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STUDY ON THE INFLUENCE OF GOVERNANCE MECHANISMS ON PERFORMANCE: EVIDENCE OF NONLINEAR RELATIONSHIPS OF LISTED COMPANIES IN DIFFERENT CONTEXTS

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Abstract

This work concerns the study of the influence of governance mechanisms on the performance of listed companies in different contexts, with evidence for nonlinear relationships. The sample consisting of 146 companies is grouped in 46 Portuguese and 100 British companies. The multiple linear regression and nonlinear regression were used. It was concluded that the influence of governance mechanisms on the performance of companies in different contexts is diverse and that there are nonlinear relationships whose effect represents an important contribution to understand the governance model.

Keywords: Governance Mechanisms, Performance, Agency Theory, Nonlinear Relationships

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1. Introduction

The literature distinguishes the Anglo-American, or outside model based on shareholder dispersion, and the European Continental and Japanese model, or inside model, based on the shareholder concentration (Aguilera and Jackson, 2003). However, globalization reinforces the importance of the governance mechanisms and the convergence of these models in the valuation of organizations and in defence of shareholder interest (Armour et al., 2003; Lane, 2003). This convergence influenced by the diffusion of codes of good governance (Zattoni and Cuomo, 2008), seems to overlook factors specific to each country, leading to potential disparity between governance practices and company performance. Its importance stems from the role of good governance to ensure the owners control over the managers (Jensen and Meckling, 1976; Fama and Jensen, 1983; Eisenhardt, 1989) and firms with poor governance being unable to adopt strategies for recovery and value creation for shareholders (Adjaoud et al., 2007).

There is insufficient knowledge of how different mechanisms of governance, for example, the composition of the board of directors and leadership structure of the company (Barnhard and Rosenstein, 1998; Wagner et al., 1998; Dalton et al., 1998; Rhoades et al., 2000) and other factors as the type of activity, influence the performance, due to the impact on the company's valuation and earnings for shareholders (Johnson et al., 1996; Coles et al., 2001).

This work relies on agency theory and stewardship theory, to support the mechanisms of corporate governance, and institutional theory (DiMaggio and Powell, 1983; Scott, 2001) to assess how, in particular, the context affects the mechanisms of governance.

The theoretical model is essentially based on the agency problem and collective action in an attempt to answer to the insufficient understanding of the effects of control mechanisms on performance, as there are different results. The well-known conflict of interest or confluence of interest between principal and agent are associated with greater or lesser shareholder dispersion.

The fact that the majority of studies base their analysis on linear relationships could justify the disparity in results, especially when some of the mechanisms of control exhibit nonlinear effects and thus obtaining critical issues enabling better knowledge of the governance models. The study examines this important theoretical gap enabling better understanding of the effect of certain control mechanisms in the performance of companies and the complexity of these models. Due to the fact that the study of linear relationships is not conclusive, De Miguel et al. (2005) analyzed the control mechanisms based in the nonlinear relationships, assuming the premise that if the relationship between some of the mechanisms and performance is nonlinear there may be points of optimization.

As there are many governance mechanisms, (Yermack, 1996, Shleifer and Vishny, 1997; Klein,

2002; Hermalin and Weisbach, 2003; Vafeas, 2003; Mintz, 2005; Lasfer, 2006, Erickson et al., 2006; Larcker et al., 2007) we decided to choose only four of these mechanisms, in order to simplify the model and the detail analysis of linear and nonlinear relationships, i.e. the composition of the board of directors (Daily and Dalton, 2003), separation of roles between Chairman and CEO (Bhagat and Black, 1999), incentives for managers (Westphal and Zajac, 1994) and the concentration of voting rights (Lins, 2003).

The focus is to assess the impact of governance mechanisms on the performance of companies and verify if these relationships have a linear or nonlinear behaviour, and if so, determine the critical points for a better understanding of the governance model. It was decided, also, by considering different contexts and analyze the effects of size (Klapper and Love, 2003) and business activity (Demsetz and Lehn, 1985). What governance mechanisms influence the performance? Is this influence linear or does it exhibit nonlinear behaviour? Is that relationship different or not depending on the context? Does the firm size and type of activity affect the model?

After the introduction and literature review, the following section presents the conceptual model and the model variables. The fourth section presents the instruments and the sample, the fifth section the data and statistical results and in the following section the discussion is developed. Finally, the conclusions are drawn and the implications for management, guidelines for future research and limitations and recommendations are presented.

2. Literature review

In the Seventies the agency theory, associated with the separation between ownership and corporate control, was presented as a central feature of modern capitalism and one of the main issues in stake in corporate governance. The agency problem is important in the relationship between ownership and control within the contractual perspective of the firm (Shleifer and Vishny, 1997; Paterson, 2001; Learmount, 2002) and relevant in the relationship between majority and minority shareholders for reasons of expropriation (La Porta et al., 1999). Their magnitude and nature, according to Gillan and Starks (2003), are associated directly with the ownership structure and differ from country to country, with variations in how different they are, the kind of consequences and solutions found. This theory supports the Anglo-American model of corporate governance based on creating shareholder value (Armour et al., 2003) and profitability and business growth. However, in Continental European and Japanese model, besides the shareholders there are other agents that play an important role in influencing firms, as the case of workers, suppliers and customers in formal terms or in the case of the community in

informal terms, by admitting that stakeholders assume risks associated with business activity involving the need to ensure better increase in value.

Several authors (Shleifer and Vishny, 1997; Gillan and Starks, 2003; Bhojraj and Sengupta, 2003; Gompers et al., 2003) consider that the adoption of certain measures of governance contributes to improved performance in the interests of shareholders, or the value of assets, and interests of stakeholders. According to Lane (2003), these “measures of governance” can be grouped and strengthen the internal control mechanisms, associated with shareholder concentration, and external control mechanisms associated with situations of greater dispersion. It is assumed that the purpose of various control mechanisms adopted in the agency perspective is to align interests between managers and shareholders, through the control and monitoring of agents, to act in the best interest of the principal or the valuation of companies (Eisenhardt, 1989; Daily et al., 2003; Dalton et al., 2003; Hill and Jones, 2004).

The stewardship theory focuses on another important discussion about the guardian manager (steward) of assets and valuation of the company. In this case, the separation between ownership and control should be an advantage, as managers tend to be more motivated to act in the interest of the company rather than in their own interest, particularly senior managers, imbued with ensuring the continuity and long-term success. Notwithstanding the existing supervision and monitoring systems, it is necessary to ensure that assets are managed in the best interest of the company (Wheelen and Hunger, 2002; Learmount, 2002). This, because it is not the same to act in the valuation of companies or in the interest of shareholders, as in many cases, for specific reasons, it does not match with the defence of company assets. According to the theory of stewardship, in many situations, managers act in seeking valuation of companies, which in the immediate situation may be detrimental to shareholders in order to safeguard the long-term assets.

The institutional theory extends to understanding the processes that tend to make organizations more similar and with different performance (DiMaggio and Powell, 1983) by use of cognitive-cultural approach (Scott, 2001). The interest and behaviour of shareholders and managers are influenced by personal factors and other effects of the social, cultural and economic environment. However, firms in similar environments may have different results which lead to induce the importance of factors intrinsic to organizations.

Most studies derive from analysis based on linear relationships between control mechanisms and performance, with mixed results in regard to the choice of governance models. In this sense, De Miguel et al. (2005) ascertained the importance of analyzing the nonlinear relationships. Their

verification enables to evaluate the alternatives, as the behaviour of relationships with the identification of critical points will be better understood. Consequently, the following working hypotheses are formulated:

Hypothesis 1: The governance mechanisms influence corporate performance differently in distinct contexts.

Hypothesis 2: The relationships between governance mechanisms and performance are linear and nonlinear.

Business characteristics such as size and sector of activity are determined by the business and investment strategies adopted and also by the control exerted by shareholders and the board of directors, ascertaining that a certain type of investors tend to invest in specific sectors. These characteristics influence the performance of companies (Tam and Tan, 2007). Several empirical studies show that the composition of the board is influenced by activity, size and age of the company (Adams and Mehran, 2003; Raheja, 2005; Boone et al., 2007). In turn, Anderson and Reeb (2003) found that size is negatively related to the valuation of the company. It was decided to consider different contexts and the effects of size and sector of activity in which companies operate, which led to the formulation of following hypotheses:

Hypothesis 3: The company size and sector of activity influence the governance mechanisms and performance, differently in distinct contexts.

Hypothesis 3 (a): The company size influences negatively in non-linear relationships the valuation of the company.

Hypothesis 3 (b): The sector of activity influences positively the return on equity and the growth of the company activity.

To reduce the problems of collective action, Becht et al. (2003) admitted the existence of alternative models, particularly based on the concentration of ownership, the board of directors and incentive compensation for executives. In another sense, Baysinger and Hoskisson (1990) indicate that, among the internal mechanisms, the separation of duties between the board chairman and CEO contributes to satisfy stakeholders and improves corporate governance. In turn, Armour et al. (2003) and Jobome (2006) report the need to use different mechanisms of governance to ensure the valuation of the company, for which they resorted particularly to independent directors and the incentives for managers.

Given the importance of the Cadbury report and in response to its recommendations, Marchica and Mura (2005) showed that it increased the proportion of independent directors on the boards of UK companies, where the manager's control prevails. This happened because the independent directors have been given the duty to avoid some of the relationships that might interfere with the exercise of their

judgement (Matolsky et al., 2004) for the protection of minority interests which requires better oversight, integrity in action and good understanding of business. Ghosh and Sirmans (2003) highlight the fact that their appointment to the board is one of the important mechanisms to reduce agency problems that affect performance. This means, according to Li (1994), that the independence of managers and legal power must imbue the structure of firms, in line with Daily and Dalton (2003) when referring that "more independent boards will result in greater oversight of corporate management and that this, in turn, will lead to improved firm performance".

There are, however, empirical studies that have produced mixed results regarding the effects of board independence on firm performance (Bhagat and Black, 2000; Daily and Dalton, 1994; Kiel and Nicholson, 2003). Some do not prove the relationship and others do confirm, although it was not significant (Daily and Dalton, 1997; Brickley et al., 1997; Dulewicz and Herbert, 2004).

The companies generally admit independent managers to improve the effectiveness of control, although there is little evidence that they are associated with higher performance (Hermalin and Weisbach, 2003) because the composition of the board is endogenous and improves monitoring and information provided (Raheja, 2005; Coles et al., 2006). In the same vein, Weir and Laing (1999) and Fosberg (1989) argue that because the boards have a majority of independent directors it does not imply that performance is better compared with boards consisting mainly of dependent directors and there was any relationship between the proportion of independent directors and the performance measures (ROE and sales). However, Nicholson and Kiel (2007) report that Lawrence and Stapledon (1999) found no robust relationship between the proportion of independent managers and various measures of performance, while Hermalin and Weisback (1991) found no such relationships. In turn, Dalton et al. (1998) found no relationship between board composition and performance, while Rhoades et al. (2000) found weak positive relationships. Other studies found that high growth companies, with higher proportion of independent managers on board, attained better performance, based on rate of return on equity (ROE) (Hutchinson, 2002). However, Uzun et al. (2004) found that the greater proportion of independent directors was associated with a lower probability of committing acts detrimental to the development of the company.

These various results lead us to conclude that the existence of a number of independent managers may have positive effects on performance but that its greater or lesser number can affect the results in a different way or simply not influence. The possibility of this behaviour occurring for reflecting the nonlinearity of the relationship leads to its evaluation.

Rhoades et al. (2001) ascertained, based on the contingency model suggested by Finkelstein and D'Aveni (1994), that the independent board structure was beneficial when the company's performance and power of managers were weak, because it strengthens the leadership and allows greater unity of command. Abdullah (2004) found a negative relationship between board independence and firm performance. In turn, Baysinger and Butler (1985), Rosenstein and Wyatt (1990), Peng et al. (2003) and Bonn (2004) found that the existence of independent managers had positive relationship with performance and contributes to value the company. Geddes and Vinod (1997) and Weisbach (1998) indicate that in firms with weak performance the existence of a significant number of independent managers improves business results. Rechner and Dalton (1991) and Finkelstein and D'Aveni (1994) found evidence that the choice of independent directors reflects positively on performance. In turn, Hambrick and Jackson (2000) found evidence that firms with independent managers had better performance by introducing improvements in governance. As a result, the following working hypothesis is formulated:

Hypothesis 4: The existence of independent directors on the board influences in a nonlinear way the performance of the company.

Regarding the management structure of the board, it is ascertained that the Unitarian structure of the board or concentration in management is prevalent in Anglo-Saxon countries (Hopt and Leyens, 2004), Japan (Jackson and Moerke, 2005) and European countries with exception of Germany, the Netherlands and Austria (Gregory and Bosch, 1999) where the structure adopted has been the dualistic or of management separation. However, in the composition of the board, the separation of the chairman and CEO is essential to reduce agency costs (Fama, 1980) with a positive influence on company performance (Learmount, 2002; Kiel and Nicholson, 2003).

In an industry with limited resources or more complex, the concentration of functions correlates positively with the ROI, while the duality of functions shows no significant relationship (Boyd, 1995). Peng (2004) ascertained that in economies in transition, firms with unified functions recorded higher sales growth but not of ROE. He further noted that the efficiency could be improved by adopting the dual function, as it reduces the information asymmetry, due to a more focused management and business goals aligned with the own interests and by the fact that transaction costs improve and thus the performance.

Research results are mixed on the effects of the functions duality or unity on company performance. Authors found a positive relationship between duality and performance (Boyd, 1995), which was contrary to what Dalton et al. (1998) and Coles et al. (2001) found. Still others showed that duality did not affect nor improve performance (Weir and Laing, 1999).

Baliga et al. (1996) ascertained that there is weak evidence that the duality of functions affects the long-term performance of companies. Faced with such diverse situations and considering for this study companies operating in different contexts, the following hypotheses are formulated:

Hypothesis 5: The concentration of management functions positively influences the ROE and growth of business activity but a separation of functions influences the valuation of the company.

The incentives given to managers (or sanction) by contingent compensation, is also based on agency theory and aims to promote their alignment with the owners or shareholders of the company with effect on performance, at least partially (Beatty and Zajac 1994; Zajac and Westphal, 1994; McDonald et al., 2008). According to the theorists of agency, managers receive financial rewards depending on the results of the company for which they are evaluated (Westphal and Zajac, 1994; Daily et al., 2003). However, Kubo (2005) considers that there are few the studies that examine the effects on performance of companies of the remuneration policy and that this relationship is weak in the case of large Japanese companies.

Studies of corporate governance (Dalton et al., 2003; Jensen and Murphy 1990) have shown that the incentives that are based on the high incomes of CEOs' are strongly related to the success of firms and its value. Tosi and Gomez-Mejia (1994) showed, in turn, that monitoring of the board compensation has an effect on company performance. Mishra and Nielsen (2000) go further and argue that the payment made to executives for performance, by aligning the interests of shareholders with incentives provided to managers, should be an option for independent managers.

The causal relationship between managers' remuneration and performance of companies is not yet clear, with studies showing the relationship (Boyd, 1994) and other studies not proving it (Hempel and Fay, 1994; Vafeas, 1999).

