

Dependent Variable: RAIN
Method: Least Squares
Sample: 1/03/2006 - 12/17/2010
Included observations: 1241

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8912.620	1202.568	7.411326	0.0000
FTSMC	-2.112440	0.383004	-5.515449	0.0000
FTSMC^2	0.000369	5.84E-05	6.310133	0.0000
J272	0.447976	0.036406	12.30506	0.0000
J272^2	-3.42E-06	3.61E-07	-9.464114	0.0000
J177	-0.384840	0.046628	-8.253405	0.0000
J177^2	6.02E-06	6.32E-07	9.516235	0.0000
LJPY3M	18777.85	847.2169	22.16416	0.0000
LJPY3M^2	-3962.296	310.8053	-12.74848	0.0000
FTSMC*J272	-3.60E-05	9.89E-06	-3.639849	0.0003
J272*J177	2.63E-06	1.07E-06	2.459859	0.0140
FTSMC*LJPY3M	-0.783681	0.169569	-4.621604	0.0000
LJPY3M*J272	-0.096831	0.020034	-4.833271	0.0000
LJPY3M*J177	-0.167319	0.022415	-7.464620	0.0000

R-squared	**0.951808**	Mean dependent variable	14246.97
Adjusted R-squared	0.951298	S.D. dependent variable	2031.081
S.E. of regression	448.2304	Akaike info criterion	15.05971
Sum squared resid	2.47E+08	Schwarz criterion	15.11751
Log likelihood	-9330.549	Hannan-Quinn criter.	15.08145
F-statistic	1864.145	Durbin-Watson stat	**0.277164**
Prob (F-statistic)	0.000000		

Dependent Variable: RAIN
Method: Least Squares
Sample (adjusted): 1/11/2006 - 12/17/2010
Included observations: 1235 after adjustments
Convergence achieved after 13 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FTSMC	4.416587	1.102378	4.006417	0.0001
FTSMC^2	-0.000816	0.000161	-5.054682	0.0000
LJPY3M	-3842.495	1547.382	-2.483223	0.0132
FTSMC*LJPY3M	1.507796	0.512652	2.941170	0.0033
AR(1)	0.965932	0.022705	42.54241	0.0000
AR(3)	0.070617	0.027407	2.576614	0.0101
AR(6)	-0.036650	0.017254	-2.124136	0.0339

R-squared	**0.990939**	Mean dependent var	14265.31
Adjusted R-squared	0.990895	S.D. dependent var	2018.843
S.E. of regression	192.6421	Akaike info criterion	13.36520
Sum squared resid	45572271	Schwarz criterion	13.39421
Log likelihood	-8246.009	Hannan-Quinn criter.	13.37611
Durbin-Watson stat	**1.973086**		

Inverted AR Roots	1.00	.57	.09+.52i	.09-.52i
	-.39-.28i	-.39+.28i		

Dependent Variable: RESID01
Method: Least Squares
Sample (adjusted): 1/12/2006 - 12/17/2010
Included observations: 1234 after adjustments
Convergence achieved after 3 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	0.789266	0.021996	35.88198	0.0000
AR(3)	0.076784	0.026212	2.929367	0.0035
AR(5)	0.066646	0.031269	2.131401	0.0333
AR(6)	-0.147598	0.036304	-4.065604	0.0001
AR(7)	0.111521	0.028202	3.954300	0.0001

R-squared	0.750081	Mean dependent var	-1.105007
Adjusted R-squared	0.749267	S.D. dependent var	446.8225
S.E. of regression	223.7384	Akaike info criterion	13.66288
Sum squared resid	61522352	Schwarz criterion	13.68361
Log likelihood	-8424.994	Hannan-Quinn criter.	13.67068
Durbin-Watson stat	1.941120		

Inverted AR Roots	.93	.54+.37i	.54-.37i	.01+.72i
	.01-.72i	-.62-.39i	-.62+.39i	

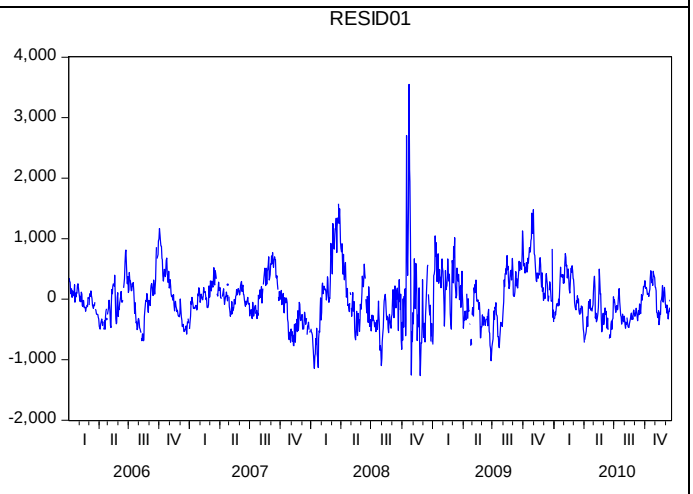
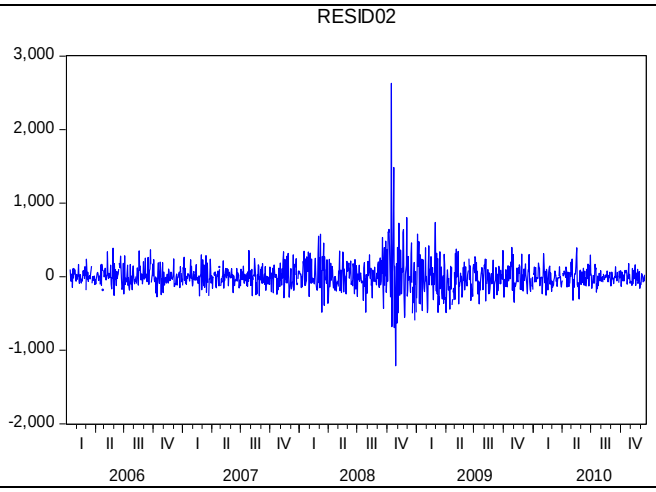


Table C.1. Fitting a Quadratic Model to the Sub-Sectors (continuation)



Null Hypothesis: RESID01 has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=22)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.596280	0.0000
Test critical values:	1% level	-2.566831	
	5% level	-1.941079	
	10% level	-1.616527	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID01)
Method: Least Squares
Sample (adjusted): 1/06/2006 - 12/17/2010
Included observations: 1238 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01(-1)	-0.116358	0.015318	-7.596280	0.0000
D(RESID01(-1))	-0.073713	0.028697	-2.568651	0.0103
D(RESID01(-2))	-0.116163	0.028261	-4.110400	0.0000

R-squared	0.084581	Mean dependent var	-0.257378
Adjusted R-squared	0.083099	S.D. dependent var	235.0144
S.E. of regression	225.0380	Akaike info criterion	13.67284
Sum squared resid	62542998	Schwarz criterion	13.68525
Log likelihood	-8460.485	Hannan-Quinn criter.	13.67750
Durbin-Watson stat	2.001506		

Dependent Variable: RAIN
Method: ML - ARCH (Marquardt) - Normal distribution
Sample (adjusted): 1/11/2006 - 12/17/2010
Included observations: 1235 after adjustments
Convergence achieved after 90 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
FTSMC	4.138976	1.008316	4.104841	0.0000
FTSMC^2	-0.000757	0.000150	-5.046307	0.0000
LJPY3M	-3114.118	1388.008	-2.243587	0.0249
FTSMC*LJPY3M	1.298258	0.477801	2.717152	0.0066
AR(1)	0.982755	0.014737	66.68591	0.0000
AR(3)	0.046612	0.018668	2.496833	0.0125
AR(6)	-0.029388	0.009429	-3.116631	0.0018
	Variance Equation			
C	60880.04	1924.390	31.63601	0.0000
RESID(-1)^2	0.008498	0.001358	6.258303	0.0000
GARCH(-1)	-0.703598	0.044417	-15.84091	0.0000

R-squared	0.990926	Mean dependent var	14265.31
Adjusted R-squared	0.990881	S.D. dependent var	2018.843
S.E. of regression	192.7845	Akaike info criterion	13.34196
Sum squared resid	45639680	Schwarz criterion	13.38341
Log likelihood	-8228.661	Hannan-Quinn criter.	13.35755
Durbin-Watson stat	2.019321		

Inverted AR Roots	1.00	.55	.09-.49i	.09+.49i
	-.37+.27i	-.37-.27i		

INTERACTION EFFECTS BETWEEN INTERNAL GOVERNANCE MECHANISMS ON THE COMPONENTS OF INITIAL RETURNS DURING THE IPO

Mediha Mezhoud*, Adel Boubaker*

Abstract

Our work provides an analysis of the interaction effects between internal governance mechanisms on the components of initial returns during the listing period. The application of multivariate regressions on a sample of 110 IPO French companies during 2005-2010, has allowed us to conclude that the different interactions between these mechanisms significantly influence the level of under / overpricing. Indeed, the positive relationship between internal governance mechanisms and overpricing reflects a substitutability relationship. In contrast, the complementarity effect comes from the negative relationship characterizing the combination of governance mechanisms and the underpricing. Thus, the interactions effects between institutional ownership, board structure and under / overpricing are not conforming to the existence of a complementarity or substitutability relationship between these variables given the absence of a significant combination between these variables.