Ittner et al. (2003), Larcker (2003) and Ryan and Wiggins (2004) prove and the evidence indicates that supervision of the board tends to reinforce the links between company performance and way of CEO compensation. Jensen and Murphy (1990), Conyon and Peck (1998) and Cordeiro et al. (2000) ascertained that managers' compensation was positively related to company performance, particularly with the growth. Vafeas (1999) found no significant relationship between the incentives given to managers and performance. As a result, the following hypothesis is formulated:

Hypothesis 6: The adoption of performance-based incentives influences positively the ROE and the growth of the company activity and doesn't influence the valuation of the company.

Recent studies (Wiwattanakantang, 2001; Lins, 2003; Suto, 2003) found that ownership concentration positively influences the performance of companies,

especially relevant in countries where investor protection is low, for mitigating the conflicts between owners and managers by aligning both interests or because the owners use strong control action. It is, however, ascertained that the excessive concentration of voting rights despite reducing the problem of collective action can lead to situations of expropriation of minority shareholders. Tam and Tan (2007) consider that the concentration of ownership and control leads managers to the entrenchment and mastery or control of the shareholders' interests.

Marchica and Mura (2005) referring to Asian companies consider corporate governance a weakness to overcome, which the rapid growth of newly industrialized economies has not allowed to mature, to ensure appropriate governance structure and good performance. In the study of governance practices in companies in Malaysia, it was ascertained that there are no significant relationships between concentration of ownership and company performance, but there are variations in the company performance with different types of property. The different results may indicate that the greater or lesser shareholder concentration binds with the options of governance that the nonlinear relationships can portray.

Liu (2005) pointed out that the dispersion of ownership allows the market and not the largest shareholders to influence the development and implementation of corporate governance. Kapopoulos and Lazaretus (2007), based on Greek companies listed on stock markets, noted the influence of ownership structure on company performance. With reference to literature the following hypothesis is formulated:

Hypothesis 7: The concentration of shareholder voting rights influences positively the valuation of the company and doesn't influence ROE and the growth of the company activity.

3. The conceptual model and variables

The research model is based on the evaluation of the relationship between governance mechanisms and performance of companies.

Four independent variables were chosen to characterize the mechanisms of governance: the percentage of independent directors on the board of directors (PID), separation of roles between the Chairman and the CEO (SCC), remuneration of managers (VRM), and concentration of the voting rights (CVR). Four dependent variables were chosen to measure corporate performance: return on equity (ROE), Tobin's q ratio (Q), market to book ratio (MBR) and sales growth rate (SGR). The two control variables were firm size and activity sector.

3.1 Independent variables

Independent board members are considered to provide an impartial evaluation of top managers' activity,

enrich the board with added experience, and help to raise the quality of the board of directors (Bhojraj and Sengupta, 2003; Wood and Patrick, 2003). In this study, the percentage of independent directors on the board of directors was calculated based on the information provided by the companies in their reports. Note that this information, though the concepts of independence derive from specific regulations in each country, can also depend on the interpretation made by each company of those regulations.

The separation of roles between the Chairman and the CEO is a way to address the non-compatibility of supervision and decision duties (Davis and Kay; 1993). In this work, the separation of duties between the Chairman and the CEO was classified as a dummy variable with 0 standing for duties concentration and 1 for roles separation.

According to several authors, a properly drawn remuneration plan (in view of performance) will contribute to align managers' and shareholders' interests, minimising the agency problem (Becht et al., 2003). The variable used in this work was the variable remuneration of the managers, calculated using disclosed information concerning the yearly remuneration of the executive members of the board.

A line of thought associates corporate governance to a high capital dispersion pattern, leading to the existence of a high number of shareholders, whereby none of them has a dominating position over the remaining (La Porta et al., 2000). In this situation a "semi-concentrated property" (Becht et al., 2003) would be a solution for the collective action and agency problems, a conclusion reached in several studies (Pivovarsk, 2003; Guriev and Rachinsky, 2005). In this work, the information concerning the three major shareholdings and their voting rights was summarized in the variable concentration of voting rights.

3.2 Dependent and control variables

Return on equity (ROE) is determined based upon the relation between net income (NI) and equity (E). This ratio is the privileged measure of efficiency for shareholders and investors. Brealey and Myers (2000), state that this is a ratio which allows checking the "efficiency level in which the corporations are using their equity".

Tobin's q ratio (Q) is based on the market and expresses the company evaluation made by investors. The ratio establishes the relation between the "market value of the indebtedness sum and equity of a company and the reposition cost of its assets" (Brealey and Myers, 2000). This indicator has been used in many studies (Loderer and Martin, 1997; Cho, 1998; Demsetz and Villalonga, 2001). Wiwattanakantang (2001) studied the effectiveness of the existing corporate governance mechanism on performance using Tobin's Q. La Porta et al. (2002)

used an alternative calculation method for Q to study the relationship between the protection of investors and the valorisation of corporations, which will be followed in the scope of this work. The ratio establishes the relationship between the ‘book value of assets less book value of common equity less deferred taxes plus market value of common equity’ and the ‘book value of assets’.

The market to book ratio (MBR) compares the market value of shares with its book value. This ratio corresponds to an index of the value created for the shareholder for the total investment he or she made in the company. The ratio establishes the relationship between the ‘market value’, and the ‘book value’.

The sales growth rate (SGR) measures the operational performance of corporations (Gompers et al., 2003). This variable avoids the repercussions of “profit volatility and manipulability” in relation to the profit growth. The ratio establishes the relation between the ‘sales (i) less sales (i-1)’ and the ‘sales (i-1)’, in which i represents the year.

Firm size (Cho and Kim, 2007) is calculated using the natural logarithm of the assets of the companies as a continuous variable.

The variable sector of activity (Tam and Tan, 2007) is calculated as dummy variable of the financial sector.

4. Research methods

4.1 Data collection/sample

The “reports and accounts” and the “report on corporate governance” of the 46 corporations listed on December 31, 2004, 2005, 2006, coinciding with the year’s closing, at the main market of Euronext Lisbon, are the universe, and were obtained at the Portuguese Stock Market Supervisory Authority (CMVM).

From the main market of London Stock Exchange (LSE), consisting of 1.294 firms (31 October 2006), 100 companies were selected randomly, using an algorithm to replicate the structure of the UK market, and their reports and accounts were collected from their institutional sites. Since the fiscal year is not identical for all companies and differs from the calendar year, we tried to approximate the conditions of the sample of study years 2004, 2005 and 2006. In statistics, we used the average of three years. The final sample consisted of 146 listed companies, of which 46 Portuguese companies and 100 UK companies.

4.2 Instruments

We used simple linear regression and multiple regression models. In the case of non-linear regressions, we proceeded to the necessary transformation of variables aiming at its’ linearization. The conditions of applicability of the

linear regression model were checked, using in particular the Durbin-Watson statistic, residuals analysis, VIF statistics and eigenvalues and condition index.

The analysis of contribution of each of the variables in the model was carried out through its’ coefficient, signal and significance. The analysis of multiple regression models, built up on simple relationships already known, took into consideration the coefficient of variability adjusted and the respective p-value.

5. Analyse and Results

5.1 Descriptive analysis

The companies listed in Portugal, based on average sales in the period of three years, on average, were nearly double the size of listed companies in the UK, have assets about eleven times higher, have more than doubled equity and recorded less than three times the results (Appendix A, Table A.1 and Table A.2). This should result from the fact that the sample matches the universe of Portuguese companies, consisting of larger companies, which should reflect the lower propensity of firms to enter the stock market and therefore less maturity of the market and a lower relative importance of the stock market in the financing of companies.

The data also show, on average, that British companies have on the board a majority of independent directors, about double compared to the Portuguese companies that, on average, represent a minority; that Portuguese companies opt for a higher percentage of variable compensation than British companies; and that the level of dispersion of capital is clearly differentiated, being British companies in general characterized, by “widely-held” while the Portuguese companies, in large measure, are characterized by “block-holdings”.

GDP per capita in PPS, Portugal, with 10.6 million inhabitants in 2007 was of 76.2 of the EU27 average = 100 and in the UK, with 60.8 million inhabitants, of 119,2.

5.2 Exploratory Analysis

The multiple linear regression model was used to analyze the cumulative effect of independent variables on each dependent variable. To optimize results for each pair of independent and dependent variables were used linear and simple nonlinear regressions and functions were obtained with better explanatory power and significance relationships between variables.

5.2.1 Portugal

By applying the multiple regression for each of the performance variables, it was ascertained that the

return on equity (ROE) is explained by variables separation of roles (SPP) and incentive compensation (VRM) in 13.2% of the total variability in the adjusted model ($\alpha = 0.025$) (Table 1). The valuation of companies measured by Tobin's Q is explained by the independent variables of board composition (PID), SCC, sector and in 18.7% of the total variability in the

adjusted model ($\alpha = 0.019$) and measured by market to book ratio (MBR) variables explained by PID and SCC in 17.7% of the total variability ($\alpha=0.008$). The growth in sales (SGR) is explained by the variables size, sector and VRM in 9.0% of the total variability ($\alpha=0.084$).

Table 1. Standardized coefficients of multiple linear regressions – Portugal

Independent Variable	ROE	Q	MBR	SGR
Size				0.252
Sector		-0.377 **		0.101
PID		1.025 **	0.232	
PID^2		-0.960 **		
SCC	0.286 ***	0.111	0.363 **	
VRM	0.234			0.153
R2 adjusted	13.2% **	18.7% **	17.7 % *	9.0% ***
p-value model	0.025	0.019	0.008	0.084

Significance: * $\alpha = 0.01$, ** $\alpha = 0.05$ e *** $\alpha = 0.10$

In the study of relationships between each independent variable and the dependent variables, the simple linear regression was used. We analyzed then the more common nonlinear functions, in particular

the quadratic and cubic function as alternatives to linear function, in search of better explanatory power for each relationship (Table 2).

Table 2. Values R2 and p-value of simple regressions. Portuguese companies

Independent Variables	Dependent Variables							
	ROE		Q		MBR		SGR	
Size (Assets)	Linear	Ln	Linear	Quadr.	Linear	Cubic	Linear	n. d.
	0.004 (0.697)	0.057 (0.113)	0.025 (0.295)	0.051 (0.325)	0.024 (0.311)	0.041 (0.415)	0.102 (0.031)	n. d.
Sector (Dummy)	Linear	n. d.	Linear	n. d.	Linear	n. d.	Linear	n. d.
	0.011 (0.493)	n. d.	0.085 (0.049)	n. d.	0.060 (0.106)	n. d.	0.067 (0.082)	n. d.
PID	Linear	Quadr.	Linear	Quadr.	Linear	n. d.	Linear	n. d.
	0.000 (0.891)	0.052 (0.341)	0.034 (0.230)	0.130 (0.058)	0.083 (0.058)	n. d.	0.047 (0.155)	n. d.
SCC	Linear	n. d.	Linear	n. d.	Linear	n. d.	Linear	n. d.
	0.117 (0.027)	n. d.	0.083 (0.065)	n. d.	0.166 (0.007)	n. d.	0.031 (0.268)	n. d.
VRM	Linear	n. d.	Linear	Quadr.	Linear	Quadr.	Linear	n. d.
	0.123 (0.023)	n. d.	0.009 (0.535)	0.089 (0.155)	0.003 (0.720)	0.028 (0.567)	0.067 (0.094)	n. d.
CVR	Linear	n. d.	Linear	Cubic	Linear	Cubic	Linear	Cubic
	0.059 (0.121)	n. d.	0.024 (0.318)	0.067 (0.433)	0.044 (0.175)	0.064 (0.456)	0.001 (0.806)	0.118 (0.174)

Note: Numbers without brackets correspond to R2. The numbers in brackets refer to significance of regression (p-value).

By studying each of the relationships it was found that the firm size explains 10.2% of the total variability of sales growth (SGR) and industry explains 8.5% of the total variability of Tobin's Q and 6.7% of sales growth. The independent composition of the board (PID) explains 8.3% of the variable MBR. The separation of roles (SCC) explains 11.7%

of return on equity, 8.3% of Tobin's Q and 16.6% of MBR. Variable incentive remuneration to managers (VRM) explains 12.3% of the ROE and 6.7% of SGR. The values calculated are significant but the variability explained is low, allowing, however, indications of trend.

Applying the non-linear regressions, the quadratic function of the variable composition of the board (PID) was found with better explanatory power, explaining 13.0% of the total variability of Tobin's Q. This result shows that there is a point of maximization of the concave function ($c < 0$), with successively increasing and decreasing tempo.

In short, there are relationships of influence of the governance mechanisms on ROE, Tobin's Q, MBR and SGR and deepens the nonlinear behaviour between the PID and Tobin's Q. The analysis of mechanisms shows greater influence on Tobin's Q and MBR as performance variables. The size of firms and activity sector influence the performance.

5.2.2 United Kingdom

Using the multiple linear regression model to analyze the combined influence of independent variables, showed that 13.1% of the total variability of return on equity (ROE) in the adjusted model ($\alpha = 0.007$) is explained by the independent variables size and CVR, 33.2% of the total variability of Tobin's Q in the adjusted model ($\alpha = 0.000$) explained by the variables Size, Sector and PID, 5.6% of the total variability in the valuation of companies (MBR) in the total model ($\alpha = 0.016$) explained by the variable Size and 19.9% of the total variability in sales growth (SGR) in the total model ($\alpha = 0.001$) explained by the variables Size, PID, VRM and CVR (Table 3).

Table 3. Standardized coefficients of multiple linear regressions - United Kingdom

Independent Variable	ROE	Q	MBR	SGR
Inv. Size	-0.247 **	0.484 *	0.259 **	-0.260 **
Sector		-0.394 *		
PID		0.039		3.594
PID ²		-0.148		-9.699
PID ³				6.216
VRM				0.218
CVR	-3.893 **			-2.230 **
CVR ²	9.561 *			
CVR ³	-5.944 *			
R2 adjusted	13.1% *	33.2% *	5.6% **	19.9% *
p-value	0.007	0.000	0.016	0.001

Note: Significance * $\alpha = 0.01$, ** $\alpha = 0.05$ and *** $\alpha = 0.10$.

Applying linear regression to all the variables showed that the sector of activity explains 12.8% ($\alpha = 0.001$) of the total variability of Tobin's Q. The variable composition of the board (PID) explains 4.8% ($\alpha = 0.048$) of the variable Q, the variable

incentive for managers (VRM) explains 4.0% ($\alpha = 0.050$) of the variable SGR (Table 4). The variable concentration of voting rights (CVR) explains 3.6% ($\alpha = 0.091$) of the variable SGR.