Key words: Ownership Structure, Board of directors, Under/overpricing, Complementarity, Substitutability

JEL Classification: G30

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Introduction

The agency theory considers the financial market as a means to strengthen the arsenal of control agents, encouraging them to make strategic decisions that create value. According to the agency theory, a complementary relationship, in terms of control may exist between the board and ownership structure. Charreaux Pitol & Belin (1990) argue that the role of the board changes with the ownership structure, and its disciplinary function becomes secondary in family firms or controlled primarily by shareholders. Thus, governance mechanisms within IPO firms occur in response to agency conflicts between owners and managers having conflicts arise from the dilution. The interaction between these mechanisms determines the effectiveness of the governance structure of a firm (Jensen (1993) and Shleifer and Vishny (1997)).

Although the study of the interactions between the different governance mechanisms is raised by various studies in different contexts, our work differs from other research on several fronts. The first contribution of this paper is to examine the phenomena associated with an IPO in the French context. Indeed, we opted for a methodology identical to that of Gao (2010) to verify the existence of the under / overpricing during the IPO. In other words, we first determine the components of the initial returns observed at the IPO.

Another contribution is to check whether the combination of internal governance mechanisms has an effect on the under/overpricing. Indeed, very few studies have focused on exploring the relationship between internal governance mechanisms and initial returns components in the French context. Thus, our work aims at understanding how the joints (complementarity / substitutability) between existing internal governance mechanisms can influence the under / overpricing. In this context, the study of these joints allows companies to avoid duplication of control and increase shareholder wealth (Fernandez & Arrondo, 2005). This article will be divided into three parts. The theoretical framework and research hypotheses to be tested cover the first part. The second part deals with methodological aspects. The third part presents the analysis and discussion of results.

1 Context of the study and hypothesis of research

1.1 Interaction effects between ownership structure and board independence on the under/overpricing

The IPO process leads to a loss of control held by the original shareholders, as it would sell an important block of shares. The result is a transfer of wealth of the original shareholders in favor of new investors. Miloud (2003) asserts that, before the initial public offering, the ownership is, generally, concentrated in the hands of the founding shareholder or the partners of origin. As a consequence to the new subscriptions which the company receives, the structure of ownership becomes more scattered after the listing period, especially when these partners choose to partially or completely divest the company, which leads to a transformation of the ownership of those who do not want to have their company controlled by new investors.

Hill (2006), and Roosenboom Schramade (2006), Wang (2005) show that ownership structure and ownership concentration affect significantly the degree of underpricing, especially in emerging markets. According to Lee (2004), dominant shareholders can directly and easily control the manager, leading to a decrease in agency costs caused by the opportunism of professional manager. However, the discretionary powers can be exercised by the controlling shareholders at the expense of minority shareholders. This may encourage the IPO firm to opt for some form of oversight by independent directors in order to reduce information asymmetry, and to protect the interests of small shareholders. Indeed, to provide oversight by outside directors may be particularly useful in the context of an IPO, where the increased complexity of management positions (due to competition and market pressures on IPO companies) and the proliferation of potential strategies (due to uncertainty in the sector) make these companies a fertile ground for managerial incompetence and / or problems of opportunism (Kor et al (2008)). This can influence the under / overpricing characterizing the IPO. Therefore, our hypothesis is the following:

H1: the effect of ownership concentration on the under/ overpricing varies with board independence.

Accordingly, monitoring by external directors may be more common during the IPO where there is a greater incentive to monitor managerial decisions. Indeed, the agency theory (Jensen and Meckling, 1976) stipulates an increase of agency costs during the listing period. Because of the divergence of interests between managers and shareholders, Jensen (1986) suggests that managers prefer to invest the funds raised during the IPO and the cash flows in unprofitable projects at the expense of shareholder wealth. Therefore, the assumption of agency cost is considered as a possible explanation for the evolution of initial returns of IPO firms. Indeed, the proportion of the capital held by insiders may much explain the underpricing and the overpricing given that they do not have too much interest to underprice their shares for not having huge losses and have interest to attribute overpriced shares to misinformed investors. Hence, the involvement of independent directors during the IPO period is necessary because the IPO environment is characterized by high levels of information asymmetry leading, therefore, to appearance of agency problems that require important monitoring of management decisions within the firm. Actually, the information asymmetry that characterizes the IPO context can be reduced if the independent directors constitute a specific data source after interaction with leaders of IPO firms. This gives them access to public and private information of the firm (Carpenter and Weestphal (2001)). Their presence may thus have an effect on the underpricing which is, in turn, an increasing function of information asymmetry during the IPO. We can, as a result, establish the following hypothesis:

H2: The interaction effect between managerial ownership and board independence can influence the level of under / overpricing.

In addition, information asymmetry characterizing IPOs can be reduced by the presence of institutional investors. Indeed, Barry et al [1990] and Megginson & Weiss [1991] suggest that the presence of venture capitalists weakens the level of information asymmetry between issuers and investors. Generally, the presence of institutional owners is considered a signal of credibility for a newly-listed public company.

This signal provides valuable information on the economy for investors and industry partners, when it is difficult to predict the financial stability and future success of entrepreneurial firms, mainly when operating in unstable environments (Kor and al (2008)). Kor and al (2008)) also argue that investors can better understand the perspectives of IPO firms as they participate regularly in IPOs. Therefore, we can expect that:

H3: The complementary effect existing between board independence and institutional ownership can affect performance during the listing period.

1.2 Interaction effects between ownership structure and CEO duality on the under/overpricing

Although it has been the most abundant literature, board independence, apprehended through the nature of its internal or external members, is not the only engine of its efficiency. Board structure is, indeed, a major reflection on corporate governance. The effectiveness of the board structure is probably has an impact on value creation. Thus, the board may have a monistic board structure, that is to say, an

accumulation of the position of President and Chief Executive Officer, or a dual structure that takes the form of the Supervisory Board and Executive Board. The latter is characterized by the separation between the functions of Chairman and Chief Executive Officer (Boutillier, M., Labye, A., Lagoutte, C., Levy, N., and Oheix. V., (2002)). Several studies suggest that a single person should not hold simultaneously the role of chairman and CEO. In fact, combining the functions is at first sight the crossroads of conflicts of interest (Zahra and Pearce (1989)), resulting in agency costs increase during the IPO. Consequently, the agency theory (Jensen and Meckling, 1976) stipulates an increase of agency costs at the IPO. Hochberg (2004) shows that agency costs are also important for an IPO company thanks to the dilution of capital and the greater separation of ownership and control. Therefore, it is interesting to have a concentrated ownership before IPO to reduce agency conflicts and eventually the agency costs. Indeed, Shleifer & Vishny (1986), Agrawal & Mandelker (1990) and Agrawal & Knoeber (1996) show that the more ownership is concentrated, the more leaders are better controlled and the more the company is profitable. Indeed, shareholders holding a significant part of capital may force leaders to work in their favor by opposing their decisions when they go against the objective of maximizing shareholder wealth. Our hypothesis is as follows:

H4: The complementarity or substitutability effect between concentration of ownership and duality can influence the under/overpricing.

According to Fama and Jensen (1983), a monistic board structure indicates a potential managerial opportunism. We find that the new investors have no incentive to participate in the capital of IPO firm whose structure of the board is monistic. Indeed, managerial control would be threatened as long as the person performing the two functions, as chairman of the board, becomes more aligned with the direction than with the shareholders (Jensen and Meckling (1983)). Based on a sample of firms in Great Britain, Dahya et al (1996) found that, when companies move from a structure of separation of functions to a structure of accumulation, the stock market reacts unfavorably. Conscious of the negative effect that the combine of functions can exercise on the performance of the firm, potential investors may require a high level of underpricing when they want to subscribe for new issues (Juan (2007)). Therefore, we hypothesize that:

H5: The combination between duality and managerial ownership may affect the performance observed during the IPO.

Institutional investors have common requirements among firms in which they are shareholders. Their fame and reputation can increase their power over managers and force them to follow their recommendations, even if they individually have a small part of capital (Plihon D. and Ponssard JP, (2002)). This may create conflicts of interest between managers and institutional owners of the company whose structure of the board is monistic and also able to influence the underpricing during the listing period. Therefore: we can make the following hypothesis:

H6: the effect of institutional ownership on the under / overpricing varies with duality.

1.3 Interaction effects between ownership structure and board size on the under/overpricing

For agency theorists, the size of the Board promotes high dominance of the leader by raising coalitions and group conflicts (Jensen (1993)). The result is the existence of boards which have difficulty operating efficiently in reaching consensus on important decisions (Herman (1981)). In contrast, Pearce and Zahra (1992) show that a large board strengthens its capacity to monitor and improves its informational sources. With its diversified structure, a board composed of a large number of directors provides better environmental links and demonstrates greater expertise. This control within the board of a large size can be strengthened in the presence of concentrated capital used to reduce agency costs characterizing the IPO process. Certo et al (2001) find a negative and significant relationship between IPO underpricing and the size of the board of directors. Indeed, a large board size reduces the uncertainty of the value of the company. A reduction of the asymmetry of information is to be observed, leading to a subsequent low IPO underpricing during a new initial public offering. We can predict the following hypothesis:

H7: The effect of ownership concentration on the under/overpricing varies with the size of the board.

The study of Yermack (1996) shows that the large board can hide entrenchment mechanisms. This means that the probability of encountering boards of large size must be even more important than the domination of leaders in the board. Moreover, the author reveals that wages and the threat of removal of managers are higher in companies with boards characterizing by a small number of administrators. This may lead us to predict a relationship of complementarity or substitutability between managerial ownership and board size, which makes us come up with the following hypothesis:

H8: the combination of managerial ownership and board size can affect the under / overpricing during the listing period.