Table 4. Values R2 and p-value of simple regressions. British Companies

Independent Variables	Dependent Variables							
	ROE		Q		MBR		SGR	
	Linear	Inverse	Linear	Inverse	Linear	Inverse	Linear	Inverse
Size (Assets)	0.004 (0.561)	0.042 (0.049)	0.004 (0.532)	0.162 (0.000)	0.007 (0.426)	0.067 (0.016)	0.000 (0.932)	0.085 (0.004)
Sector (Dummy)	Linear 0.000 (0.925)	n. d. n. d.	Linear 0.128 (0.001)	n. d. n. d.	Linear 0.020 (0.188)	n. d. n. d.	Linear 0.007 (0.405)	n. d. n. d.
PID	Linear 0.000 (0.978)	Cubic 0.027 (0.480)	Linear 0.048 (0.040)	Quadr. 0.069 (0.047)	Linear 0.012 (0.314)	Inverse 0.015 (0.253)	Linear 0.019 (0.184)	Cubic 0.066 (0.097)
SCC	Linear 0.002 (0.656)	n. d. n. d.	Linear 0.004 (0.538)	n. d. n. d.	Linear 0.000 (0.954)	n. d. n. d.	Linear 0.001 (0.745)	n. d. n. d.
VRM	Linear 0.027 (0.115)	Cubic 0.055 (0.170)	Linear 0.009 (0.367)	Quadr. 0.030 (0.273)	Linear 0.002 (0.660)	n. d. n. d.	Linear 0.040 (0.050)	n. d. n. d.
CVR	Linear 0.001 (0.798)	Cubic 0.116 (0.028)	Linear 0.008 (0.445)	Inverse 0.026 (0.163)	Linear 0.000 (0.883)	n. d. n. d.	Linear 0.036 (0.091)	n. d. n. d.

Note: Numbers without brackets correspond to R2. The numbers in brackets refer to significance of regression (p-value).

Applying non-linear functions on each of the relationships, it was found those with better significance and explanatory power. The size of companies using the inverse equation explains 4.2% ($\alpha = 0.049$) of the total variability of return on equity (ROE), explains 16.2% ($\alpha=0.000$) of Tobin's Q, explains 6.7% ($\alpha=0.016$) of company's value, measured by the ratio of market price to book value (MBR), and explains 8.5% ($\alpha=0.004$) of sales growth (SGR). The variable PID explains 6.9% ($\alpha = 0.047$) of the total variability of Tobin's Q variable, using the quadratic equation, and explains 6.6% ($\alpha = 0.097$) of the variable SGR, using the cubic equation. Using the cubic equation, the variable CVR explains 11.6% ($\alpha = 0.028$) of the total variability of ROE. These results obtained with the cubic equation change with three different tempos. For example, the results grow to a certain point, then decline and grow back, determining two inflection points that are calculated using the second derivative, enabling a better understanding of the type of relationship between variables.

In short, the study done between each governance mechanism adopted and each performance variable checks relationships of influence on ROE, Tobin's Q and SGR and deepens the nonlinear behaviour. The combined analysis of mechanisms shows greater influence on Tobin's Q and SGR as performance variables. Both firm size and activity sector influence the performance.

6. Discussion

It is observed that the governance mechanisms influence the return on equity, sales growth and the valuation of companies. This relationship differs depending on the context. In the Portuguese listed companies there are larger shareholdings, a fewer number of directors on the board and higher focus on variable remuneration while the UK listed companies have a higher dispersion of capital, higher average number of directors on the board and lower focus on the incentives for managers.

The combined analysis of the mechanisms in the case of Portuguese firms shows a greater influence on Tobin's Q and MBR as performance variables and in the case of UK companies, higher influence on Tobin's Q and sales growth. This difference, observed on the side of the British companies, stressed the importance of incentives for executive directors and admission of independent directors on the board in view of greater shareholder dispersion.

The literature considers that the adoption of certain control mechanisms contributes to improved performance in the interest of the shareholder or valuation of company assets (Gillan and Starks, 2003; Bhojraj and Sengupta, 2003; Gompers et al., 2003) to address problems of agency and collective action in the perspective of creating shareholder value (Armour

et al., 2003) and the valuation of the company (Wheelen and Hunger, 2002) which is in line with the results. This perspective is consonant with the greater or lesser shareholder dispersion, under theories of agency and stewardship. In turn, the mechanisms of governance that affect the return on equity, sales growth and MBR differentiate between the Portuguese and British companies, which is in accordance with the observation of Gillan and Starks (2003) when referring to the fact of ownership structure having an effect on results, different from country to country, admitting, however, that it may converge to a similar model as observed by DiMaggio and Powell (1983). Hypothesis 1 is proven.

The literature generally ascertains linear effect between mechanisms of governance and performance and evaluates the intensity and signal with varying results, sometimes contradictory, which leads to insufficient understanding of the particular agency problems and collective action. The deepening of the behaviour of nonlinear relationships found that independent managers in the board, to a certain number, have positive effects on the valuation of the company, showing after a negative effect or zero, determining a peak, with consequences for the agency problem. In the case of the larger shareholder concentration, it has been noted its positive influence on return on equity that decreases as shareholder dispersion increases up to a certain minimum value, after which it increases again up to a maximum and falling back on a continuous negative relationship. The prospect of non-linear relations follows the observations of De Miguel et al. (2005). Hypothesis 2 is proven.

There is evidence of the size and activity of companies influencing different measures of performance. By analyzing Portuguese companies, it was found that the size has a positive effect on sales. In turn, the business sector has positive influence on sales and negative on the valuation of companies.

In the study of UK companies, it was found that the increasing size of companies match the rapid increase in return on equity and sales growth increases with decreasing marginal decrease and rapid recovery of firms with decreasing marginal increases, both to a point of indifference. That is, the larger British companies are those that less value and achieve greater return on equity and sales growth. There are two distinct behaviours which ensures different governance models depending on objectives. In turn, the business sector has a negative effect on the valuation of companies, ascertaining in this study that both the British and Portuguese companies of the financial sector negatively influence their valuation.

The size of companies, as they operate in specific contexts, particularly in economies with higher or lower level of development and own legal, financial and social structures, influences their performance differently (Tam and Tan, 2007). In a

specific context, Anderson and Reeb (2003) showed that the size has negative effects on the valuation of companies. Confirmed the hypotheses 3 and 3 (a). In this case, there was a negative nonlinear relationship between the size and valuation of companies but a positive nonlinear relationship with profitability and sales. In the case of hypothesis 3 (b), it was found that the activity has a positive influence on the growth of business and has no significant relationship with profitability. It shows, however, a negative relationship with the valuation of companies.

The literature shows mixed results regarding the option for independent directors on the board of companies influencing the performance. A group of authors (Rechner and Dalton, 1991; Finkelstein and D'Aveni, 1994; Peng et al., 2003; Bonn, 2004) referred to be positive its relationship with performance without, however, specifying how this influence is exerted. Another group (Abdullah, 2004) refers to the negative relationship between board independence and firm performance. Others (Hermalin and Weisback, 1991; Dalton et al., 1998), still consider that the independent managers do not influence the performance of companies. This finding allows us to consider that different situations lead to different results or that with the same situation the relationship shows a non-linear evolution, and may observe different kinds of positive, negative or neutral effects. Similarly, in safeguarding the interests of minority shareholders, different authors (Matolcsy et al., 2004; Ghosh and Sirmans, 2003; Hutchinson, 2002) refer to this relationship as a mechanism to reduce problems of collective action or to minimize acts detrimental to the development of firms. They admit the existence of positive or negative influence relationships without specifying their behaviour and whether they are identical or not for companies operating in different contexts.

The analysis of results shows that the valuation of Portuguese firms increases with the integration of independent directors in the board. However, boards with more independent managers have a tendency to negatively influence the value of companies, which leads to observe a point of optimization.

Although, on average, there are more independent managers on board of UK companies, compared to the boards of Portuguese companies, their inclusion influences positively the sales and value of companies, this measured by Tobin's Q, to a certain extent, from which the larger inclusion of independents has a negative effect on the value of British companies. Also, in this case, there is an optimum point where the existence of a certain number of independent directors maximizes the performance of companies, as a nonlinear relationship is found. The hypothesis 4 is proven. The relationship between composition of the board and performance determines a maximum point and the curve expressing the relationship has different development.

The separation of duties between the Chairman and the CEO is considered another of the mechanisms leading to the reduction of agency problems and improving performance (Learmount, 2002; Kiel and Nicholson, 2003). However, other authors (Boyd, 1995; Peng, 2004) show that in economies with greater complexity or limited resources or in less developed economies, the concentration of duties improves performance. The issue of duality or concentration of duties as governance mechanism has wide-ranging discussion.

UK companies have no data with significance on the effects of separation of duties in the performance. As for Portuguese companies the concentration of duties between the Chairman and the CEO has strong significance values, allowing to verify the influence on the return on equity and the valuation of companies. The hypothesis 5 considers that the concentration of functions has an influence on profitability, which is proved, and that separation of roles influences the valuation of the company, which is not proven, ascertaining the relationship between the concentration and valuation of the company.

The variable referring to the remuneration of the managers is another important mechanism of governance in view of the agency theory, used to align the agent with the principal (Daily et al., 2003; McDonald et al., 2008). By indexing the financial retribution of managers to results achieved, owners or shareholders with concentrated equity intend to ensure control of firms and warrant the value to shareholders. However, when shareholder equity is dispersed, incentives granted may reverse only in the interests of managers and dissociate from the valuation of firms, which leads Kubo (2005) to invoke the weak relationship between results and incentives to managers, in the case of large firms. Several authors (Ittner et al., 2003; Dalton et al., 2003; Ryan and Wiggins, 2004) show that a positive relationship exists between the incentives of managers and the results attained, which others do not (Hempel and Fay, 1994; Vafeas, 1999).

With the use of variable remuneration of the executive members of the board, is intended to alleviate the agency problem by making them share the same interests of shareholders. There is evidence of the incentive given to Portuguese managers having a positive effect on return on equity and sales growth. Also ascertained is the fact of incentives of variable remuneration to British managers having a positive influence on sales growth.

The incentives offered to managers through variable remuneration has positive effects with strong significance of the return on equity and weak significance of sales growth of Portuguese companies and strong significance of the British companies. Hypothesis 6 is proven.

The concentration or dispersion of shareholder voting rights are a further control mechanism that determines the governance model, dependent on how

societies organize themselves in terms of legal, financial and social structure, with effects on company performance (Aguilera and Jackson, 2003; Zattoni and Cuomo, 2008). Recent authors like Suto (2003) and Kapopoulos and Lazaretus (2007) show there is influence between the concentration of voting rights and company performance, but do not mention the type of relationships, which was highlighted by Marchica and Mura (2005) but these authors do not explicit when referring to the existence of variations in the performance of firms with different types of property.

It is ascertained that the concentration of voting rights in Portuguese firms shows no significant values. In the case of British companies, characterized by dispersion, the higher concentration of voting rights in relation to the return on equity, in a certain range, decreases slightly to go up as there is greater shareholder dispersion, after which it decreases abruptly, in a nonlinear relationship. In the interval with lower shareholder dispersion, agency problems are reduced insofar as the interests of the principal are respected by the agent. The issues of expropriation of minority shareholders may emerge, to the extent that the excessive concentration of voting rights can lead to perverse effect, leading to the majority shareholders seeking to draw direct benefits from the dominance by favouring in trades with the company, a situation referred to as "expropriation of minority shareholders". The optimization of performance occurred with the shareholder dispersion. In a certain range, it appears that an increase in shareholder concentration results in a better performance of the organization, according to the theory, but for high values of concentration performance decreases, in line with what applies to the expropriation of minority shareholders. It is noticed that sales growth of British companies decreases as there is greater shareholder dispersion. There were non-linear relationships but the hypothesis 7 is not proven.

7. Conclusions

The control mechanisms influence the performance of companies. However, companies listed in a less developed economy that is characterized by shareholder concentration, a lower average number of directors on the board and a greater incentive for managers, focus more on their valuation. For companies listed on a developed economy that had greater shareholder dispersion, a higher average number of directors on the board and lower bet on incentive for managers, in addition to valuing the companies, focus on sales growth.

Certain control mechanisms showed nonlinear effects in the relationship with performance, with implications for governance models, which may explain the different results obtained by different authors. The evaluation of nonlinear relationships shows that there exist critical points which

understanding allows better matching the complexity of governance models, according to agency theory and of collective action.

It was observed in the case of Portuguese firms that separation of roles influences the return on equity and the value of companies, not ascertained in the case of British companies. The valuation of Portuguese companies is clearly influenced by the existence of independent directors on the board, while in British companies their presence affects sales in a positive manner to a certain number of directors, negative when that number increases and positive again with the larger number on the board. In this relation there were two points of optimization, a maximum and a minimum, which means that sales are growing with the existence of independent directors on the board, decrease with the further increase and increase again with a large number in the board.

For British companies, the largest concentration of shareholder voting rights positively influences the return on equity up to a maximum, at a certain interval, which contradicts the agency problem, i.e. solves the problem of collective action, from which the influence is very negative. It tends to be the reason why to a certain level of shareholder concentration they may exert moderate influence on managers. From a certain level of influence on, it can be deduced that the shareholder return instead of resulting from return on invested capital is the result of business with the company by way of expropriation of minority shareholders. In turn, the highest concentration negatively influences the volume of activity. It is also noted that the larger size of firms influences positively, with decreasing gains, the return on equity and sales and negatively with decreasing gains, the value of companies.

7.1 Implications for Management

This work shows nonlinear relationships between several of the governance mechanisms with influence on performance, which allows determining points of optimization with implications on management. It also shows, the influence of context implying differences between the mechanisms of governance and performance, reflected in the type of governance model.

7.2 Directions for Future Research

The studies should be extended to other mechanisms of governance and deepen their influence on the performance of firms exploiting the nonlinear relationships to determine maximum or minimum inflection points. There certainly are other nonlinear functions with explanatory power, possibly, higher.

Other points should consider different sectors to better understand the effects on corporate behaviour, through the mechanisms of governance and study the implications of company size, as well as introduce a

new control variable to ensure the influence of the quotation time of the company in the stock market and make the study more comprehensive, extending the number of variables of the governance mechanisms. The context should consider other variables such as the legal, financial and social systems.

7.3 Limitations and recommendations

Despite the identification of significant models there is, however, and in general, weak explanatory power, which justifies the continuation of studies. It is recognized, particularly in the Portuguese case, that there are limitations derived from the sample size of listed companies, which may extend to other nonlisted companies and similar between the two samples.

References

1. Abdullah, S. (2004), "Board composition, CEO duality and performance among Malaysian listed company", *Corporate Governance*, Vol. 4 No. 4, pp. 47-61.
2. Adams, R. and Mehran, H. (2003), "Is corporate governance different for bank holding companies?", *Economic Policy Review*, Vol. 9, pp. 123-142.
3. Adjaoud, F., Zeghal, D. and Andaleeb, S. (2007), "The effect of board's quality on performance: a study of Canadian firms", *Corporate Governance: An International Review*, Vol. 15 No. 4, pp. 623-635.
4. Aguilera, R. and Jackson, G. (2003), "The cross-national diversity of corporate governance: dimension and determinants", *Academy of Management Review*, Vol. 28 No. 3, pp. 447-465.
5. Anderson, R. and Reeb, D. (2003), "Founding-family ownership and firm performance: evidence from the S&P 500", *The Journal of Finance*, Vol. 58 No. 3, pp. 1301-1328.
6. Armour, J., Deakin, S. and Konzelmann, S. (2003), "Shareholder primacy and the trajectory of UK corporate governance", *British Journal of Industrial Relations*, Vol. 41 No. 3, pp. 531-555.
7. Baliga, B., Moyer, R. and Rao, R. (1996), "CEO duality and firm performance: what's the fuss?", *Strategic Management Journal*, Vol. 17 No. 1, pp. 41-53.
8. Barnhard, S. and Rosenstein, S. (1998), "Board composition, managerial ownership, and firm performance: an empirical analysis", *Financial Review*, Vol. 33 No. 4, pp. 1-36.
9. Baysinger, B. and Hoskisson, R. (1990), "The composition of board of directors and strategic control: effects on corporate strategy", *Academy of Management Review*, Vol. 15 No. 1, pp. 72-87.
10. Baysinger, R. and Butler, H. (1985), "Corporate governance and the board of directors: performance effect of changes in board composition", *Journal of Law, Economics and Organization*, Vol. 1 No. 1, pp. 101-124.
11. Beatty, R. and Zajac, E. (1994), "Managerial incentives, monitoring, and risk bearing: a study of executive compensation, ownership, and board structure in Initial Public Offering", *Administrative Science Quarterly*, Vol. 39 No. 2, pp. 313-335.
12. Becht, M., Bolton, P. and Roell, A. (2003), "Corporate governance and control", In Constantinides, G., Harris, M. and Stulz, R. (Eds.), *Handbook of the Economics of Finance*, North-Holland, Amsterdam, pp. 1-109.
13. Bhagat, S. and Black, B. (1999), "The uncertain relationship between board composition and firm performance", *Business Lawyer*, Vol. 54 No. 3, pp. 921-963.
14. Bhagat, S. and Black, B. (2000), "Independence du conseil d'administration et performance corporative", *Gouvernance Revue Internationale*, Vol. 1, pp. 68-95.
15. Bhojraj, S. and Sengupta, P. (2003), "Effect of corporate governance on bond ratings and yields: the role of institutional investors and outside directors", *Journal of Business*, Vol. 76 No. 3, pp. 455-475.
16. Bonn, I. (2004), "Board structure and firm performance: evidence from Australia", *Journal of Australian and New Zealand Academy of Management*, Vol. 10 No. 1, pp. 14-24.
17. Boone, A.L., Field, L.C., Karpoff, J.L. and Raheja, C.G. (2007), "The determinants of corporate board size and composition: an empirical analysis", *Journal of Financial Economics*, Vol. 85 No. 1, pp. 66-101.
18. Boyd, B. (1994), "Board control and CEO compensation", *Strategic Management Journal*, Vol. 15 No. 5, pp. 335-344.
19. Boyd, B. (1995), "CEO duality and firm performance: a contingency model", *Strategic Management Journal*, Vol. 16 No. 4, pp. 301-312.
20. Brealey, R. and Myers, S. (2000). *Principles of Corporate Finance*, 6th ed., Burr Ridge, IL: Irwin McGraw-Hill.
21. Brickley, J., Coles, J. and Jarrell, G. (1997), "Leadership structure: separating the CEO and the chairman of the board", *Journal of Corporate Finance*, Vol. 3 No. 3, pp. 189-220.
22. Cho, D.-S. and Kim, J. (2007), "Outside directors, ownership structure and firm profitability in Korea", *Corporate Governance: An International Review*, Vol. 15 No. 2, pp. 239-250.
23. Cho, M. (1998), "Ownership structure, investment, and the corporate value: an empirical analysis", *Journal of Financial Economics*, Vol. 47 No. 1, pp. 103-121.
24. Coles, J., McWilliams, V. and Sen, N. (2001), "An examination of the relationship of governance mechanisms to performance", *Journal of Management*, Vol. 27 No. 1, pp. 23-55.
25. Coles, J., Naveen, D. and Naveen, L. (2006), "Managerial incentives and risk-taking", *Journal of Financial Economics*, Vol. 79, pp. 431-468.
26. Conyon, M. and Peck, S. (1998), "Board control, remuneration committees and management compensation", *Academy of Management Journal*, Vol. 41, pp. 146-157.
27. Cordeiro, J., Veliyath, R. and Erasmus, E. (2000), "An empirical investigation of the determinants of outside director compensation", *Corporate Governance: An International Review*, Vol. 8 No. 3, pp. 268-279.
28. Daily, C. and Dalton, D. (1994), "Bankruptcy and corporate governance: the impact of board composition and structure", *Academy of Management Journal*, Vol. 37 No. 6, pp. 1603-1617.
29. Daily, C. and Dalton, D. (1997), "CEO and board chairperson roles held jointly or separately: much ado about nothing", *Academy of Management Executive*, Vol. 11 No. 3, pp. 11-20.
30. Daily, C. and Dalton, D. (2003), "Dollars and sense: the path to board independence", *The Journal of Business Strategy*, Vol. 24 No. 3, pp. 41-43.

31. Daily, C., Dalton, D. and Rajagopalan, N. (2003), "Governance through ownership: centuries of practice, decades of research", *Academy of Management Journal*, Vol. 46, pp. 151-158.
32. Dalton, D., Daily, C., Certo, S. and Roengpitya, R. (2003), "Meta-analyses of financial performance and equity: fusion or confusion?", *Academy of Management Journal*, Vol. 46 No. 1, pp. 13-26.
33. Dalton, D., Daily, C., Ellstrand, A. and Johnson, J. (1998), "Meta-analytic reviews of board composition, leadership structure, and financial performance", *Strategic Management Journal*, Vol. 19 No. 3, pp. 269-290.
34. Davis, E. and Kay, J. (1993), "Corporate governance, takeovers, and the role of the non-executive director", In Bishop, M. and Kay, J. (Eds.), *European Mergers and Merger Policy*, Oxford University Press, Oxford, pp. 200-215.
35. De Miguel, A., Pindado, J. and De la Torre, C. (2005), "How do entrenchment and expropriation phenomena affect control mechanisms?", *Corporate Governance: An International Review*, Vol. 13 No. 4, pp. 505-516.
36. Demsetz, H. and Lehn, K. (1985), "The structure of corporate ownership: causes and consequences", *Journal of Political Economy*, Vol. 93 No. 6, pp. 1155-1177.
37. Demsetz, H. and Villalonga, B. (2001), "Ownership structure and corporate performance", *Journal of Corporate Finance*, Vol. 7 No. 3, pp. 209-233.
38. DiMaggio, P. and Powell, W. (1983), "The iron cage revisited: institutional isomorphism and collective rationality in organizational fields", *American Sociological Review*, Vol. 48, pp. 147-160.
39. Dulewicz, V. and Herbert, P. (2004), "Does the composition and practice of boards and directors bear any relationship to the performance of their companies?", *Corporate Governance: An International Review*, Vol. 12 No. 3, pp. 263-280.
40. Eisenhardt, K. (1989), "Agency theory: an assessment and review", *Academy of Management Review*, Vol. 14 No. 1, pp. 57-74.
41. Erickson, M., Hanlon, M. and Maydew, E. (2006), "Is there a link between executive equity incentives and accounting fraud?", *Journal of Accounting Research*, Vol. 44, pp. 113-143.
42. Fama E.F. and Jensen, M.C. (1983), "Separation of ownership and control", *Journal of Law and Economics*, Vol. 26 No. 2, pp. 301-325.
43. Fama, E.F. (1980), "Agency problems and the theory of the firm", *Journal of Political Economy*, Vol. 88 No. 4, pp. 288-307.
44. Finkelstein, S. and D'Aveni, R. (1994), "CEO duality as a double-edged sword: how boards of directors balance entrenchment avoidance and unity of command", *Academy of Management Journal*, Vol. 37 No. 5, pp. 1079-1108.
45. Fosberg, R.H. (1989), "Outside directors and managerial monitoring", *Akron Business and Economics Review*, Vol. 20 No. 2, pp. 24-32.
46. Geddes, R. and Vinod, H. (1997), "CEO age and outside directors: a hazard analysis", *Review of Industrial Organization*, Vol. 12 No. 5, pp. 767-780.
47. Ghosh, C. and Sirmans, C.F. (2003), "Board independence, ownership structure and performance: evidence from real estate investment trusts", *Journal of Real Estate Finance and Economics*, Vol. 26 No. 2/3, pp. 287-318.
48. Gillan, S.L. and Starks, L.T. (2003), "Corporate governance, corporate ownership and the role of institutional investors: a global perspective", *Journal of Applied Finance*, Vol. 12 No. 2, pp. 4-22.
49. Gompers, P., Ishii, J. and Metrick, A. (2003), "Corporate governance and equity prices", *Quarterly Journal of Economics*, Vol. 118 No. 1, pp. 107-155.
50. Gregory, F., and Bosch, F. (1999), "On the supposed independence of two-tier boards: formal structure and reality in the Netherlands", *Corporate Governance*, Vol. 1 No. 7, pp. 31-37.
51. Guriev, S. and Rachinsky, A. (2005), "The role of oligarchs in Russian capitalism", *Journal of Economic Perspectives*, Vol. 19 No. 1, pp. 131-150.
52. Hambrick, D. and Jackson, E. (2000), "Outside directors with a stake: the linchpin in improving governance", *California Management Review*, Vol. 42 No. 4, pp. 108-127.
53. Hempel, P. and Fay, C. (1994), "Outside director compensation and firm performance", *Human Resource Management*, Vol. 33 No. 1, pp. 111-133.
54. Hermalin, B. and Weisbach, M. (2003), "Boards of directors as an endogenously determined institution: a survey of the economic literature", *Economic Policy Review*, Vol. 9 No. 1, pp. 7-26.
55. Hermalin, B. and Weisbach, M. (1991), "The effects of board composition and direct incentives on firm performance", *Financial Management*, Vol. 20 No. 4, pp. 101-112.
56. Hill, C. and Jones, G. (2004), *Strategic Management: An Integrated Approach*, Houghton Mifflin, Boston.
57. Hopt, K.J. and Leyens, P.C. (2004), "Board models in Europe: recent developments of internal corporate governance structures in Germany, the United Kingdom, France, and Italy", *European Corporate Governance Institute. Working Paper No. 18/2004*, European Corporate Governance Institute, Brussels.
58. Hutchinson, M. (2002), "An analysis of the association between firms' investment opportunities, board composition and firm performance", *Asia-Pacific Journal of Accounting and Economics*, Vol. 9 No. 1, pp. 17-38.
59. Ittner, C., Larcker, D. and Randall, T. (2003), "Performance implications of strategic performance measurement in financial services firms", *Accounting, Organizations & Society*, Vol. 28 No. 7/8, pp. 715-741.
60. Jackson, G. and Moerke, A. (2005), "Continuity and change in corporate governance: comparing Germany and Japan", *Corporate Governance: An International Review*, Vol. 13, pp. 351-361.
61. Jensen, M. and Meckling, W. (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, Vol. 3 No. 4, pp. 305-360.
62. Jensen, M. and Murphy, K. (1990), "Performance pay and top management incentives", *Journal of Political Economy*, Vol. 98 No. 2, pp. 225-264.
63. Jobome, G. (2006), "Management pay, governance and performance: the case of large UK nonprofits", *Financial Accountability and Management*, Vol. 22 No. 4, pp. 331-358.
64. Johnson, J., Daily, C. and Ellstrand, A. (1996), "Boards of directors: a review and research agenda", *Journal of Management*, Vol. 22 No. 3, pp. 409-438.
65. Kapopoulos, P. and Lazaretus, S. (2007), "Corporate ownership structure and firm performance: evidence

- from Greek firms”, *Corporate Governance: An International Review*, Vol. 15 No. 2, pp. 144-158.
66. Kiel, G. and Nicholson, G. (2003), “Board composition and corporate performance: how the Australian experience informs contrasting theories of corporate governance”, *Corporate Governance: An International Review*, Vol. 11 No. 3, pp. 189-205.
67. Klapper, L. and Love, I. (2003), “Corporate governance, investor protection, and performance in emerging markets”, *Journal of Corporate Finance*, Vol. 195, pp. 1–26.
68. Klein, A. (2002), “Audit committee, board of director characteristics, and earnings management”, *Journal of Accounting and Economics*, Vol. 33 No. 3, pp. 375-400.
69. Kubo, K. (2005), “Executive compensation policy and company performance in Japan”, *Corporate Governance: An International Review*, Vol. 13 No. 3, pp. 429-436.
70. La Porta, R., Lopez-De-Silanes, F., and Shleifer, A. (1999), “Corporate ownership around the world”, *Journal of Finance*, Vol. 54 No. 2, pp. 471-518.
71. La Porta, R., Lopez-De-Silanes, F., Shleifer, A. and Vishy, R. (2002), “Investor protection and corporate valuation”, *Journal of Finance*, Vol. 57, pp. 1147-1170.
72. La Porta, R., Lopez-De-Silanes, F., Shleifer, A. and Vishy, R. (2000), “Investor protection and corporate governance”, *Journal of Financial Economics*, Vol. 58 No. 1, pp. 3-27.
73. Lane, C. (2003), *Changes in Corporate Governance of German Corporations: Convergences to the anglo-american model?*, University of Cambridge, Cambridge.
74. Larcker, D. (2003), “The association between performance plan adoption and corporate capital investment”, *Journal of Accounting and Economics*, Vol. 5, pp. 3-30.
75. Larcker, D., Richardson, S. and Tuna, I. (2007), “Corporate governance, accounting outcomes, and organizational performance”, *The Accounting Review*, Vol. 82, pp. 963-1008.
76. Lasfer, M. (2006), “The interrelationship between managerial ownership and board structure”, *Journal of Business Finance & Accounting*, Vol. 33, pp. 1006-1033.
77. Lawrence, J. and Stapledon, G. (1999), *Do independent directors add Value?*, Melbourne Centre for Corporate Law and Securities Regulation, University of Melbourne.
78. Learmount, S. (2002), *Theorizing Corporate Governance: New organizational alternatives*, University of Cambridge, Cambridge.
79. Li, J. (1994), “Ownership structure and board composition: a multi-country test of agency theory predictions”, *Managerial and Decision Economics*, Vol. 15 No. 4, pp. 359-368.
80. Lins, K. (2003), “Equity ownership and firm value in emerging markets”, *Journal of Financial and Quantitative Analysis*, Vol. 38, pp. 159-184.
81. Liu, G. (2005), “Comparative corporate governance: the experience between China and the UK”, *Corporate Governance: An International Review*, Vol. 13 No. 1, pp. 1-4.
82. Loderer, C. and Martin, K. (1997), “Executive stock ownership and performance: tracking faint traces”, *Journal of Financial Economics*, Vol. 45 No. 2, pp. 223-255.
83. Marchica, M.-T. and Mura, R. (2005), “Direct and ultimate ownership structures in the UK: an intertemporal perspective over the last decade”, *Corporate Governance: An International Review*, Vol. 13 No. 1, pp. 26-45.
84. Matolcsy, Z., Stokes, D. and Wright, A. (2004), “Do independent directors add value?”, *Australian Accounting Review*, Vol. 14 No. 1, pp. 33-40.
85. McDonald, M., Khanna, P. and Westphal, J. (2008), “Getting them to think outside the circle: corporate governance, CEOs’ external advice networks, and firm performance”, *Academy of Management Journal*, Vol. 51 No. 3, pp. 453-475.
86. Mintz, S. (2005), “Corporate governance in an international context: legal systems, financing patterns and cultural variables”, *Corporate Governance*, Vol. 13, pp. 582-597.
87. Mishra, C. and Nielsen, J. (2000), “Board independence and compensation policies in large bank holding companies”, *Financial Management*, Vol. 29 No. 3, pp. 51-70.
88. Nicholson, G. and Kiel, G. (2007), “Can directors impact performance? A case-based test of three theories of corporate governance”, *Corporate Governance: An International Review*, Vol. 15 No. 4, pp. 585-608.
89. Paterson, J. (2001), “Corporate governance, the limits of rationality and proceduralisation”, Working Paper N.º 198, ESRC Centre for Business Research, University of Cambridge.
90. Peng, M. (2004), “Outside directors and firm performance during institutional transitions (in China)”, *Strategic Management Journal*, Vol. 25 No. 5, pp. 453-471.
91. Peng, M.W., Buck, T. and Filatotchev, I. (2003), “Do outside directors and new managers help improve firm performance? An exploratory study in Russian privatization”, *Journal of World Business*, Vol. 38, pp. 348-360.
92. Pivovarsky, A. (2003), “Ownership concentration and performance in Ukraine’s privatized enterprises”, *IMF Staff Papers*, Vol. 50 No. 1, pp. 10-42.
93. Raheja, C. (2005), “Determinants of board size and composition: a theory of corporate boards”, *Journal of Financial and Quantitative Analysis*, Vol. 40 No. 2, pp. 283-306.
94. Rechner, P. and Dalton, D. (1991), “CEO duality and organizational performance: a longitudinal analysis”, *Strategic Management Journal*, Vol. 12 No. 2, pp. 155-160.
95. Rhoades, D., Rechner, P. and Sundaramurthy, C. (2000), “Board composition and financial performance: a meta-analysis of the influence of outside directors”, *Journal of Management Issues*, Vol. 12 No. 1, pp. 76-91.
96. Rhoades, D., Rechner, P. and Sundaramurthy, C. (2001), “A meta-analysis of board leadership structure and financial performance: are ‘two heads better than one?’”, *Corporate Governance: An International Review*, Vol. 9 No. 4, pp. 311-319.
97. Rosenstein, S. and Wyatt, J.G. (1990), “Outside directors, board independence and shareholder wealth”, *Journal of Financial Economics*, Vol. 26 No. 2, pp. 175-192.
98. Ryan, H. and Wiggins, R. (2004), “Who is in whose pocket? Director compensation, board independence, and barriers to effective monitoring”, *Journal of Financial Economics*, Vol. 73, pp. 497-524.
99. Scott, R.W. (2001). *Institutions and Organizations*. 2nd Ed., Sage, Thousand Oaks, CA.