High uncertainty and information asymmetry characterizing the IPO period require the presence of institutional investors. As a matter of fact, their presence within the IPO company reduces the asymmetry of information thereby creating an inverse relationship between the underpricing and the part of capital held by the investors. These can add significant value to the company by a positive signal that manifests itself by better supervision on the board of

directors. It follows then that the pressure from institutional investors to empower administrators may also be responsible for the decrease in board size (Wu (2000)). In this regard, we can establish the following hypothesis:

H9: There is a relationship of complementarity or substitutability between board size and institutional ownership influencing the initial returns at the IPO.

2 Methodology

2.1 Sampling

Our study concerns a sample of 110 French companies listed on the Stock Exchange, between 2005-2010. This sample was obtained from the site of Euronext (www.euronext.com). We removed certain observations of our sample as far as the logic of transfer of markets or the private placement does not correspond to that of the first initial public offering.

Table 1. Sample Selection Procedure

	2005	2006	2007	2008	2009	2010	Total
Eurolist	12	19	10	4	1	5	**51**
Alternext	-	38	16	-	-	5	**59**
Total	**12**	**57**	**26**	**4**	**1**	**10**	**110**

So, we note that the number of new issues during 2006-2007 is relatively important. This involves the existence of a relatively favorable stock exchange context.

2.2 Equations of the model to be studied and description of variables

2.2.1 Presentation of the model

By referring to the study of Gao (2010), we can formulate the idea according to which the initial return includes elements of under / overpricing. Thus, the initial return can be influenced by different governance mechanisms given that the impact of the governance structure on the IPO underpricing has been the subject of several previous studies. However, the nature of the relationship between governance structure and IPO overpricing has not yet been studied. Consequently, the interaction effects between internal governance mechanisms may have important implications for determining the initial return and particularly the level of under/overpricing.

To examine the interactions between internal governance mechanisms and their impact on the components of the initial returns, we found advisable to opt for the multivariate regression analysis:

a. Interaction between ownership concentration, board structure (ownership concentration * board structure) and over/underpricing

$$\textbf{Initial return} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Own.C} + a_5(\text{Own.C} * \text{B.Indep}) + a_6(\text{Own.C} * \text{Dual}) + a_7(\text{Own.C} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (1)$$

$$\textbf{Underpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Own.C} + a_5(\text{Own.C} * \text{B.Indep}) + a_6(\text{Own.C} * \text{Dual}) + a_7(\text{Own.C} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (2)$$

$$\textbf{Overpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Own.C} + a_5(\text{Own.C} * \text{B.Indep}) + a_6(\text{Own.C} * \text{Dual}) + a_7(\text{Own.C} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (3)$$

b. Interaction between managerial ownership, board structure (managerial ownership * board structure) and over/underpricing

$$\textbf{Initial return} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{M.Own} + a_5(\text{M.Own} * \text{B.Indep}) + a_6(\text{M.Own*Dual}) + a_7(\text{M.Own*} \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (4)$$

$$\textbf{Underpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{M.Own} + a_5(\text{M.Own} * \text{B.Indep}) + a_6(\text{M.Own*Dual}) + a_7(\text{M.Own*} \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (5)$$

$$\textbf{Overpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{M.Own} + a_5(\text{M.Own} * \text{B.Indep}) + a_6(\text{M.Own*Dual}) + a_7(\text{M.Own*} \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (6)$$

c. Interaction between institutional ownership, board structure (institutional ownership * board structure) and over/underpricing

$$\textbf{Initial return} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Ins.Own} + a_5\,(\text{Ins.Own} * \text{B.Indep}) + a_6\,(\text{Ins.Own} * \text{Dual}) + a_7\,(\text{Ins.Own} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (7)$$

$$\textbf{Underpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Ins.Own} + a_5\,(\text{Ins.Own} * \text{B.Indep}) + a_6\,(\text{Ins.Own} * \text{Dual}) + a_7\,(\text{Ins.Own} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (8)$$

$$\textbf{Overpricing} = a_0 + a_1\,\text{B.Indep} + a_2\text{Dual} + a_3\text{B.Size} + a_4\,\text{Ins.Own} + a_5\,(\text{Ins.Own} * \text{B.Indep}) + a_6\,(\text{Ins.Own} * \text{Dual}) + a_7\,(\text{Ins.Own} * \text{B.Size}) + a_8\,\text{F.A} + a_9.\text{F.S} \quad (9)$$

Where: Own.C : Ownership Concentration
M.Own : Managerial Ownership
Ins.Own : Institutional Ownership
B.Indep : Board Independence
Dual : CEO Duality
B.Size : Board Size
F.A : Firm Age
F.S : Firm Size

2.2.2 Defining and Measuring Variables

The measures adopted to study the impact of interactions between internal governance mechanisms on the level of under/overpricing are presented in the following table.

3 Description and analysis of the results

3.1 Determination of the intrinsic value

Concerning our study, the intrinsic value is obtained by a linear regression while considering the market price and the listing price, of all the new issues, between 2005-2010.

Table 2. Definitions of variables in our model

Variables	Definitions
Explanatory variables of the under/overpricing	
Ownership Concentration	This is the percentage of ownership held by the largest shareholders (which is greater than or equal to 20% for each shareholder).
Managerial Ownership	The percentage of shares owned by managers and directors
Institutional Ownership	The percentage of shares held by institutional investors.
Board Independance	The percentage of independent (non affiliated) outside directors on a firm's board (number of outside directors/board size)
CEO Duality	Dummy variable taking one if CEO is also the chairman of the *board*, and is 0 otherwise.
Board Size	The number of directors on a board for each firm
Firm Age	Logarithm of the number of years between the year of creation and the IPO
Firm Size	Logarithm of total assets at the end of the year preceding the IPO of the issuing firm
Explanatory variables of the initial return[4]	
Underpricing	(Offer Price – Intrinsic Value) / Intrinsic Value
Overpricing	(Market Price – Intrinsic Value)/ Intrinsic Value

[4] The initial return is defined as follows: Initial Return = (Offer Price – Market Price) / Market Price (according to Gao (2010)).

Replacing a and ß by their value in the equation of the model according to the market price observed the first day of listing, the shares listed on the Stock Exchange of Paris, we succeeded to determine the intrinsic value of every listed share. The model, thus, spells as follows: IV i,t = a + ß MRi,t + e i,t

Table 3. Determination of the intrinsic value

$VI_{i,t} = \alpha + \beta RM_{i,t} + \varepsilon_{i,t}$				
Variable	**Coefficient**	**Ecart Type**	**t-Student**	**Prob.**
α	12.71434	2.234084	5.69	0.000
β	1.847272	0.9967695	1.85	0.067
R^2	0.0308			
Adjusted R^2	0.0218			
F-statistic	3.43			
Prob(F-statistic)	0.0666			

It stands out from the following table, that the coefficients **α** and ß, are statistically significant (α is significant at the level of 1 % and ß at the level of 10 %).

3.2 Descriptive analysis

According to table 4 we can see that the offer price exceeds the market price, with a relatively high value on average. The intrinsic value obtained by linear regression, is greater than the offering price and the market price recorded during the IPO. This explains the negative mean value of under/overpricing. The analysis shows, therefore, that the offer price is, on average, closer to the intrinsic value, in comparison to the market price. This justifies the fact that the average value of the underpricing is higher compared to that observed at the overpricing. We note that the ownership structure is highly concentrated with an average of 94.54%. This implies that most of the major shareholders of the companies in our sample have a part of shares in excess of 20%. Indeed, we have decided to opt for the definition of La Porta et al (1999) to define our variable of ownership concentration. Indeed, a highly concentrated ownership implies that the main shareholders have a stock of shares equal to or greater than 20% of all shares representing the capital of the firm. A highly concentrated ownership implies that the minority of companies have widely dispersed ownership, in the sense that the major shareholder does not even have a part of shares equal to 20% of all shares constituting the capital of the firm. Shareholders-managers hold, on average, 47.51% of the shares of IPO company. This value is, relatively, large, with a median of 50% (49.45%). This implies that most managers hold a significant part of shares before the listing period, strengthening their managerial power within the firm. This implies, therefore, that the majority of these firms are family because property ownership is highly concentrated, and the managerial ownership is, on average, higher. This justifies the fact that over 50% of our sample are listed on Alternext, which is a market designed primarily for SMEs.

Similarly, we find that institutional ownership is, relatively, large with an average of 35.38%. Legal persons involved heavily in the capital of IPO company because of their important role in the control before and during the listing period in order to succeed the IPO. However, this does not preclude the existence of firms which the property ownership is held primarily and exclusively by individuals, in the sense that institutional ownership takes a minimum value (that is equal to 0).

Table 4. Descriptive Statistics

	Mean	**Median**	**S.D**	**Minimum**	**Maximum**	**Skewness**	**Kurtosis**
Initial Return	8.898	7.466	7.0992	-0.1431	53.0205	2.5931	15.2721
Underpricing	-0.0032	-0.1486	0.7618	-0.8657	5.8160	4.2918	32.1992
Overpricing	-0.8894	-0.9083	0.0469	-0.9491	-0.6955	1.4848	4.8679
Ownership Concentration	0.9454	1	0.2281	0	1	-3.9231	16.3910
Managerial Ownership	0.4751	0.4945	0.3608	0	1	0.0731	1.55917
Institutional Ownership	0.3538	0.212	0.3623	0	1	0.6069	1.8312
Board Independence	0.1347	0	0.1853	0	0.8	1.4798	4.6932
Duality	0.7454	1	0.4376	0	1	-1.1269	2.2700
Board Size	6.9	6	3.2452	3	18	1.0801	4.1127

Board size takes a minimum value of 3 and a maximum value of 18. In addition, the low level of board independence may be due to the duality, since most companies have a monistic structure. This

reinforces the idea that these companies are family and have no interest in separating the control from direction. Hence, the appointment of independent directors in these firms is reduced. This table shows that the coefficients of skewness are different from zero and positive, with the exception of those related to the concentration of ownership and duality. This implies that most of the distributions are skewed to the right. In contrast, distributions concerning the ownership concentration and the duality are spread to the left. Thus, the coefficients of kurtosis are strictly greater than 3, except those related to managerial ownership, institutional ownership, and duality. The distributions of these last three variables are platykurtique, that the kurtosis is less than 3. Distributions of other variables are leptokurtic, since the kurtosis is greater than 3.

3.3 Multivariate analysis

3.3.1 Correlation matrix between the independent variables

The problem of multicollinearity arises when two variables are highly correlated. Kervin (1992) states that a problem of multicollinearity is present when the correlation coefficient is greater than 7. Examination of the various correlation coefficients contained in the two tables shows that they are below the limits set by Kervin (1992). This means the absence of a critical correlation that can present a serious problem of collinearity between the independent variables included in our regression model. These findings allow us to apply multivariate regressions without fear that there is a problem of multicollinearity between independent variables included in our model.

Table 5. Correlation coefficients of the explanatory variables of IPO Under/Overpricing

	Firm Age	Managerial Ownership	Institutional Ownership	CEO Duality	Board Size	Board Independence	Ownership Concentration
Firm Age	1.0000						
Managerial Ownership	0.0258	1.0000					
Institutional Ownership	-0.1392	-0.2704***	1.0000				
CEO Duality	0.1684*	0.4384***	-0.0141	1.0000			
Board Size	0.1125	-0.5140***	0.0713***	-0.3734	1.0000		
Board Independence	-0.1640*	-0.0999	-0.0541	-0.1646*	0.2046**	1.0000	
Ownership Concentration	0.1039	0.1856**	-0.0083	0.3191***	-0.2305**	-0.1289	1.0000

3.3.2 Combination effects between ownership concentration and board characteristics on the under/overpricing

The significant and positive relationship between board independence and underpricing leads to the conclusion that the control provided by the independent directors does reduce neither the level of information asymmetry nor the agency costs characterizing the IPO nor the level of underpricing. That goes in the direction of reducing the level of the overpricing. Indeed, we can notice that the existence of independent directors on the board weakens the extent of overpricing. Juan (2007) predicted that the uncertainty from potential problems associated with the low board independence may motivate investors to seek higher underpricing. However, the result contradicts the research hypothesis insofar as an independent board is associated with a high level of underpricing, which may justify the negative and significant link between overpricing and board independence. In fact, a significant demand of underpricing on the part of investors is in line with a reduction of the level of overpricing for a firm whose board is independent. In contrast, the interaction between ownership concentration and board independence affects negatively the underpricing. This can be attributed to an effect of complementarity between the two variables used to reduce the level of underpricing observed during the listing period in an attempt to protect the interests of controlling shareholders selling part of their shares at the IPO. Put differently, the process of the IPO leads to a loss of control held by the original shareholders, as it would sell an important block of shares. The result is a transfer of wealth of the original shareholders in favor of new investors. Thus, the underpricing that involves a reduction in share value over the market price is in contradiction with the interests of controlling and original shareholders. On the other hand, informed external investors wishing to participate in the capital of the IPO firm may take advantage of this underpricing. Nevertheless, uninformed investors will benefit from overpriced shares of IPO companies.

Table 6. Impact of the interaction between ownership concentration and board structure on the under/overpricing

	Underpricing	Overpricing	Initial Return
Board Independence	1.380676** (2.12)	-.1564833 (-1.46)	11.56179* (1.84)
CEO Duality	-.1501456 (-0.57)	-.3613332*** (-8.30)	3.36146 (1.32)
Board Size	-.0238196 (-0.70)	-.0552255*** (-9.84)	.0939828 (0.29)
Ownership Concentration	-.3793568 (-0.97)	-.9887422 *** (-15.25)	7.638222** (2.01)
Own.Conc * B.Indep	-2.572319*** (-2.54)	.1921608 (1.15)	-19.22378** (-1.96)
Own.Conc * dual	.4740876 (1.25)	.4409139*** (7.02)	-1.167157 (-0.32)
Conc.prop * B.size	.1256826 *** (2.68)	.075529 *** (9.76)	.2159715 (0.48)
Firm Age	-.1781807 (-1.19)	-.0392671 (-1.58)	-.8595116 (-0.59)
Firm Size	.0109183 (0.27)	-.0124818 * (-1.90)	.1578659 (0.41)
N	**110**	**110**	**110**
R^2	**0.2175**	**0.9879**	**0.7273**
Fisher (Prob)	**3.09**	**993.10**	**29.63**
*** significant at the 0.001 level, ** significant at the 0.05 level, *significant at the 0.10 level			

As has been observed, the common presence of dominant shareholders and independent directors can strengthen monitoring and encourage managers to act in the interests of the firm. Indeed, monitoring within a firm with concentrated ownership of *capital* and independent board reduces information asymmetry and agency cost bringing about a reduction in the level of the underpricing. This explains the inverse relationship between the combination of the two governance mechanisms and the underpricing.

We found that the common presence of dominant shareholders and independent directors affects the overpricing favorably. This means that there is a relationship of substitutability between the two internal governance mechanisms increasing the level of overpricing. It should be noted that this overpricing is a component of the initial return (according to Gao (2010)) and can adversely affect the performance. In contrast, the underpricing improves the performance observed during the IPO. It is for this reason that the underpricing is a signal to potential investors reflecting the good quality of the issuing company as only good companies are able to recover the cost of this underpricing. Therefore, the overpricing discourages the prospective investors to subscribe to new shares. This is not beneficial to the company which strives to make its IPO succeed in order to attract investors in the stock market. Hence, the positive relationship between the internal mechanisms of governance and the overpricing reflects a relative substitutability between board independence and ownership concentration having a positive impact on the overpricing

3.3.3 Combination effects between managerial ownership and board characteristics on the under/overpricing

The observation of the table shows that Model 2 is significant, with a power of explanation of 97.51%. This means that variables strongly determine the level of the overpricing, compared to the underpricing. The results show that board size and managerial ownership positively and significantly influence the underpricing. However, there is a negative and significant relationship between duality, board size, managerial ownership and the overpricing. Indeed, a significant presence of insiders can increase the capacity of founding CEOs to negotiate the initial public offering price with investment banks, reflecting the assessments of their companies by the market during the first day of trading (Certo (2001)), which can reduce the risk of observing a phenomenon of overpricing. It also implies that a large board with a monistic configuration and high managerial ownership before IPO does not reduce information asymmetry and agency costs by providing less effective control resulting in the appearance of conflicts of interest among stakeholders.

Table 7. Impact of the interaction between managerial ownership and board structure on the under/overpricing

	Underpricing (model 1)	Overpricing (model 2)	Initial Return (model 3)
Board Independence	.5299902 (1.06)	-.1026165 (-0.85)	0.7371 (0.66)
CEO Duality	.1259826 (0.62)	-.1795224*** (-3.91)	1.384246 (0.79)
Board Size	.1152885 *** (3.96)	-.0387777*** (-6.71)	.8507665*** (3.84)
Managerial Ownership	1.308477** (2.03)	-.8396329*** (-6.17)	14.50278*** (2.78)
Manag.Own * B.Indep	-1.455586 (-1.55)	-.0070105 (-0.03)	-6.140132 (-0.70)
Manag.Own * dual	.0308349 (0.07)	.2993766*** (2.71)	.9413473 (0.22)
Manag.Own * B.Size	-.1451815*** (- 2.49)	.0704687*** (5.43)	-1.78634*** (-3.59)
Firm Age	-.1577212 (-1.02)	-.1014815*** (-2.78)	-.7662831 (-0.55)
Firm Size	-.0051156 (-0.12)	-.0482922*** (-5.48)	-.0372836 (-0.11)
Constant	-.833397 ** (-2.18)	-	-
N	**110**	**110**	**110**
R^2	**0.1703**	**0.9751**	**0.7371**
Fisher (Prob)	**2.26**	**435.15**	**31.14**
*** significant at the 0.001 level, ** significant at the 0.05 level, *significant at the 0.10 level			

Quite the contrary, the combination of managerial ownership and board size has a negative impact on the underpricing. This can go along with the idea of Yermack (1996) that shows that large boards can hide entrenchment mechanisms. This means that the probability of encountering the boards of large size in our sample of companies must be all the more important that the domination of the manager is accentuated. Indeed, the large part of managerial ownership within the board encourages them to not undervalue overmuch their shares for sale during the IPO for not realizing huge losses.

Thus, the decline in the level of underpricing is usually accompanied by an increase in the overpricing, given that this overpricing and underpricing represent the components of the initial returns, which justifies the positive relationship between the combination of the two mechanisms of governance (managerial ownership size of the board) and the overpricing.

3.3.4 Combination effects between institutional ownership and board characteristics on the under/overpricing

Observing the table, we can see that the internal governance mechanisms strongly influence the overpricing with an explanatory power of 96.49%. In contrast, the explanatory power of the Model 1 explaining the nature of the relationship between the internal governance mechanisms and the underpricing is 14.45%. This means that internal governance mechanisms strongly determine the level of overpricing compared to the underpricing.

The results allow us to see that a wide board whose structure is monistic and with a large number of independent directors influence positively the underpricing and negatively the overpricing at the IPO. Therefore, a board with these characteristics does not ensure effective control leading to reduce the level of the underpricing in order to protect the interest of the original shareholders who sold a portion of their capital during the IPO.