100. Shleifer, A. and Vishny, R. (1997), "A survey of corporate governance", *The Journal of Finance*, Vol. 52 No. 2, pp. 737-783.
101. Suto, M. (2003), "Capital structure and investment behaviour of Malaysian firms in the 1990s: a study of corporate governance before the crisis", *Corporate Governance*, Vol. 11, pp. 25-39.
102. Tam, O.K. and Tan, M. (2007), "Ownership, governance and firm performance in Malaysia", *Corporate Governance: An International Review*, Vol. 15 No. 2, pp. 209-222.
103. Tosi, H. and Gomez-Mejia, L. (1994), "CEO compensation monitoring and firm performance", *Academy of Management Journal*, Vol. 37 No. 4, pp. 1002-1016.
104. Uzun, H. Szewczyk, S. and Varma, R. (2004), "Board composition and corporate fraud", *Financial Analyst Journal*, Vol. 60 No. 3, pp. 33-43.
105. Vafeas, N. (1999), "Board meeting frequency and firm performance", *Journal of Financial Economics*, Vol. 53 No. 1, pp. 113-142.
106. Vafeas, N. (2003), "Length of board tenure and outside director independence", *Journal of Business Finance and Accounting*, Vol. 30, pp. 1043-1064.
107. Wagner, J., Stimpert, J. and Fubara, E. (1998), "Board composition and organizational performance: two studies of insider/outsider effects", *Journal of Management Studies*, Vol. 35, pp. 655-677.
108. Weir, C. and Laing, D. (1999), "Governance structures, size and corporate performance in UK firms", *Management Decision*, Vol. 37 No. 5, pp. 457-464.
109. Weisbach, M. (1998), "Outside directors and CEO turnover", *Journal of Financial Economics*, Vol. 20 No. 1/2, pp. 431-460.
110. Westphal, J. and Zajac, E. (1994), "Substance and symbolism in CEOs' long-term incentive plans", *Administrative Science Quarterly*, Vol. 39, pp. 367-390.
111. Wheelen, T.L. and Hunger, J.D. (2002), *Strategic Management and Business Policy*, Eighth Edition, Prentice Hall, New Jersey.
112. Wiwattanakantang, Y. (2001), "Controlling shareholders and corporate value: evidence from Thailand", *Pacific-Basin Finance Journal*, Vol. 9, pp. 323-362.
113. Wood, M. and Patrick, T. (2003), "Jumping on the bandwagon: outside representation in corporate governance", *The Journal of Business and Economic Studies*, Vol. 9 No. 2, pp. 48-53.
114. Yermack, D. (1996), "Higher market valuation of companies with a small board of directors", *Journal of Financial Economics*, 40 No. 2, pp. 185-211.
115. Zajac, E. and Westphal, J. (1994), "The costs and benefits of managerial incentives and monitoring in large U.S. corporations: when is more not better?", *Strategic Management Journal*, 15, pp. 121-142.
116. Zattoni, A. and Cuomo, F. (2008), "Why adopt codes of good governance? A comparison of institutional and efficiency perspectives", *Corporate Governance: An International Review*, 16, pp. 1-15.

Appendix A. Descriptive Statistics

Table A .1 Descriptive statistics – Portugal

	Mean	Std. Dev.	Median	Min	Max
Control variables					
Net income	256.006	910.538	17.004	-15.493	5.807.325
Equity	1.589.163	5.791.230	137.398	-383	37.096.709
Assets	18.269.677	76.718.610	793.139	31.314	488.440.058
Sales	2.198.759	5.615.144	579.233	10.939	34.850.762
PAI	0,307	0,229	0,300	0,000	1,000
PRV	0,295	0,227	0,287	0,000	0,830
CDV	0,606	0,228	0,650	0,130	0,970

Source: Banco de Portugal, 2007.

Note: Value in thousands of Euros. Exchange rate, 1 Euro = 0,68434 Pound.

Table A.2 Descriptive statistics - United Kingdom

	Mean	Std. Dev.	Median	Min	Max
Control variables					
Net income	63.727	130.338	20.968	-141.567	892.537
Equity	491.007	1.394.559	177.633	-776.267	11.847.370
Assets	1.154.676	2.488.945	376.577	8.170	17.360.926
Sales	699.750	1.839.600	182.960	1.258	14.632.114
PAI	0,568	0,204	0,500	0,250	1,000
PRV	0,251	0,192	0,253	0,000	0,677
CDV	0,292	0,137	0,267	0,137	0,770

Source: Banco de Portugal, 2007.

Note: Value in thousands of Euros. Exchange rate, 1 Euro = 0,68434 Pound.

Appendix B. Tables of correlation

Table B.1 Pearson correlation – Portugal

	Size	Sector*	independent directors	separation of roles*	variable remuneration of managers	concentration of voting rights	return on equity	Tobin's q	market to book ratio	sales growth
Size	1.00									
Sector*	.63	1.00								
independent directors	.05	.01	1.00							
separation of roles*	.25		.18	1.00						
variable remuneration of managers	.76	.43	-.02	.29	1.00					
concentration of voting rights	-.40	-.22	-.07	-.07	-.27	1.00				
return on equity	.18	.07	-.20	.35	.32	-.16	1.00			
Tobin's q	-.11	-.28	.15	.28	.11	-.13	.35	1.00		
market to book ratio	-.10	-.17	.29	.39	-.01	-.22	.51	.65	1.00	
sales growth	.23	.28	-.23	-.18	.20	-.03	.31	.03	.01	1.00

* Dummy variables

Table B.2 Pearson correlation – United Kingdom

	Size	Sector*	independent directors	separation of roles*	variable remuneration of managers	concentration of voting rights	return on equity	Tobin's q	market to book ratio	sales growth
Size	1.00									
Sector*	-.09	1.00								
independent directors	-.20	.56	1.00							
separation of roles*	.17		.16	1.00						
variable remuneration of managers	.40	-.19	-.60	-.07	1.00					
concentration of voting rights	-.18	.02	-.18	-.23	.15	1.00				
return on equity	.02	.07	-.02	-.09	-.00	-.13	1.00			
Tobin's q	-.34	-.30	-.20	.07	.06	.06	-.32	1.00		
market to book ratio	-.26	-.29	-.18	.04	.07	.04	-.09	.84	1.00	
sales growth	.12	.05	-.15	-.04	.26	-.23	.05	.09	.05	1.00

* Dummy variables

OWNERSHIP STRUCTURE, ONGOING RELATED PARTY TRANSACTIONS AND CORPORATE PERFORMANCE: EVIDENCED FROM CHINESE LISTED FIRMS

Mei-Ai Cheng*, Noel W. Leung**

Abstract

This paper is to review the association of the magnitudes of ongoing related party transactions with the largest shareholders (ORPTs) on the ownership structure and their impact on corporate performance of Chinese listed firms after substantial reform of Chinese corporate governance framework in 2005. Previous literature found that the largest shareholders used related party transactions to tunnel or prop up their controlled firms for their own benefits. Based on a sample of 6657 firm-year observations from 2007 to 2011, the authors find that there is still a positive association between ownership of the largest shareholders and ORPTs, but no significant association between ORPTs and corporate performance, and therefore, there is no evidence that the largest shareholders use ORPTs to tunnel or prop-up their listed firms. This study also finds that there is an endogenous effect of ownership of the largest shareholders on ORPTs, and the authors suggest that the largest shareholders still have to retain the control of Chinese listed firms because in economic reality, those listed firms are still an integral part of business operations of the largest shareholders (business groups), i.e. alignment effect.

Keywords: Ownership Structure, Ongoing Related Party Transactions, Corporate Performance

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1. Introduction

In 1990's, the Chinese government re-established the stock market as a vehicle for her state-owned enterprises (SOE) to raise funds from the public through initial public offerings (IPO) to overcome their financial difficulties and improve their operating performance. Nowadays, in view of the significance in market capitalization and turnover, Chinese stock market has become one of the leading stock markets in the world. However, there have been several corporate scandals, especially those concerning related party transactions (RPTs) between the listed firms and their largest (controlling) shareholders.

2. Related party transactions in Chinese listed firms

Same as the practice in other countries, Chinese stock exchanges require profitability of the IPO candidates in the latest three years (track record) before the IPO, but the quality of the assets held by SOEs was highly variable; so many SOEs restructured themselves and spun off their core and high-quality (profitable) business segments and assets for IPO, while leaving

their non-core businesses, assets, debts, and surplus manpower in the residual SOEs. In that way, SOEs were able to improve their chances of a successful listing of the spun-off portion (i.e. listed firms). The residual SOEs (business groups) normally retained control of the new listed entity as the largest shareholder (or controlling shareholder); however, having spun off their core assets, they were often forced to rely on the listed firms for support, resulting that there have been a series of RPTs between the listed firms and their controlling business groups in Chinese stock market. On one hand, the listed firms could raise funds through subsequent placements and bank loans, and then re-lend the funds to their largest shareholders or their controlled business groups. On the other hand, the listed firm's products might be sold to the business groups at unreasonably low prices, or the listed firm might make payments to the business group for "consulting services" while in fact no services had been provided. In some cases, the listed firms even provided collateral (guarantee) to help the group to obtain bank loans. The cost of these RPTs, which hurts the market value of the listed firms, was borne by the minority shareholders.

Further, some listed firms would have been propped up by their controlling shareholders for the purpose of IPO. As indicated by Leung and Cheng (2013), Agricultural Bank of China (ABC) shows in its H-share prospectus that in 2008, before its corporate restructuring, ABC disposed of certain non-performing assets to its controlling shareholders; otherwise, ABC would have had negative equity in the track record.

The issue of RPTs has been highly scrutinized by the scholars. Johnston et al. (2000) use the term “tunneling” to describe the diversion of resources between the controlling shareholder and its controlled firm at the expense of minority shareholders, while Friedman et al. (2003) define “propping-up” as the negative of tunneling. Several scholars have studied that in Chinese stock market, the controlling shareholders use RPTs to tunnel the interest of minority shareholders (e.g. He and Liu, 2005; Berkman et al., 2009; Jiang et al., 2010). Several scholars also study that the controlling shareholders use RPTs for earnings management and propping-up, i.e. increasing the profitability of their listed firms for IPO, avoidance of being delisted due to recurrent loss-making and subsequent funds raising (e.g. Liu and Lu, 2007; Lo et al., 2010; Jian and Wong, 2010; Peng et al., 2011).

2.1 Ownership structure of Chinese listed firms

In order to retain the control of those Chinese listed firms, a typical Chinese listed firm has two classes of shares: tradable and non-tradable shares. Normally, the controlling shareholders hold about 40% of ownership of listed firms before the share reform (i.e. concentrated ownership in the hands of the largest shareholders). The largest (controlling) shareholders and the governments mostly hold those non-tradable shares (including state shares and restricted institutional shares) which could not be freely

disposed of in the stock exchanges for cash, and those shares could only be transferred privately or through irregularly scheduled auctions. In addition, both tradable and non-tradable shares offered their holders the same dividend and voting rights per share, but non-tradable shares of those firms were priced at a significant discount to the tradable shares of the same firms, and those shares were not readily for sale in the stock market. Therefore, once the largest shareholders need funds for their own use, they were more likely to extract the funds from their controlled listed firms as mentioned in Section 1.1.

Due to higher concentrated ownership in Chinese listed firms, other large shareholders can rarely restrict the acts of the controlling shareholders. Several scholars (e.g. Tai et al., 2007; Chen et al., 2009; Hu et al., 2009; Lo et al., 2009) demonstrate that the controlling (largest) shareholders can extract private benefits from their controlled firms or expropriate the interests of minority shareholders through RPTs between the controlled firms and the controlling (largest) shareholders (or business groups). Those scholars also conclude that the likelihood of high magnitudes of RPTs results from the higher concentration of ownership of Chinese listed firms. Appendix 1 presents a suspicious tunneling example of a Chinese listed firm through RPTs.

On 29 April 2005, the China Securities Regulatory Commission (CSRC) promulgated the Notice Relevant to Pilot Reform on the Segmented Shares Structure of Listed Companies (hereafter “share reform”), so that the largest shareholders could realize their interests in listed firms for cash. Table 1 reports the average ownership of the largest shareholders from 2003 (before share reform) to 2011, but it indicates that there is no substantial change in ownership after the share reform.

Table 1. Ownership structure of Chinese listed firms in 2003 to 2011

	Year								
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average ownership of the largest shareholders (%)	42.6	41.9	40.5	36.5	36.2	36.4	36.6	36.7	36.4

(Source: the firm's data in 2003 to 2011 in CSMAR database)

After the completion of the share reform scheme, the non-tradable shares of Chinese listed firms can be converted into tradable portion, and therefore, the largest shareholders can readily dispose of those shares for cash, thereby reducing the likelihood of tunneling the resources of listed firms through RPTs. SSE (2012) states that after the completion of share reform scheme, the valuation of the interests of those controlling shareholders in the listed firms has been changed from the book value of

the firms to the market value of the listed shares, and if the controlling shareholders engage in RPTs to expropriate their controlled firms, such effect would also deteriorate the value of the listed firms, resulting in the deterioration of interests of both controlling and minority shareholders. Hence, it is expected that the largest shareholders would not abuse RPTs to tunnel their controlled Chinese listed firms after the share reform.