Our results reflect, to some extent, the ideas of Hermalin (2004) and Ginglinger (2002), insofar as the large board is ineffective in exercising control of management. This reduces the opportunities to make decisions for the benefit of shareholders and enhances the discretion of management. The latter will, thereafter, act in their own interests by increasing the level of underpricing, to attract new investors, while ensuring that their managerial power is strengthened.

Table 8. Impact of the interaction between institutional ownership and board structure on the under/overpricing

	Underpricing	**Overpricing**	**Initial Return**
Board Independence	.0333772 (0.08)	-.2767581** (-2.27)	1.659018 (0.39)
CEO Duality	.2150007 (1.20)	-.1965066 *** (-3.92)	4.575711*** (2.64)
Board Size	.0384882* (1.72)	-.0141424** (-2.24)	.1194724 (0.55)
Institutional Ownership	-.6799009 (-0.98)	-.3342229* (-1.71)	-5.343784 (-0.79)
Inst.Own * B.Indep	-.7225657 (-0.74)	.4092707 (1.49)	-1.613757 (-0.17)
Inst.Own * dual	-.1500282 (-0.37)	.133387 (1.17)	-2.408752 (-0.61)
Inst.Own * B.Size	.071034 (1.05)	.0159787 (0.84)	.7482893 (1.13)
Firm Age	-.1724776 (-1.17)	-.1755757*** (-4.24)	.805435 (0.56)
Firm Size	-.0022166 (-0.06)	-.0701945*** (-7.09)	.721223** (2.11)
N	**110**	**110**	**110**
R^2	**0.1445**	**0.9649**	**0.6981**
Fisher (Prob)	**1.88**	**305.56**	**25.69**
*** significant at the 0.001 level, ** significant at the 0.05 level, *significant at the 0.10 level			

Thus, an improvement in the underpricing is generally accompanied by a deterioration of the overpricing. The significant underpricing can be attributed to the high level of informational asymmetry resulting from conflicts of interest between shareholders and managers before the listing period. This causes an increase in the underpricing usually accompanied by a reduction in the overpricing. We note that the interaction between institutional ownership, board independence (inst.own*B.indep) , duality (inst.own*Duality) and under / overpricing do not provide significant results. The existence of a relationship of complementarity or substitutability between these variables is not consistent with the last result.

4 Conclusion

In this article, we have shown that the governance structure is a major determinant of initial returns observed during the IPO. Indeed, the application of multivariate regressions on a sample of 110 French companies during 2005-2010, has allowed us to assert that the different mechanisms of internal governance as well as the interactions between these mechanisms significantly influence the level of under / overpricing. We have found that most of the internal governance mechanisms affect positively and significantly the levels of underpricing and negatively the overvpricing. In contrast, the combination of these mechanisms creates an adverse effect on these phenomena observed at the IPO. In other words, most of the interactions between these governance mechanisms have a positive impact on the overpricing. In contrast, the underpricing is negatively and significantly influenced by the combination of these different mechanisms. Indeed, the positive relationship between internal governance mechanisms and overpricing reflects a substitutability relationship. In contrast, the complementarity effect comes from the negative relationship characterizing the combination of governance mechanisms and the underpricing. Thus, the interactions between institutional ownership, board independence, duality and under / overpricing are not statistically significant. This does not substantiate the existence of a complementarity or substitutability relationship between these variables.

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THE EFFECT OF BANK MONITORING AS AN ALTERNATIVE OF CORPORATE GOVERNANCE MECHANISMS ON THE BORROWERS' FIRM VALUE: EVIDENCE FROM INDONESIAN LISTED FIRMS

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Abstract

The objective of this research is to examine the effect of bank monitoring as an alternative of corporate governance mechanisms on the borrowers' firm value. The strengths of bank monitoring on the borrowers are measured based on the magnitude of the bank loan, the size of the loan from banks with high monitoring quality, the length of a bank loan outstanding period, and the number of lenders. The research hypotheses were tested using multiple regression model with a sample of 230 companies listed in Indonesia Stock Exchange during 2009. The empirical results show that only the size of the loan from banks with high monitoring quality and the number of lenders significantly influences the borrowers' firm value. These findings imply that only banks with high monitoring quality could play an important role in the corporate governance and therefore increasing the firm value by their monitoring function. Furthermore, bank monitoring is less effective if a company borrows from many banks, and therefore decreasing the firm value.

Keyword: Corporate Governance, Bank Monitoring, Bank Loan, Firm Value

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1 Introduction

The concept of good corporate governance has been formally introduced in Indonesia after the 1998 economic crisis. The basic principle of corporate governance is to ensure the fulfillment of the company's responsibility to the company's stakeholders. Internal corporate governance structure, such as the board of commissioners[5] and audit committee, has been set up in companies in order to have a controlling function for management decisions and actions. Agency problems between shareholders and management, between creditors and shareholders, and between majority shareholders and minority shareholders, are expected to be minimized with the existence of good corporate governance. Corporate governance enhances effective decision-making control, prevent opportunistic actions that are inconsistent with the interests of the stakeholders, and reduce the information asymmetry between management and stakeholders of the company. One corporate governance mechanisms that can be used to address the agency problem is to perform both internal and external monitoring (Jensen and Meckling, 1976). External monitoring is primarily done by external auditors, but creditors can also play an important role in monitoring by external parties.

In line with the objective of corporation to maximize shareholders' wealth by increasing firm value, many companies use debt financing combined with equity financing to get the interest tax shield benefit (Modigliani and Miller, 1963). The source of debt financing could be from the capital market by issuing bonds, or from financial institutions. The bond market in Asia is relatively undeveloped; therefore most large companies in Asia including Indonesia are still use bank loans as their source of debt financing (Nam and Nam, 2004). When a company uses bank loans as its source of financing, the bank becomes one of the company's stakeholders, who have the interest to monitor any activity undertaken by the company's management. One of the main reasons why banks do the monitoring activity is to reduce the credit risk (Ahn and Choi, 2009). Agency problems could arise between creditors and shareholders, because each of them has different contingent claim amount on the firm value. Therefore, creditors need to make sure that the funds obtained by the company are used appropriately as planned and

[5] Indonesia adopts a two-tier system in its corporate governance structure, where there is a complete distinction between executive function and monitoring function. Therefore, the monitoring role is the responsibility of board of commissioners, and the managing role is the responsibility of board of directors or board of executives. Board of commissioners has similar roles as board of directors in the one-tier system companies in other countries.

efficiently. In this case, the bank will do a monitoring function, which is somewhat similar to the function of board of commissioners and audit committee in corporate governance. If the management could act prudently with the existence of bank monitoring, the firm value should increase eventually.

This study discusses the influence of the monitoring role of banks as an alternative of corporate governance mechanisms to increase the value of a company that has a bank loan. This study refers to previous research conducted by Ahn and Choi (2009) and Hermawan (2009). Both studies have tried to examine the role of bank monitoring in the borrowers' quality of earnings. Hermawan (2009) measured the level of bank monitoring based on the total amount of loan from banks that are considered having good monitoring capability on their borrowers. Ahn and Choi (2009) used the magnitude of bank loans, lead bank reputation, length of bank loan, and the number of bank lenders to measure the level of bank monitoring. In contrast to Ahn and Choi (2009) and Hermawan (2009), this study examines the influence of bank monitoring as an alternative of corporate governance mechanisms on the firm value. The objective of this study is to provide empirical evidence in Indonesia regarding the possibility of external corporate governance mechanisms conducted by the bank as one of the company's stakeholders to increase the firm value.

2 Literature Review

2.1 The Role of Bank Monitoring as Corporate Governance Mechanisms

Basically, in some countries where the economic system is characterized by bank financing as an external source of financing, such as Japan and Germany, corporate governance mechanisms can also be done by the banks through direct ownership or financing mechanisms (Charkham, 1995). Moerland (1995) showed that agency problem is reduced in such situation. Some literatures in financial economics explore how banks run their unique role and how relationships between the banks and the companies affect the company's business. However, there are still only few empirical evidences about the monitoring role of banks as one of corporate governance mechanism (Shleifer and Vishny, 1997). Byers et al. (2008) convey some important insights about the extent to which the bank can replace the monitoring of internal and external corporate governance mechanisms. They found the existence of positive association between loan announcements and the borrowers' excess returns.

The objective of bank monitoring is to reduce the banks' credit risk by preventing borrowers' opportunistic behavior both before and after the loan is approved. Prior to the loan approval, the borrowers can take opportunistic actions to be able to have higher borrowing capacity, lower interest rates, and lower contract costs (Mishkin and Eakins, 2003). Borrowers have the possibility to manage their earnings to achieve such objectives. Recently, managing earnings are not only done by managing discretionary accruals in the financial statement reporting, but also through real activites. Roychowdury (2006) states that there are three methods based on real activities that can be used by management to manipulate earnings: (1) Revenue manipulation by giving price discount or soft credit sales to boost up sales; (2) Reduction in discretionary expenditures such as research and development cost, human resources development cost, marketing costs, maintaince cost, etc.; (3) Overproduction. Graham et al. (2005) found that management tend to use real activities manipulation than accruals to manage their financial reporting. Therefore, borrowers' opportunistic behavior to manage their earnings could possibly destroy the company's value in the future. After the loan is realized, borrowers still have an incentive to perform opportunistic actions. One of the reasons is to avoid default due to inability to meet the debt covenants. Some covenants are accounting-based measured, which depends on the borrowers' financial performance. Generally, violations of debt covenants would have a negative impact such as higher interest rates, obligations for early repayment of loans, and additional restrictions on the borrowers' activities (Beneish and Press, 1993).