2.2 Motivation of this study

Most studies focus on the firm's data before the share reform. For example, Hu, et al. (2009) and Chen et al. (2009) studied the RPTs from 2002 to 2006, Tai et al. (2007) from 2002 to 2004, Lo et al. (2010) from 2004, Cheung et al. (2009) from 2001 to 2002. In addition to the share reform, in 2005 and 2006, the legal framework in the Chinese stock market encountered substantial reform (hereafter financial reform) as follows:

First, Company Law and Securities Law (and related rules and regulations applicable to Chinese listed firms) were amended in 2005 and became effective in 2006 mainly for the protection of minority shareholders. For example, Chapter 4.5 of Company Law (2005) regulates the organization structure of listed firms, including Article 125 which requires the approval of RPTs by unrelated directors in the board meetings; Chapter 11 of Securities Law (2005) imposes civil and criminal offences to controlling shareholders, directors and officers of listed firms involved in corporate frauds.

Second, Chinese Accounting Standards (CAS) was converged with International Financial Reporting Standards (IFRS) with effect from 2007, and the disclosure of such RPTs seems to be consistent with international standards. In addition, CAS No. 36 further requests enterprises to disclose the paid up capital of the related parties and pricing strategies for the RPTs and the auditors are also required to ensure the completeness and accuracy of that information contents in the financial statements (see Appendix 2). From the information content related to RPTs, financial statement users can also assess the reasonableness of the amounts of RPTs and the firm size of the related parties. The authors expect that the increase in information dissemination of Chinese listed firms can reduce the likelihood of tunneling effects (see OECD1, 2012).

Third, as evidenced from Appendix 3, several Chinese listed firms have reorganized their organization structure to reduce the impact of RPTs on their controlling shareholders. The authors believe this study will provide insight on the possible corporate performance of RPTs in contemporary Chinese listed firms.

Overall, RPTs are permitted in current Chinese legal framework, but subject to restricted requirements. For example, IPO and Listing Management Measure (enacted in 2006) requires the listed firm to have complete business operations (Article 15) and to be financially, organizationally and operationally independent (Articles 17 to 19) and the transfer prices of RPTs must be fair without earnings management (Article 32). Moreover, RPTs can be classified as ongoing (regular) RPTs (i.e. sales,

purchases and provision of services) which exist in the normal course of business operations of the listed firms and its controlling shareholders (business groups); and irregular RPTs (i.e. loans, guarantee and transfer of assets upon the corporate reorganization between the listed firm and controlling shareholders).

Therefore, this study covers the firm's data from 2007 to 2011, and the results are expected to provide the most updated and accurate findings on the financial reform. Besides, this study only covers ongoing RPTs, and excludes irregular RPTs because irregular RPTs include (1) tunneling - the embezzlement of firms' resources through loan and guarantees to the largest shareholders and those RPTs are strictly prohibited by law and their effects have been well addressed by several scholars (e.g. Berkman et al., 2009; Jiang et al., 2010); (2) propping-up - the largest shareholders provide financial support through loans and advances to the listed firms and the motive and consequence are apparent and self-explanatory; (3) the transfer of assets, mostly in corporate reorganization, is strictly regulated by law and under a series of administrative procedures for approval and disclosure, and it should be non-current.

This section presents the historical background of RPTs in Chinese listed firms. The remainder of this paper proceeds as follows. Section 2 describes a review of the literature and establishes the testing hypotheses. Section 3 explains the research design. Section 4 discusses the empirical results, and the conclusions drawn from this study are presented in Section 5.

3. Literature review and hypotheses

3.1 Ownership structure and related party transactions (RPTs)

A classical agency problem that arises as a result of the separation of ownership and management when ownership is widely dispersed (Jensen and Meckling, 1996). However, as mentioned in Section 1.2, ownership of Chinese listed firms is concentrated in the hands of the largest shareholders, and therefore, the concentrated ownership of a listed firm can, in principle, lead to the following agency problems:

(1) conflict between managers and shareholders (Jensen and Meckling, 1996; Shleifer and Vishny, 1997); and

(2) conflict between controlling shareholders and minority shareholders (La Porta et al., 2002; Jiang et al., 2010).

Therefore, RPTs between the listed firm and its largest (controlling) shareholder (for tunneling, propping-up and earnings management) is one of the typical agency problems in contemporary corporate governance and most scholars and regulators frequently study this issue. For example, Shanghai Stock Exchange conducts two studies on RPTs of

¹ OECD (2012) reports that the disclosure and transparency of RPTs (through the application of IFRS) has been adopted in several countries for minority protection.

Chinese listed firms, one reports on the corporate governance and financial performance of Chinese listed firms (SSE, 2010a), the other on the regulations and governance of RPTs (SSE, 2010b).

Previous literature has addressed the association between the magnitudes of RPTs and corporate governance mechanisms of Chinese listed firms. As the ownership structure is a key corporate governance factor, this paper focuses on the association of the magnitudes of ongoing RPTs (ORPTs) and ownership structure.

As mentioned in Sections 1.1 and 1.2, most of contemporary Chinese listed firms have been spun off from Chinese business groups for the purpose of IPO and the controlling shareholders retain the control of their listed firms by holding the substantial ownership of those listed firms. When a controlling shareholder obtains controlling power, the primary agency issue is not the potential conflict of interest between management and shareholders, but to prevent the controlling shareholder from taking benefits at the expenses of minority shareholders (Shleifer and Vishny, 1997; La Porta et al., 2002; Jiang et al., 2010).

The engagement of RPTs between the listed firms and their controlling shareholders is always used as for tunneling, propping-up and earnings management (e.g. Johnson et al., 2000; Chen, Chen and Chen, 2009; Cheung et al., 2009; Jian and Wong, 2010; Lo et al., 2010). It is expected that with the increase in ownership (control) in the listed firms, the largest shareholders have higher influence the firms and tunnel them. In China, Chen and Wang (2005) study the association between the corporate governance mechanisms and RPTs, and find positive association between the scale of all RPTs and the ownership concentration from 1998 to 2002. Liu and He (2004) also find that the higher the ownership of the largest shareholders, the higher is the amount of cash dividend and the more use of related sales and purchases activities in order to benefit the largest shareholders. Chen and Wang (2005), Liu (2008), Tai et al. (2007) and Hu et al. (2009) find that the magnitudes of RPTs is positively related to ownership of the largest shareholders in most cases, and is negatively related to the increase in number of other large shareholders and the alignment of other large shareholders in some cases before the financial reform. Previous studies are based on the firm's data prior to the financial reform. In accordance with the contemporary rules and regulations, RPTs between the listed firms and their controlling shareholders (parties) are restricted and even prohibited. Therefore, the following hypothesis is upheld:

H1: There is an association of the magnitudes of ongoing related party transactions between largest shareholders and their controlled listed firms (ORPTs) on the ownership structure of Chinese listed firms.

H1 is further divided into H1.1 and H1.2 as follows:

H1.1: There is a positive association between ownership of largest shareholders and ORPTs.

H1.2: There is a negative association between ownership of other large shareholders and ORPTs.

3.2 RPTs and corporate performance

Both domestic and foreign researches demonstrate that the frequency and magnitudes of RPTs are detriment to the firms and the market value. For example, Nekhili and Cherif (2011) find that in French listed firms, the magnitude of RPTs exhibit a negative effect on their firm value from 2002 to 2005. Wahab et al. (2011) evidence that in Malaysian listed firms, the magnitudes of RPTs are negatively related to the return on total assets from 2005 to 2007.

However, some scholars find that there are dual effects of related party transactions, tunneling and propping-up, that are beneficial or detrimental to the firm performance, respectively. Cheung et al. (2009) find that minority shareholders in Chinese listed firms seem to be subject to expropriation through tunneling but also gain from propping-up during 2001 and 2002. Peng et al. (2011) find that all RPTs can be used for tunneling or propping-up, depending on different financial situations of the listed firms from 2001 to 2003. Lin et al. (2010) find that based on the Taiwanese listed firms from 1996 to 2006, the firm performance (firm value and earnings per share) is positively related to ongoing sales and purchases RPTs, but negatively related to the level of guarantees made for the borrowing of related parties which results in expropriation of firm's minority shareholders. Jian and Wong (2010) study that from 1998 to 2002, Chinese listed firms prop up earnings by using related sales to controlling shareholders and then lend the sales proceeds back to controlling shareholders after propping-up. He and Liu (2005) study the corporate performance and related party asset transactions in Chinese listed firms from 1998 to 2001, but find that the large shareholders will tunnel using RPTs when the listed firms have good accounting performance. Aharony et al. (2010) evidence that from 1999 to 2001, some listed firms engaged in related party sales of goods and services to manage earnings upwards in the pre-IPO period; and tunneled for the benefit of the parent company in the post-IPO period.

In this paper, the authors examine the association between ORPTs and corporate performance of Chinese listed firms because ORPTs are ongoing (regular) and may have two potential consequences: (1) As RPTs are conducted at arm's length basis or measured in the same prices and conditions with non-related third parties, they are motivated by purely economic reasons (e.g. to realign the firm operations) and there is no potential

tunneling or propping-up effect (Cheung et al., 2009). Chen et al. (2012) state that ORPTs decrease the transaction costs of listed firms or increase its value (efficiency enhancing theory); (2) As RPTs are not at the arm's length basis, with the possible dual effects of tunneling and propping-up to achieve the specific needs of the controlling shareholders (Cheung et al., 2009). The prices and conditions of RPTs between a listed firm and its largest shareholder are unfair or abnormal, for tunneling, i.e. the transaction costs are more favorable to the largest shareholders, and the firm's resources are transferred to business groups (Liu and He, 2004), or earnings management, under which the listed firm can maintain its profitability of ROE not less than three years for subsequent issues of new shares for fund raising, or avoid recurrent loss for being delisted (Liu and Lu, 2007; Tai et al., 2007).

Second, previous literature has addressed the association between ORPTs and corporate performance. Chen et al. (2009) find that there is significant positive relationship between the magnitude of related party purchases and ROA or Tobin's Q, but Tai et al. (2007), Liu (2008), and Cheung et al. (2009) argue that in Chinese stock market, the controlling (largest) shareholders may either tunnel or prop-up, depending on the financial performance of their listed firms. Because a Chinese listed firm is permitted to issue new shares for funds raising if it can have an average return on equity of not less than 6% for the past three years, Tai et al. (2007) and Liu (2008) classify the benchmark of ROE of 6% as a division for the potential tunneling or propping-up: (1) for firm with ROE of higher than 6%, the controlling shareholder is likely to transfer its interest to the listed firm through RPTs (propping-up); (2) for low-performing firm (ROE less than 6%), the controlling firm is likely to tunnel the resources of its controlled firm through RPTs (tunneling). Therefore, the following hypothesis is made:

H2: There is an association between ORPTs and the corporate performance of Chinese listed firms.

H2 is further divided into H2.1 and H2.2 in respect of the benchmark of ROE at 6%:

H2.1: There is a positive association between ORPTs and the corporate performance of Chinese listed firms, if the return on equity equals to 6% or more.

H2.2: There is a negative association between the magnitudes of ORPTs and the corporate performance

of Chinese listed firms, if the return on equity is less than 6%.

1. Research design and model

The empirical model used in this paper is based on Tai et al. (2007), Liu (2008) and Chen et al. (2009). Each variable in this paper is discussed in turn.

(1) The magnitudes of ongoing related party transactions (ORPTs)

Sales transactions (RPT_SALES) include both the sales of goods and the provision of services to the largest shareholder and its controlled entities; purchase transactions (RPT_PURCHASES) include both the purchase of goods and the receipt of services from the largest shareholder and its controlled entities. In this paper, the values of these variables are divided by the total sales, i.e. the business size, to determine the magnitudes to which Chinese listed firms are engaged in particular types of RPTs, consistent with Chen et al. (2009).

(2) Corporate performance variables

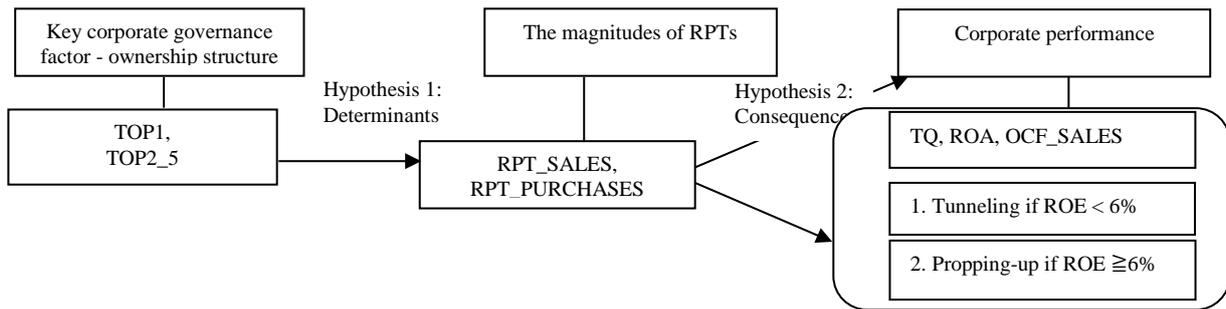
Consistent with previous literature, Tobin's Q value and return on total assets (ROA) are used as indicators of corporate performance (e.g. Xu and Chen, 2003; Chen et al., 2009; SSE, 2010a; Tai et al., 2007). However, some studies (e.g. Liu and Lu, 2007) demonstrate that Chinese listed firms had engaged in RPTs for earnings management by means of discretionary accruals. Jian and Wong (2010) also find that related party sales transactions can be cash-based and accrual-based. Therefore, this paper introduces "net operating cash flow" as the third proxy for corporate performance, consistent with Bowen et al. (2008). OCF_SALES is the net cash flow from operating activities divided by the total sales.

(3) Testing variables - Ownership of the largest shareholder and the alliance of other large shareholders

Ownership of the largest shareholder and other large shareholders

Consistent with previous literature, TOP1, the ownership of the largest shareholders is used as the proxy. Some studies presume that other large shareholders can restrict the tunneling effect by the largest shareholders. This study presumes the alliance of the second to fifth largest shareholders can restrict the acts of the largest shareholders, and aggregate ownership of the second to fifth large shareholders TOP2_5 is used as the proxy (e.g. Li, et al., 2004; Tai et al., 2007; Liu, 2008).

Figure 1. Summarizing of two hypotheses



(Adapted from Liu, 2008)

(4) Control variables

In this paper, business size (lnTA) is measured using the natural log of total assets, consistent with the scale of those RPT variables². The debt ratio (LEV) is included as a control variable and is measured by dividing long-term liabilities by total assets, consistent with Tai et al. (2007). Consistent with Chen et al. (2009), the percentage of growth in total assets (GROW_TA) and that of growth in sales (GROW_SALES) are included as control variables because those factors are expected to have significant impact on the ORPTs and corporate performance. The ultimate control of the largest shareholders (SCLF) is added as the proxy to differentiate those from government control because Brown et al. (2012) find that SOEs engage in more tunneling, but find no evidence that privately controlled firms engage in a greater degree of tunneling or propping-up.