Banks have specific interest to reduce the possibility of borrowers take such opportunistic actions that can reduce their repayment capacity. This bank monitoring will complement the monitoring function of internal corporate governance mechanism. Hopefully this will have positive impact to borrowers' firm value. Treacy and Carey (1998) found that major banks in the United States are using qualitative and quantitative measurements for evaluating their credit risk. Their study showed that banks examine borrowers' risk factors such as the financial statements reliability, the management quality, and the financial conditions. These findings support the importance of effective monitoring on management actions in order to achieve a good corporate governance.

Unlike individual creditors and other specialized agencies such as auditors, banks have a comparative advantage in monitoring their borrowers, because the banks have a low cost of delegation, economies of scale in monitoring activity, and the ability to access inside information (Ahn and Choi, 2009). Diamond (1984) and Fama (1985) focused their research on the banks' ability to get better information about borrowers, and therefore banks have some advantages in carrying out the monitoring function. Diamond (1984) developed a theory about the delegation of monitoring, which prove the superiority of the banks in term of the cost of delegation. While Fama (1985)

shows that banks have informational advantages over other financial intermediaries.

2.2 The Effect of Corporate Governance on Firm Value

Many previous studies focused on the effect of corporate governance on the firm value. Some studies used the ownership structure as the corporate governance mechanisms. Jensen and Meckling (1976) suggested that the greater ownership by management could reduce the agency problem between management and shareholders. However, Demsetz and Villalonga (2001) found that there was no significant association between management shares ownership and company's performance.

Arsjah (2002) investigated the influence of corporate governance on firm's performance. Firm's performance is measured by Price to Book Value (PBV) ratio and corporate governance is measured based on corporate governance index published by Credit Lyonnais Securities Asia (CLSA) and Indonesian Institute of Corporate Governance (IICG). The result of her study is still mixed. Corporate governance has some influence on company's performance only for the sample that used corporate governance index from CLSA, but for the sample that used corporate governance index from IICG there was no significant influence. Utama and Utama (2005) conducted a study on the practice of corporate governance and value creation of companies in Jakarta Stock Exchange. Corporate governance practices are measured by two measurements, i.e. the Corporate Governance Performance Index (CGPI) and the Corporate Governance Score (CGS). The company's value is measured by the ratio of Economic Value Added (EVA) Spread and Market Value Added to Invested Capital (MVA/IC). This study also showed mixed results. Corporate governance measured by CGPI positively affects the firm's value measured by EVA spread, although the association is still marginally significant. However, the association is negatively significant when firm's value measured by MVA/IC. If corporate governance is measured by CGS, it has a significant and positive effect on firm's value measured by MVA/IC, but it does not have any effect on firm's value measured by EVA Spread.

Black et al. (2003) proved the association between corporate governance and the firm value in Korea. This study used a Corporate Governance Index (CGI) as a proxy for corporate governance and Tobin's Q as a measure of firm value. The result showed statistically strong evidence that firms with higher CGI will have higher Tobin's Q. Silveira and Barros (2006) investigated the influence of the quality of corporate governance on market value of over 154 Brazilian companies listed on São Paulo Stock Exchange (Bovespa) in the year 2002. The quality of governance is measured by CGI, and the company's market value is measured by Tobin's Q and Price to Book Value ratio. The findings also show that quality of corporate governance has positive and significant impact on the company's market value.

2.3 The Effect of Bank Monitoring on Borrowers' Firm Value

Most studies of bank monitoring associated with syndicated loans, focusing more on the information asymmetry between the lead bank with the syndicated participants (Dennis and Mullineaux, 2000, Lee and Mullineaux, 2004, Champagne and Kryzanowski, 2007; Sufi, 2007). However, these studies did not test the monitoring role of banks in corporate governance. Ahn and Choi (2009) provide empirical evidence regarding the role of bank monitoring on the borrowers' earnings management behavior. Their study found that earnings management behavior decreases if the strength of bank monitoring increases. The strength of bank monitoring is measured by the amount of bank loans, reputation (rank) of lead banks, length of bank loans, and the number of lenders. The results showed that the amount of bank loans, reputation (rank) of lead bank, and length of bank loan have negative effects on borrowers' earnings management behavior, but the number of lenders has no significant effect. This result implies that bank monitoring has an important role just like the monitoring function of Board of Commissioners and Audit Committee as the company's internal governance structure. Therefore bank monitoring could also contribute in creating good corporate governance that will create firm value.

Hermawan (2009) also conducted a study to examine the effect of bank monitoring role on the earnings informativeness measured by the earnings response coefficient (ERC). The proxy for bank monitoring effectiveness is the amount of loan from banks with good monitoring quality. Banks that are considered having good monitoring quality if the banks meet all the three conditions (1) Have large assets, i.e. above Rp 1 trillion; (2) Have Non Performing Loans < 5%; and (3) Have a rating of "very good" and "good" in bank performance rating conducted by InfoBank magazine (2007). This study used a multiple regression model with 357 data observations (firm-year) of companies listed on the Indonesia Stock Exchange during the years 2006-2007. The result reveals that bank monitoring does not have any significant influence on the earnings informativeness. However, the earnings response coefficients (ERC) of companies with larger amount of loan from the bank with a good monitoring quality are higher than of companies with smaller loan from banks with good monitoring quality. Therefore, investors may have more confidence on corporate governance of companies that have borrowings from banks with good monitoring quality, and bank

monitoring could be one of the corporate governance mechanisms to increase the firm value.

The analogy that the role of banks monitoring can influence the increase of firm value is supported by Byers et al. (2008) who found the effect of loan announcement on the firm value associated with the characteristics of the borrowers' corporate governance. By using a sample of more than 800 commercial loan announcements during the period of 1980-2003, they found that the loan announcement has a positive effect on the borrowers' firm value if the borrowers have weak internal corporate governance. However, several other studies that specifically discuss the effect of bank monitoring on the performance and value of the company provided conflicting results (Degryse et al., 2008). Weinstein and Yafeh (1998) found that the relationship between banks and borrowers does not lead to borrowers' profitability or higher growth. Their explanations for their findings are: (1) the cost of capital will increase due to higher interest rates paid to the banks; (2) banks are more risk averse and more conservative in their investment policies, therefore it can reduce the borrowers' growth prospect.

In contrast, Kang et al. (2000) proved that the relationship between banks and companies can facilitate investment policies that can increase shareholders' wealth. Shepherd et al. (2008) also found positive and significant relationship between firm value and the existence of bank loan, especially in companies with high agency cost. By using the Governance Index (G-index) as a measure of managerial entrenchment and Tobin's Q as a measure of corporate value, they prove that the emergence of free cash flow as a result of the bank monitoring can increase the borrowers' firm value. Furthermore, Van Overfelt et al. (2006) also provide empirical evidence regarding the effect of bank affiliation on the performance and risk of bank-affiliated companies. With a sample of 129 public companies in Belgium, they found that the bank affiliation has a positive impact on the ratio of market-to-book and return-on-assets. Bank's level of involvement has a positive effect on company performance and can significantly reduce the volatility of the return-on-assets. The yield on stocks measured by the Sharpe ratio also showed a better performance for bank-affiliated companies.

3 Hypothesis Development

In general, the purpose of this study is to have an empirical evidence of how bank monitoring on the borrowers can be considered as an alternative of corporate governance mechanisms to improve the borrowers' firm value. The strength level of the monitoring function assumed to be influenced by the magnitude of the bank loans, the size of loans from banks with high monitoring quality, the bank loan outstanding period, and the number of lenders.

3.1 Magnitude of Bank Loans

Banks should be willing to put greater attention to borrowers with higher amount of loan because the borrowers' credit risk should be higher. Khalil and Parigi (1998) showed that the increasing amount of the loan can be a signal for banks to give greater attention in monitoring. Kang et al. (2000) stated that the large amount of borrowers' bank loans is positively associated with the banks' motives to conduct monitoring activities. While Lee and Mullineaux (2004) argued that in the case of syndicated loans, banks that have a larger portion in the syndicated loan would have stronger motives to monitor than the other banks. In general, previous studies showed that banks will enhance their monitoring power when banks provide larger loans to a borrower. Ahn and Choi (2009) found that borrowers' earnings management decreases as the size of the loan increases, which indicates that the banks monitoring function becomes more effective as the size of loans of the borrowers increases. An effective monitoring should induce management to take actions that are best for the company. Therefore, the first hypothesis of this study is:

H1a: The size of a company's bank loans has a positive effect on its PBV ratio.

3.2 Bank Monitoring Quality

The role of bank monitoring will be effective if and only if the bank has the capability to do a good monitoring function. One of the factors that could affect the level of monitoring quality is the bank's financial performance. The bank's financial performance could reflect how the bank's management manages the business as financial intermediaries. If banks can manage their credit optimally, by having an effective monitoring on the borrower not only prior to but also after the credit approval, they will achieve an excellent financial performance. Therefore, financial performance indicators and ratings could be used as a standard of bank monitoring quality. Hermawan (2009) refers to the banks performance ratings published by InfoBank (2007) to consider the banks monitoring quality. The result showed that the higher proportion of loans in a company granted by banks that have high monitoring quality, the quality of earnings reported by the company is better.