The marketization index (MI) is added to distinguish those registered in eastern (well-developed) region³ because Gao et al. (2006) demonstrate that an increase in the transparency of corporate information and the operation of listed firms in an open commodity market can restrict tunnelling. The presence of two-way ORPTs (RPT_SP) variable is added to differentiate from those with both RPT_SALES and RPT_PURCHASES

Details of variable descriptions are shown in Table 2.

Hypothesis 1 is to account for the association of ORPTs on the ownership of the largest shareholders and the counter-balance of other large shareholders. Eq (1) is formulated as follows:

$$RPT \quad (RPT_SALES_{i,t}, RPT_PURCHASES_{i,t}) = \beta_0 + \beta_1 TOP1_{i,t} + \beta_2 TOP2_5_{i,t} + \beta_3 \ln TA_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GROW_TA_{i,t} + \beta_6 GROW_SALES_{i,t} + \beta_7 MI_{i,t} + \beta_8 SCLF_{i,t} + \beta_9 FIXED_EFFECTS_{i,t} + \varepsilon_{i,t} \quad (1)$$

where ε is the random error term of the model; i is the i th firm and t is the year.

Hypothesis 2 is to account for the association of corporate performance on ORPTs. In order to verify Hypothesis 2.1 and Hypothesis 2.2, Eq (2) is run based on (1) the whole sample, (2) those firms with ROE of at least 6% (propping-up effect) and (3) those firms with ROE of less than 6% (tunneling effect). Eq (2) is formulated as follows:

$$CP \quad (TQ, ROA, OCF_SALES)_{i,t} = \beta_0 + \beta_1 RPT_SALES_{i,t} + \beta_2 RPT_PURCHASES_{i,t} + \beta_3 \ln TA_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GROW_TA_{i,t} + \beta_6 GROW_SALES_{i,t} + \beta_7 MI_{i,t} + \beta_8 SCLF_{i,t} + \beta_9 FIXED_EFFECTS_{i,t} + \varepsilon_{i,t} \quad (2)$$

where ε is the random error term of the model; i is the i th firm and t is the year.

5. Research results and interpretation

5.1. Data source and sample selection

Table 3 presents the details of the sample. Our sample period covers five years, from 2007 to 2011, and the data was obtained from the China Stock Market and Accounting Research Data Base (CSMAR). There are 9462 firm-year observations for these five years, of which 160 observations are from the financial sector, 574 observations are under special treatment (ST) status⁴ and 2071 observations with missing variables are excluded⁵. Our final sample contains 6657 firm-year observations.

² The natural logarithm of the total assets of Chinese listed firms (lnSALES) was also considered as a control variable for the firm size of these listed firms. As the correlation coefficient between lnSALES and lnTA was extremely high (0.854 at the 1% significance level) in pretesting, the authors selected lnTA only as a control variable for business size.

³ Gao and Kling (2008) consider Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Fujian and Guangdong as the developed eastern coastal region, which might exhibits better governance structures.

⁴ In accordance with Article 13.2.1 of listing rules of both Shanghai and Shenzhen Stock Exchanges, a Chinese listed firm that has a negative equity or has been creating losses for two consecutive years is labeled as a ST firm, which is subject to additional regulations, such as the announcement of its quarterly results and an external audit on its interim financial results.

⁵ Most scholars exclude these financial sectors and ST firms because those firms are subject to additional regulations.

Table 2. Variable descriptions

Magnitudes of ORPTs	
RPT_SALES	Sales of goods and provision of services to the largest shareholders and its controlled parties, to the total sales for the year
RPT_PURCHASES	Purchases of goods and receiving services from the largest shareholders and its controlled parties, to the total sales for the year
Corporate performance (CP)	
TQ	Tobin-Q value as a ratio of the market value of equity of a firm to the book value of its assets
ROA	Net profit/(loss) for the year to the total assets at year-end
OCF_SALES	Net cash flows from operating activities, to the total sales for the year
Ownership structure	
TOP1	Percentage of shares held by the largest shareholder
TOP2_5	Aggregate percentage of shares held by the second to fifth largest shareholders
Control variables	
lnTA	Natural logarithm of the total assets at year-end
LEV	Total long-term liabilities to the total assets at year-end
GROW_TA	$\frac{TA_t - TA_{t-1}}{TA_{t-1}}$, where TA is the total assets of listed firms at year-end
GROW_SALES	$\frac{SALES_t - SALES_{t-1}}{SALES_{t-1}}$, where SALES is the total sales for the year
SCLF	Dummy variable that takes the value of 1 if the largest shareholder of the listed firm is under state control, and 0 otherwise
MI	Dummy variable that takes the value of 1 if the listed firm is registered in the eastern coastal areas (as defined by Gao and Kling, 2008), and 0 otherwise
RPT_SP	Dummy variable that takes the value of 1 if the listed firm has both RPT_SALES and RPT_PURCHASES in the same year, and 0 otherwise
FIXED_EFFECTS	Dummy variables controlling the fixed effects of calendar years and industries

Table 3. Details of the sample

Period from 2007 to 2011		Number of firm-year observations
Raw sample		9462
Less:	Firms engaged in financial sector (I)	160
	Firms under ST status	574
	Firms with missing variables	2071
Total available firm-year observations		6657

4.2 Descriptive statistics

Table 4 presents the descriptive statistics of the variables. The means of RPT_SALES and RPT_PURCHASES are 4.0% and 4.5%, respectively, indicating that ORPTs in Chinese listed firms are not serious; however, the maximums of these two variables amount to 99.5% and 91.0%, respectively, indicating that some of Chinese listed firms are, in substance, part of their largest shareholders or business group. The means (standard deviations) of TQ, ROA and OCF_SALES are 206.5% (276.9%), 3.5% (64.8%) and 11.4% (682.5%), respectively, indicating that corporate performance of those listed firms is violently dispersed over those years and

across industries. The mean of TOP1, is 36.6%, indicating that ownership of the largest shareholders in this sample is same as that of the whole population (see Table 1). The mean of TOP2_5 is 14.2%, and much lower than that of TOP1, indicating that the alignment of other large shareholders is unlikely to restrict the acts of the largest shareholders in Chinese listed firms.

Table 5 presents the frequencies and the percentages of dummy variables and industry categories of our sample. The percentage of those listed firms which are registered in eastern coastal region (MI) amount to 58.6% indicating that more than half of them are governed in a higher competition market; and 38.2% of them are under

state control (SCLF), indicating that political pressure may still have significant influence on Chinese stock market. RPT_SP amount to 50.6%, indicating that more than half of Chinese listed firms are still an

integral part of their largest shareholders or business groups as they provide the goods and services to, and receive goods and services from, their largest shareholders and their business groups.

Table 4. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Dev.
RPT_SALES	6657	0.000	0.995	0.040	0.113
RPT_PURCHASES	6657	0.000	0.910	0.045	0.107
TQ	6657	0.000	182.831	2.065	2.769
ROA	6657	-51.298	7.696	0.035	0.648
OCF_SALES	6657	-185.127	517.309	0.114	6.825
TOP1	6657	0.006	0.894	0.366	0.156
TOP2_5	6657	0.003	0.610	0.142	0.108
lnTA	6657	14.108	28.282	21.761	1.282
LEV	6657	0.000	3.385	0.091	0.130
GROW_TA	6657	-0.994	4719.612	2.096	78.012
GROW_SALES	6657	-1.000	14883.060	3.547	185.462

Table 5. Frequency of dummy variables

	Years						
	2007	2008	2009	2010	2011	Total	%
MI	770	782	787	777	785	3901	58.6%
SCLF	778	738	446	327	251	2540	38.2%
RPT_SP	646	648	683	689	705	3371	50.6%
Distribution by industry:							
A - agricultural	30	29	27	28	25	139	2.1%
B - mining	30	32	36	38	44	180	2.7%
C - manufacturing	767	761	768	746	760	3802	57.1%
D - production and supply of electricity and gas	52	55	56	56	61	280	4.2%
E - construction	32	32	33	30	29	156	2.3%
F - transportation and storage	58	56	60	57	58	289	4.3%
G - information technology	83	76	81	79	63	382	5.7%
H - wholesale and retail	84	80	80	85	92	421	6.3%
J - property developer	63	71	84	92	111	421	6.3%
K - social services	44	43	45	45	44	221	3.3%
L - media	9	10	9	8	15	51	0.8%
M- others	70	71	68	64	42	315	4.7%
Total firm-year observations	1322	1316	1347	1328	1344	6657	100.0%

Table 6 presents the distribution of ownership of the largest shareholders (TOP1) in Chinese listed firms in our sample. Ownership of the largest shareholders concentrates in the range between 10 and

50%, and most noticeably, about 23.2% in the range of 20 and 30%, indicating that the ownership of Chinese listed firms is still highly concentrated in the hands of the largest shareholders.

Table 6. Distribution of TOP1

Ownership of the largest shareholders	Years						
	2007	2008	2009	2010	2011	Total	%
0- 10%	84	82	87	88	93	434	6.5
10 - 20%	264	259	266	274	285	1348	20.2
20 - 30%	303	294	316	315	318	1546	23.2
30 - 40%	264	267	262	259	263	1315	19.8
40 - 50 %	247	240	231	219	212	1149	17.3
50 - 60%	116	124	126	113	105	584	8.8
Over 60%	44	50	59	60	68	281	4.2
	1322	1316	1347	1328	1344	6657	100.0

Table 7 reports correlation coefficients. The correlation coefficients between the independent variables are generally low, indicating that multicollinearity is unlikely to be a serious problem in the interpretation of the results.

4.3 Multiple regression analysis

This section reports on the results of the multiple regression analysis with respect to the two hypotheses. The results are shown in Tables 8 to 11. According to Berman (2007), the variance inflation factor (VIF) values of variables that do not exhibit multicollinearity are usually between 1.0 and 2.0. The collinearity test results show that none of the independent variables in this paper have a VIF of over 2 (not tabulated). According to these results and the correlation analysis of these variables shown in Table 7, multicollinearity is not considered to be a problem for either model.

4.3.1 The association of ownership and the magnitudes of ORPTs

Table 8 reports on the regression results for the association of ownership and the magnitudes of RPTs. TOP1 is positively related to RPT_SALES and RPT_PURCHASES at the 1% significance level, respectively, implying that the magnitudes of ORPTs increase in line with ownership of the largest shareholder, consistent with previous literature mentioned in Section 2.1. TOP2_5 is not significantly related to any of RPT_SALES and RPT_PURCHASES, indicating that the alignment of other large shareholders cannot restrict ORPTs.

More surprisingly, InTA is negatively related to RPT_SALES, but positively related to RPT_PURCHASES, each at 1% significant level, implying that the smaller-sized listed firms heavily relied upon the largest shareholders (business groups) on the sources of raw materials and supporting services; while the larger-sized firms are quite independent in the sales and business operations from their largest shareholders and business groups. MI is

negatively related to RPT_SALES and RPT_PURCHASES at the 1% significance level, indicating that the issue of RPTs is also serious in those registered in non-eastern coastal region mostly because there is less product competition in that region (Gao et al., 2006). RPT_SP is positively related to RPT_SALES and RPT_PURCHASES at the 1% significance level, maybe because the magnitude of ORPTs becomes more significant when a listed firm is still an integral part (in both upstream and downstream) of the business group.

Some studies demonstrate that there may be a significant “U-shaped” or non-linear relationship between ownership of the largest shareholders and tunneling effects (e.g. Li, et al., 2004; He and Liu, 2005). First sensitivity test was performed using Eq (1) and TOP12 was inserted to replace TOP1. TOP12 is positively related to RPT_SALEAS and RPT_PURCHASES, at 1 % significance level, respectively, indicating that there is a “U-shaped” association between ownership of the largest shareholders and the magnitudes of OPRTs, and after the threshold percentage, there is a positive association between these two factors. Therefore, Hypothesis 1.1 is supported (see also Robustness check on TOP1 and ORPTs in Section 4.3.3).

Second sensitivity test is rerun by eliminating TOP1. The results of second sensitivity test show that TOP2_5 is negatively related to RPT_SALES and RPT_PURCHASES without the presence of TOP1 and such association is consistent with the correlation as shown in Table 5, but TOP2_5 is only negatively related to RPT_PURCHASES at 1% significant level. Some scholars find that the alliance of other large shareholders may restrict the tunneling effects through RPTs in some incidents (e.g. Li et al., 2004; Tai et al., 2007; Liu, 2008). Our results support that in principle, the alignment of other large shareholders seems to restrict to ORPTs with the largest shareholder; however, in practice, since the aggregate ownership of those large shareholders is relatively lower than that of the largest shareholders and therefore, Hypothesis 1.2 is not supported.

Table 7. Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
RPT_SALES (1)	1												
RPT_PURCHASES (2)	0.310**	1											
TQ (3)	0.003	-0.033**	1										
ROA (4)	0.002	0.002	-0.758**	1									
OCF_SALES (5)	-0.002	-0.002	-0.068**	0.016	1								
TOPSHARE (6)	0.152**	0.164**	-0.097**	0.018	-0.004	1							
SHARE2_5 (7)	-0.059**	-0.076**	0.012	0.016	0.005	-0.307**	1						
lnTA (8)	0.040**	0.148**	-0.277**	-0.007**	-0.011**	0.312**	-0.042**	1					
LEV(9)	0.003	0.060**	-0.074**	-0.007	0.031*	0.067*	0.029*	0.323**	1				
GROW_TA (10)	0.023	0.000	-0.009	0.003	-0.001	0.053**	-0.006	0.007	0.010	1			
GROW_SALES (11)	-0.004	-0.006	-0.007	0.001	-0.001	-0.001	0.026**	0.024	0.020	0.049**	1		
MI (12)	-0.092**	-0.104**	-0.016	0.001	0.014	0.030*	0.069**	0.049**	-0.098**	-0.011	-0.015	1	
SCLF (13)	0.115**	0.114**	-0.085**	-0.018	-0.001	0.184**	-0.076**	0.160**	0.066**	0.001	-0.013	-0.089**	1
RPT_SP	0.271**	0.308**	-0.073**	0.012	-0.006	0.278**	-0.128**	0.243**	-0.010	0.000	-0.013	-0.010	0.176**

* Correlation is significant at the 5% level (two-tailed) and

** Correlation is significant at the 1% level (two-tailed).

Table 8. Regression results: Ownership and ORPTs

	Expected sign	RPT_SALES						RPT_PURCHASES					
		Main test		Sensitivity tests				Main test		Sensitivity tests			
TOP1	+	0.065	***					0.043	***				
		(0.000)						(0.000)					
TOP12	+			0.086	***					0.058	***		
				(0.000)						(0.000)			
TOP2_5	-	0.009		0.012		-0.018		-0.018		-0.016		-0.036	***
		(0.511)		(0.361)		(0.147)		(0.134)		(0.195)		(0.002)	
lnTA	?	-0.006	***	-0.007	***	-0.004	***	0.005	***	0.004	***	0.006	***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
LEV	?	0.009		0.009		0.007		0.020	*	0.020	*	0.018	
		(0.429)		(0.437)		(0.554)		(0.067)		(0.068)		(0.091)	
GROW_TA	+	0.001		0.001		0.001	*	0.001		-0.001		0.001	
		(0.137)		(0.178)		(0.068)		(0.939)		(0.980)		(0.748)	
GROW_SALES	+	0.001		0.001		0.001		-0.001		-0.001		-0.001	
		(0.874)		(0.883)		(0.863)		(0.877)		(0.871)		(0.885)	
MI	-	-0.017	***	-0.017	***	-0.016	***	-0.020	***	-0.020	***	-0.019	***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
SCLF	+	0.015	***	0.015	***	0.017	***	0.007	**	0.007	**	0.007	***
		(0.000)		(0.000)		(0.000)		(0.021)		(0.021)		(0.010)	
RPT_SP	+	0.052	***	0.052	***	0.055	***	0.054	***	0.054	***	0.056	***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
FIXED_EFFECTS		Included		Included		Included		Included		Included		Included	
Constant	?	0.134	***	0.152	***	0.120	***	-0.085	***	-0.074	***	-0.095	***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.002)		(0.000)	
Adj-R2		0.107		0.108		0.101		0.127		0.127		0.124	
F-stat.		34.324		34.692		33.644		41.167		41.380		41.847	
OBS		6567		6567		6567		6567		6567		6567	

Note: P-values are in parentheses.