Within the framework of a bank's risk management, reputation risk is one of the main factors that determine the ability and credibility of the bank in performing monitoring functions. This risk refers to the negative opinion of the banks' depositors, from whom banks will get most of their funding. Ahn and Choi (2009) found that reputation (rank) of the lead bank in a syndicated loan significantly influenced the borrowers' earnings management in an opposite direction. Based on prior studies, bank monitoring

function on the borrowers will be more effective if the bank has good monitoring capabilities. Therefore, companies that get loans from banks that have high monitoring quality, assumed to be highly monitored and they are not free to act opportunistically (Hermawan, 2009). In other words, the larger the size of loans in a company granted by banks with high monitoring quality, the more effective the bank monitoring on the borrowers. Therefore, the second hypothesis of this study is:

H2a: Companies with large size of loans from banks that have high monitoring quality have PBV ratio higher than any other company.

3.3 Length of Bank Loans Outstanding Period

Rajan and Winton (1995) argued that the existence of debt covenants resulting from long-term loans in a company will provide incentives for banks to increase the strength of monitoring, especially when the covenants are costly. Also, banks will gain more information if they have a longtime relationship with the borrowers (Ongena and Smith, 1998). The presence of long-term loans can reduce the duplication of monitoring costs incurred by banks (Dennis and Mullineaux, 2000). In general, previous studies suggest that the incentives of banks to conduct monitoring activities will increase with the longer loan period. According to Ahn and Choi (2009), the bank monitoring function could be more effective if the outstanding period of the loan is longer. Therefore, the third hypothesis of this study is:

H3a: The length of a company's bank loans outstanding period has a positive effect on its PBV ratio.

3.4 Number of Lenders

Syndicated loan is one of the sources of external debt financing available for a company. Compared to loans from a single bank, syndicated loans can offer a better deal for companies, i.e. larger loan amount, and lower cost of debt (Ross et al., 2010). From the perspective of the bank monitoring role, in a syndicated loan the process of credit analysis and risk asessment is done not only by the lead bank, but by all the participating banks (Fraser et al., 2001). Therefore, syndicated loans provide a collective monitoring which could result in more intensive monitoring. Ahn and Choi (2009) used the total number of banks involved in syndicated loans as a proxy of number of lenders. They found that the number of lenders has no significant association with the firm's earnings management. In contrast to Ahn and Choi (2009), this study does not focus on syndicated loans due to small number of sample firms (19 out of 230 companies) that use syndicated loans. This study used the number of banks involved in financing a specific company. Based on the same arguments as Ahn and Choi (2009), it can be assumed that if a company has loans from more than one bank, then more banks are interested to perform monitoring functions. Thus the monitoring intensity is expected to increase with the increasing number of banks that provide loans to a company. Therefore, the fourth hypothesis of this study is:

H4a The number of banks that provide loans to the company has a positive effect on its PBV ratio.

4 Research Model

The model used in this study is based on the models of Ahn and Choi (2009) and Hermawan (2009):

$$PBV_i = \beta_0 + \beta_1 MAGNITUDE_i + \beta_2 DMONQUAL_i + \beta_3 LENGTH_i + \beta_4 NLENDER_i + \beta_5 ROE_i + \beta_6 GROWTH_i + \beta_7 RISK_i + \beta_8 SIZE_i + \beta_9 LEVERAGE_i + \varepsilon_i \quad (1)$$

Where:

PBV_i	:	Price to Book Value Ratio of firm i at the end of the study period
$MAGNITUDE_i$	:	The ratio of the amount of bank loans to total assets of firm i at the end of the study period.
$DMONQUAL_i$	:	Dummy variables (1.0) with a value of 1 if firm i at the end of the study period have the amount of borrowings from the bank with high monitoring quality greater than or equal to the median, and 0 if otherwise.
$LENGTH_i$	:	Average loan outstanding period of firm i at the end of the study period.
$NLENDER_i$	:	The number of banks related to the outstanding loans of firm i at the end of the study period.
ROE_i	:	Return on Equity, the ratio of earnings to book value of equity of firm i at the end of the study period.
$GROWTH_i$	:	The growth rate of the firm i measured by sales growth rate at the end of the study period.
$RISK_i$	:	Firm risk measured by the beta of firm i at the end of the study period.
$SIZE_i$	:	Firm size measured by total sales of firm i at the end of the study period.
$LEVERAGE_i$	:	The ratio of total liabilities to total assets of firm i at the end of the study period.

5 Population and Sample

The population of this study consists of all companies listed on the Indonesia Stock Exchange (IDX) in 2009. Using a purposive sampling method, there are 230 firms that meet all the criteria to be the sample for this study. Table 1 shows the sample determination in this study.

6 Descriptive Statistics

The descriptive statistics of the variables used are presented in Table 2. Data that is considered as outliers i.e. has the value higher or lower than 3 (three) standard deviation from the mean, has been winsorized. Based on Table 2, the average PBV ratio of the sample is

Table 1. Determination of Sample

Step	Sample Criteria	Number of Companies
1	Companies listed on the Indonesia Stock Exchange (IDX) in 2009	397
2	Companies in financial industry	(67)
3	Companies which have their IPOs in the year 2009	(11)
4	Companies that have negative equity	(19)
5	Companies that have incomplete data	(8)
6	Companies that do not have any bank loan in the year 2009	(62)
	Total samples used	230

1.6993. It indicates that most of the companies used in the sample have created firm value, although still relatively small becasue the average PBV ratio is less than 2.00. Besides, there are some companies that have PBV ratio lower than 1.00, meaning that those companies have not created value and therefore their market performance is poor.

The average magnitudes of bank loans as ratio to total assets is 0.1986. It indicates that the use of bank loans as the source of financing in the sample companies is not dominant. In other words, companies used as the sample in this study have relatively low leverage. From the monitoring quality perspective, there is only 44% of the sample obtain loans from banks in the category of good monitoring quality. It means that more than half of the sample firms borrow from banks that are considered having low monitoring quality.

Bank loan outstanding period measures the loan elapsed time since the loan is granted by banks. The average bank loans outstanding period is 2.86 years, or aproximately equivalent to 3 years. It indicates that most sample firms may have short-term bank loans only or recently acquired long-term bank loans. The shortest bank loan outstanding period in the sample is 1 year and the longest period is 8 years. The average number of lenders in the sample firms is 3.48, with the minimum number is 1 lender and the maximum nubmer is 13. It indicates that most companies in the sampel borrows from more that one bank.

Table 2. Descriptive Statistics

	Minimum	Maximum	Mean	Standard Deviation
PBV	0.07	5.68	1.5655	1. 4322
MAGNITUDE	0.00	0.70	0. 1977	0. 1635
DMONQUAL	0	1	0.44	0.497
LENGTH (years)	1.00	8.00	2.8692	1. 6341
NLENDER	1	13	3.48	3.015
ROE (%)	-99.32	64.14	7.2422	23.3224
GROWTH (%)	-91.49	478.69	4.7286	61.7330
RISK	-1.505	2.460	0.6220	0.74633
SIZE (million Rupiah)	1,715	30,261,178	3,411,225	6,187,7919
LEVERAGE	0.05	0.97	0.5171	0.1989

PBV_i: value of the firm measured by the ratio of price to book value of equity of firm i at the end of the study period, $MAGNITUDE_i$: size of bank loans measured by the ratio of the amount of bank loans to total assets of company i at the end of the study period, $DMONQUAL_i$: bank's monitoring quality measured by dummy variables (1.0) with a value of 1 if firm i at the end of the study period has the total borrowing amount from banks with high monitoring of quality greater than or equal to the median, and 0 if otherwise, $LENGTH_i$: loan period measured by the average loan outstanding period in company i at the end of the study period, $NLENDER_i$: number of lenders measured by the number of banks relate to the company i outstanding loan at the end of the study period, ROE_i: company's profitability measured by

the ratio of net earnings before extraordinary items to book value of equity of company i at the end of the study period, $GROWTH_i$: company's rowth rate measured by the sales growth rate of company i at the end of the study period, $RISK_i$: company's risk measured by the beta of firm i at the end of the study period, $SIZE_i$: company's size measured by total sales of company i at the end of the study period, $LEVERAGE_i$: company's capital structure measured by the ratio of total liabilities to total assets of firm i at the end of the study period.

Most companies in the sample have a moderate profitabilty, with average ROE of 6.85%. The leverage of the sample measured by total liabilities to total assets is 51.90% on average. It indicates that companies tend to have liabilities other than bank loans in a quite significant proportion. The average sample firms' size measured by the total sales is Rp. 3,423,950 million and the average sales growth rate of the sample firms in 2009 is 67.34%.. It indicates that most sample firms are large firms and have a relative high sales growth. RISK variable reflects the firm's risk as measured by beta that company. The average value of the sample firms' beta is 0.6233, which means that on average the sample firms have a lower risk than the market. However, the low average value of beta can be also due to the inactively traded stock of some companies in the sample during the study period.

7 Correlation Analysis

The result of the correlation analysis is presented in Table 3. The value of the dependent variable (i.e. PBV) has been transformed into logarithm value (LogPBV) to have a more normal distribution. From the four main variables in the model, only DMONQUAL has a significant positive correlation with LogPBV. It indicates that firms with high amount of loans obtained from banks with high monitoring quality have higher increase in PBV.
LogPBV variable correlates positively and significantly to all the control variables, i.e. ROE, GROWTH, RISK, SIZE, and LEVERAGE. This relationship strengthens the findings from previous studies that profitability, size, growth rate, the level of leverage and risk the company will affect the increased value of the company. The correlation coefficients among all independent variables are relatively small, i.e. below 0.80. Thus, there is low likelihood of multicollinearity problems in the regression output for the research model.

8 Hypothesis Testing Analysis

8.1 The Effect of Magnitude of a Company's Bank Loans on the Firm Value

Based on the regression results in Table 4, the magnitude of bank loans in a company does not have any effect on the firm's value. This result does not support the finding of Ahn and Choi (2009) which states that the increasing amount of bank loans will reduce the borrowers' earnings management. Our finding also does not support Khalil and Parigi (1998) statement that the increasing amount of loan can be a signal for banks to increase the strength of the monitoring of the borrowers. The fact that the size of bank loans has no effect on the firm's value indicates that the banks as creditors still do not give any contribution to the implementation of the company's corporate governance. This suggests that the monitoring role of external parties, in this case specifically banks, as corporate governance mechanisms, is still not as effective as the monitoring role of company's internal governance structure.

Another possible argument of why the magnitude of firm's bank loans does not have any effect on the value of the firm is that not all banks actually perform monitoring functions effectively. Based on the descriptive statistics in Table 2, there is only 44% of the samples have their loans granted by banks with high monitoring quality. It indicates that even though a firm has used a greater amount of bank loans in its capital structure, but if the banks do not have the capability of good monitoring on their borrowers, then the monitoring function conducted by banks will not contribute to the change in firm's in value. This explanation is consistent with the hypothesis 2a result that will be discussed next.

Table 3. Pearson Correlation Analysis

	LogPBV	MAGNITUDE	DMONQUAL	LENGTH	NLENDER	ROE	GROWTH	RISK	SIZE	LEVERAGE
LogPBV	1.00									
MAGNITUDE	0.018 (0.788)	1.00								
DMONQUAL	0.149* (0.024)	-0.179** (0.006)	1.00							
LENGTH	-0.018 (0.791)	0.043 (0.514)	0.028 (0.669)	1.00						
NLENDER	-0.022 (0.736)	0.151* (0.022)	-0.423** (0.000)	-0.059 (0.370)	1.00					
ROE	0.208** (0.001)	-0.229** (0.000)	-0.051 (0.443)	-0.018 (0.783)	-0.003 (0.961)	1.00				
GROWTH	0.133* (0.045)	-0.149* (0.024)	0.094 (0.154)	0.175 (0.008)	-0.110 (0.097)	0.143* (0.030)	1.00			
RISK	0.151* (0.022)	-0.083 (0.212)	0.116 (0.079)	-0.035 (0.602)	0.184** (0.005)	-0.039 (0.552)	-0.074 (0.261)	1.00		
SIZE	0.319** (0.000)	-0.131* (0.048)	-0.081 (0.223)	-0.172** (0.009)	0.453** (0.000)	0.301** (0.000)	0.068 (0.305)	0.271** (0.000)	1.00	
LEVERAGE	0.131* (0.047)	0.534** (0.000)	-0.135* (0.041)	0.032 (0.625)	0.207** (0.002)	-0.173** (0.008)	-0.039 (0.560)	-0.154* (0.019)	0.158* (0.016)	1.00
* Significant at the level of $\alpha = 5\%$ (2-tailed)										
** Significant at the level of level $\alpha = 1\%$ (2-tailed)										
Amount in the bracket is the p-value										

Table 4. Regression Output

	Expected Sign	Unstandardized Coefficients	t-Statistic	Sig.
		B		
(Constant)		-1.0667	-4.1459	0.0000
MAGNITUDE	+	0.2189	1.1655	0.1226
DMONQUAL	+	0.0963	1.7366	0.0420**
LENGTH	+	0.0014	0.0854	0.4660
NLENDER	+	-0.0208	-2.0143	0.0226**
ROE	+	0.0026	1.7636	0.0396**
GROWTH	+	0.0005	1.1730	0.1211
RISK	-	0.0636	1.7890	0.0375**
SIZE	+	0.0646	3.2143	0.0008***
LEVERAGE	+	0.2561	1.5511	0.0612*
R-squared	0.2032			
Adjusted R-squared	0.1706			
Durbin-Watson stat	2.0442			
F-statistic	6.2332			
Prob(F-statistic)	0.0000			
*** Significant at level α =	1% (one-tailed)			
** Significant at level α =	5% (one-tailed)			
* Significant at level α =	10% (one-tailed)			

$LogPBV_i$: value of company i measured by logarithm value of price to book value of equity at the end of the study period, $MAGNITUDE_i$: size of bank loans measured by the ratio of the amount of bank loans to total assets of company i at the end of the study period, $DMONQUAL_i$: bank's monitoring quality measured by dummy variables (1.0) with a value of 1 if firm i at the end of the study period has the total borrowing amount from banks with high monitoring of quality greater than or equal to the median, and 0 if otherwise, $LENGTH_i$: loan period measured by the average loan outstanding period in company i at the end of the study period, $NLENDER_i$: number of lenders measured by the number of banks relate to the company i outstanding loan at the end of the study period, ROE_i: company's profitability measured by the ratio of net earnings before extraordinary items to book value of equity of company i at the end of the study period, $GROWTH_i$: company's rowth rate measured by the sales growth rate of company i at the end of the study period, $RISK_i$: company's risk measured by the beta of firm i at the end of the study period, $SIZE_i$: company's size measured by total sales of company i at the end of the study period, $LEVERAGE_i$: company's capital structure measured by the ratio of total liabilities to total assets of firm i at the end of the study period.

8.2 *The Effect of Bank Monitoring Quality on the Firm Value*

Based on the regression results in Table 4, bank monitoring quality has significant influence on the firm's value. This means that the banks' monitoring function on their borrowers really exists and is conducted effectively only if the banks have good monitoring capability. The monitoring conducted by the banks then will contribute as a governance mechanism to increase the firm's value. This finding is consistent with the finding of Ahn and Choi (2009) which states that the borrowers' earnings management will decrease when the loans are from banks with higher rank of reputation. The result of this study also supports Hermawan (2009) who found that companies with larger proportion of loans from the bank with a good monitoring quality will improve the response of investors on companies' earnings reflected on the stock returns. Therefore a good monitoring by the banks could prevent the borrowers to lower the earnings quality, so that investors become more responsive to the earnings information in the market.
This result also supports Billett et al. (1995) which proves that the bank identity indicated by the credit ratings is positively associated with the stock returns for companies that have bank loans. The identity of the bank gives a signal to investors about the two things, i.e. the bank knows the level of the borrowers' risk and the bank has the capability of monitoring to ensure that the borrowers' investment decisions and expenditures are increasing the firm's value (Fama, 1985). Therefore, the monitoring role by the banks could be an alternative of corporate governance mechanisms only if the banks have good monitoring capability on their borrowers.

8.3 *The Effect of the Length of Bank Loans Outstanding Period on the Firm Value*

Based on the regression results in Table 4. the length of the loan outstandidng period has no influence on the firm value. This result is not consistent with the finding of Ahn and Choi (2009) which states that the

longer the bank loan period will reduce the borrowers' earnings management, meaning that the bank monitoring should be more effective. One possible argument for the lack of influence of the loan outstanding period to the firm value in this study is because most of the loans obtained by the borrowers have an average elapsed time of 2.8 years, as shown in Table 2. Out of the total samples (230 companies), only 150 companies or about 65% have long-term loans, and the average elapsed time of 3.3 years. Therefore, the samples in this study may fail to capture the benefit of longer loan period in term of bank monitoring, i.e. long-term relationship between companies and banks that can strengthen the monitoring capacity from the bank perspective. The longer the bank loan period will provide incentives for banks to increase their monitoring efforts (Rajan and Winton, 1995).

8.4 The Effect of Number of Lenders on the Firm Value

Based on the regression results in Table 4, the increase in the number of banks that provide loans to a company will a negative effect on the firm value. This result supports the study of Preece and Mullineaux (1996) who found that increasing the number of banks as the company creditors will significantly decrease the firm value. Their finding were confirmed by the robustness test that provides evidence that when a company received a syndicated loan of over 3 (three) banks in it will have a lower value than firms that have loans from a single bank. The explanation of this finding is that a syndicated loan involves a number of bank participants and in this situation the bank loan would be similar to a publicly held bonds where the creditor are numerous and scattered. The monitoring function could become ineffective and it could be more difficult for banks to renegotiate loan terms.

Based on the descriptive statistics in Table 2, the average number of lenders in the samples is 3.47. It supports the statement of Preece and Mullineaux (1996) that if the number of lenders is more than 3 (three) than the firm value will decrease. Our finding in this study implied that bank monitoring becomes ineffective when a company deals with many banks as its source of debt financing, because each bank might rely on other banks to do the monitoring function on their borrowers and does not do the monitoring on their own. However, the result of this study is not consistent with Ahn and Choi (2009) who found no influence of the number of banks in a syndicated loan on the borrowers' opportunistic behavior.

9 Conclusion

This research examines the effect of bank monitoring as an alternative of corporate governance mechanisms on the borrowers' firm value. The strengths of bank monitoring are measured based on the magnitude of a company's bank loan, the size of a company's loan from the bank with a high monitoring quality, the length of a bank loan outstanding period, and the number of lenders in a company. The empirical results show that the bank monitoring quality and the number of lenders are significantly influence to the borrowers' firm value. However, the magnitude of the company's bank loan and the length of the bank loan period have no significant effect on the borrowers' firm value. These findings imply that only bank with good monitoring quality that could play an important role in the corporate governance of bank-dependent firms, and could give a significant contribution in the company's value creation by their monitoring function. Furthermore, bank monitoring is less effective if the company borrows from more banks and can result in decreasing the firm value.

There are several limitations of this study. The bank monitoring effectiveness is measured by certain proxies and is not based on an actual observation of how the monitoring is conducted by the bank. The monitoring quality is also determined by the banks' performance rating done by InfoBank magazine (2010). Therefore, there may be some inaccuracy in the measurement of the bank monitoring quality. Further research should use other measurement to solve these limitations and provide more solid findings regarding the role of banks as external corporate governance mechanisms.

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