* Indicate significance at the 10% level.

** Indicate significance at the 5% level.

*** Indicate significance at the 1% level.

4.3.2 The association between ORPTs and corporate performance

Table 9 reports the regression results for the association of ORPTs and the corporate performance. All of TQ, ROA and OCF_SALES are insignificantly related to RPT_SALES, RPT_PURCHASES and RPT_SP in (1) the whole sample, (2) those with ROE of not lower than 6% (possible propping-up effect) and (3) those with ROE of less than 6% (possible tunneling effect), respectively. The results of second regression are inconsistent with Tai et al. (2007), Liu (2008) and Chen et al. (2009) because they find that particular related party purchases and sales may have some influence on the ROA or TQ value for the firm's data prior to 2006. The inconsistency in corporate performance is possibly because Chinese listed firms have adopted the new Chinese Accounting Standards to disclose the details of RPTs and related parties in their annual report and the auditors have to check whether those RPTs are conducted at arm's length basis or not (e.g. details of pricing policies of RPTs), and the increase in information dissemination of those RPTs may result in reducing likelihood of tunneling and propping-up effects (see also OECD, 2012). Such associations are consistent with the correlations as shown in Table 5. lnTA is negatively related to TQ, ROA and OCF_SALES in all cases, indicating that small business firms have higher impact on corporate performance⁶.

Apparently, there is no tunneling effect on ORPTs between Chinese listed firms and their largest shareholders when the listed firms have ROE of less than 6%; there is no propping-up effect on those RPTs when the listed firms have ROE of not less than 6%; and there is no effect on the whole sample. No tunneling effects might result as there is an alignment between the interests of the largest and minority shareholders because their shares are readily for sales after the completion of share reform as mentioned in Section 1.2.

The results of descriptive statistics present that corporate performance of those listed firms is violently dispersed over those years and across industries. Accordingly, four sensitivity tests are performed: (1) only RPT_SALES and RPT_PURCHASES included in Eq (2), i.e. only one RPT variable is included; (2) Eq (2) is run on yearly basis, consistent with the research model of Tai et al. (2007); (3) Eq (2) is run based on manufacturing sector only (C), MI and non-MI groups, and SCLF and non-SCLFs group, respectively; and (4) two ownership structure variables, TOP1 and TOP2_5 are added into Eq (2). The results of these sensitivity tests (not tabulated) further confirm that there is no association between ORPTs and corporate performance, and therefore, there is no evidence that

⁶ Under ROE<6, TA is negatively related to OCF_SALES without significance.

the largest shareholders use ORPTs to tunnel or prop-up their controlled listed firms. Therefore, Hypotheses 2.1 and 2.2 are not supported.

4.3.3 Robustness check on TOP1 and ORPTs

Several scholars argue whether the largest shareholders can control the listed firms and are able to effectively influence the listed firms when they hold an insignificant percentage of the total equity shares (e.g. Chan et al., 2006; Lin and Liu, 2009; Cullinan et al., 2012). Chan et al. (2006) consider the threshold of 20% for the implications of control. In addition to 20% cut-off, the authors also consider "significant influence" or "control" in accordance with the legal framework and professional practice on them, and set the threshold percentages (breakeven points) to be 20%, 30%⁷ and 50%⁸. Eq (1) is rerun by (1) 20% cut-off (i.e. eliminating those observations with ownership of the largest shareholders less than 20% of the total equity), (2) 30% cut-off (i.e. eliminating those observations with ownership of the largest shareholders less than 30% of the total equity) and (3) 50% cut-off (i.e. eliminating those observations with ownership of the largest shareholders not higher than 50% of the total equity). Table 10 reports the regression results of ownership structure and ORPTs in three panels. Except for 50% cut-off in which TOP1 is insignificant to RPT_SALES, TOP1 is positively related to RPT_SALES and RPT_PURCHASES. Such results support our argument in Section 4.3.1 that after the threshold percentage of ownership of the largest shareholders, TOP1 is positively related to ORPTs.

4.3.4 Endogenous effect of TOP1 on ORPTs (endogenous ownership theory)

Chen et al. (2004) suggest that ownership structure is determined by the trade-off of many factors, including firm value, and firm value is likely to affect ownership structure. To examine the potential endogenous effects between ORPTs and TOP1, Eq (1) was modified so that TOPSHARE is the dependent variable and any of RPT_SALES and RPT_PURCHASES are the independent variables as follows:

$$\begin{aligned} \text{TOP1}_{i,t} = & \beta_0 + \beta_1 \text{ORPT} (\text{RPT_SALES}_{i,t}, \\ & \text{RPT_PURCHASES}_{i,t}) + \beta_2 \text{TOP2_5}_{i,t} + \beta_3 \ln \text{TA}_{i,t} + \\ & \beta_4 \text{LEVI}_{i,t} + \beta_5 \text{GROW_TAI}_{i,t} + \beta_6 \text{GROW_SALES}_{i,t} \quad (3) \\ & + \beta_7 \text{MI}_{i,t} + \beta_8 \text{SCLFI}_{i,t} + \beta_9 \text{FIXED_EFFECTS}_{i,t} + e_{i,t} \end{aligned}$$

where $e_{i,t}$ is the random error term of the model; i is the i th firm and t is the year.

⁷ Article 47 of Regulations on the Takeover of Listed Companies (2006) requires when a shareholder holding 30% of equity interest of a listed firm continues to acquire such shares, such shareholder has to make a general offer for the rest of the shares of this firm.

⁸ Article 217 (2) of Company Law (2005) requires when controlling shareholder is one who holds more than 50% of equity interest ...

Table 9. Regression results: The magnitudes of ORPTs and corporate performance

	Expected sign	TQ						ROA						OCF_SALES					
		Whole sample		ROE ≥ 6		ROE < 6		Whole sample		ROE ≥ 6		ROE < 6		Whole sample		ROE ≥ 6		ROE < 6	
RPT_SALES	-	0.176		0.162		0.131		-0.032		-0.007		0.076		0.065		-0.020		0.130	
		(0.569)		(0.303)		(0.851)		(0.676)		(0.518)		(0.678)		(0.936)		(0.865)		(0.947)	
RPT_PURCHASES	-	0.242		0.005		0.875		-0.058		0.001		-0.139		0.091		0.003		0.377	
		(0.463)		(0.980)		(0.232)		(0.479)		(0.994)		(0.472)		(0.916)		(0.983)		(0.855)	
lnTA	?	-0.637	***	-0.312	***	-1.133	***	0.046	***	-0.004	***	0.110	***	-0.128	*	-0.030	***	-0.138	
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.097)		(0.009)		(0.497)	
LEV	?	0.456		-1.672	***	1.850		-0.182	***	-0.105	***	-0.185		2.028	***	-0.186		3.263	**
		(0.104)		(0.000)		(0.000)		(0.009)		(0.000)		(0.179)		(0.006)		(0.163)		(0.026)	
GROW_TA	+	0.000		0.000		-0.359	*	0.001		0.001		0.032		0.000		-0.001		-0.270	
		(0.676)		(0.370)		(0.052)		(0.854)		(0.278)		(0.508)		(0.872)		(0.719)		(0.603)	
GROW_SALES	+	0.001		.0001		-0.003		-0.001		0.001		0.013		-0.001		-0.001		-0.032	
		(0.816)		(0.868)		(0.956)		(0.921)		(0.916)		(0.372)		(0.904)		(0.909)		(0.835)	
MI	?	-0.004		-0.109	***	-0.015		-0.006		-0.002		-0.017		0.241		-0.076	***	0.576	
		(0.955)		(0.005)		(0.922)		(0.703)		(0.514)		(0.679)		(0.171)		(0.003)		(0.180)	
SCLF	+	-0.037		-0.225	***	0.298	*	-0.048	***	-0.006	**	-0.094	**	-0.095		0.046		-0.287	
		(0.617)		(0.000)		(0.082)		(0.009)		(0.024)		(0.038)		(0.628)		(0.105)		(0.552)	
RPT_SP	+	-0.093		-0.102	**	-0.129		-0.006		-0.003		-0.004		0.039		-0.056	**	0.116	
		(0.202)		(0.012)		(0.454)		(0.730)		(0.313)		(0.929)		(0.840)		(0.041)		(0.811)	
FIXED_EFFECTS		Included		Included		Included		Included		Included		Included		Included		Included		Included	
Constant	?	16.483	***	9.770	***	25.332	***	-0.939	***	0.176	***	-2.325	***	2.318		0.835	***	2.306	
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.160)		(0.000)		(0.584)	
Adj-R2		0.109		0.283		0.118		0.007		0.054		0.014		-0.001		0.028		0.000	
F-stat.		34.921		66.454		15.811		2.919		10.567		2.564		0.857		5.835		0.986	
OBS		6657		3989		2668		6657		3989		2668		6657		3989		2668	

Note: P-values are in parentheses.

* Indicate significance at the 10% level.

** Indicate significance at the 5% level.

*** Indicate significance at the 1% level.

Table 11 reports the results of this regression and there is a significant endogenous effect of ownership of the largest shareholder on ORPTs, as both any of RPT_SALES and RPT_PURCHASES and both variables are positively related to TOP1 in those three scenarios. This association supports our explanation on why the largest (controlling) shareholders still hold substantial ownership (say about 40% as mentioned) in Chinese listed firms after IPO and even after the completion of share reform, mostly because the largest shareholder could exercise significant control on them to maintain the continuity of RPTs between listed firms and the business groups as well as the business operations of the whole group (alignment effect). Therefore, we can interpret that in economic reality, most Chinese listed firms are still an integral part of the business operations of their largest shareholders, and even after the completion of share reform, the ownership of the largest shareholders remains the same as that before the share reform, as the largest shareholders can retain the control on their listed firms. In other words, because of having a high portion of ORPTs between the largest shareholders and their controlled firms, the largest shareholders should maintain high ownership on those firms to reduce the threats of discontinued operations of their business groups.

4.4 Summary of the regression results

This paper reexamines the association of ORPTs with ownership structure and corporate performance after the financial reform. Overall, there is still a positive association between ownership of the largest shareholders and the magnitudes of ORPTs, and the alignment of other large shareholders seems to be unable to restrict such RPTs. Hopefully, since the largest shareholders (and the related shareholders/directors) must abstain the voting in the relevant shareholders' (and directors') meeting when any RPTs are reviewed and approved, it is expected that other large shareholders can, in practice, restrict the unfair (unfavorable) RPTs between the largest shareholders and their controlled listed firms.

More surprisingly, the magnitudes of such RPTs seem not to have significant impact on corporate performance, and there seems not to have tunneling effect nor propping-up effects on Chinese listed firms, more likely because (1) the adoption of new Chinese Accounting Standards enhances the disclosure of information content of RPTs, especially the pricing policies and financial position of related parties, (2) new rules and regulations have been implemented for the governance of the disclosure and internal approval of RPTs in Chinese listed firms, and those ORPTs are subject to the review by independent auditors and valuers, (3) after share reform scheme, the interests of the largest and minority shareholders become the same because both interests in the listed firms are valued at the market price, and (4) the largest

(controlling) shareholder can readily realize the shares of their listed firms for cash after the completion of share reform, reducing the likelihood of embezzlement of the firms' resources through tunneling. These institutional reform can restrict the largest shareholders to engage RPTs to tunnel and prop up (earnings management) their controlled listed firms.

5. Conclusion

This study is to explore the association among the ownership structure, the magnitudes of ORPTs and corporate performance of Chinese listed firms after the financial reform.

Before the financial reform, most literature found that it was common for the largest shareholders to transfer interests to controlled firms (propping-up), or to tunnel interest from the listed firms to themselves, through several types of RPTs. The propping-up was to manipulate the profitability of listed firms for IPO or subsequent share issue for funds raising, and then the funds were flowed back to the controlling shareholders. Both the motive of propping-up and tunneling is mainly to expropriate the interests of minority shareholders. This paper finds that there is no significant change on ownership of the largest shareholders in Chinese listed firms after the completion of share reform scheme, and there is still a significant positive effect of ORPTs on ownership of the largest shareholders. Nevertheless, the results of this study do not find any significant association between the magnitudes of ORPTs and corporate performance of Chinese listed firms since 2007. This paper further finds that there is an endogenous effect of ownership of the largest shareholders on ORPTs, suggesting that the largest shareholders have to retain control on those listed firms to maintain the survival of their business groups, but apparently there is no potential of tunneling or propping-up effect.

After the occurrence of a series of corporate scandals in Chinese listed firms, Chinese government, the regulators and stock exchanges are recurrently revising the legal framework to restrict certain RPTs, and regulate ORPTs which should be conducted at arm's length basis. We expect that with the open of commodity markets, the magnitudes of ORPTs and their potential embezzlements and earnings management can be further reduced in future.

Table 10. Regression results: Ownership structure and ORPTs

	Expected sign	RPT_SALES						RPT_PURCHASES					
		20% cut-off		30% cut-off		50% cut-off		20% cut-off		30% cut-off		50% cut-off	
TOP1	+	0.076	***	0.106	***	0.101	**	0.046	***	0.094	***	-0.056	
		(0.000)		(0.000)		(0.047)		(0.000)		(0.000)		(0.240)	
TOP2_5	-	0.012		0.003		0.081		-0.016		-0.022		-0.148	***
		(0.407)		(0.886)		(0.142)		(0.244)		(0.183)		(0.004)	
lnTA	?	-0.007	***	-0.009	***	-0.010	***	0.006	***	0.006	***	0.011	***
		(0.000)		(0.000)		(0.003)		(0.000)		(0.000)		(0.000)	
LEV	?	0.022		0.041	**	0.037		0.028	**	0.029	*	0.093	**
		(0.107)		(0.038)		(0.353)		(0.024)		(0.084)		(0.011)	
GROW_TA	+	0.001		0.001		0.001		0.001		0.001		0.001	
		(0.165)		(0.128)		(0.180)		(0.935)		(0.992)		(0.873)	
GROW_SALES	+	0.001		-0.001		-0.001		-0.001		-0.001		0.001	
		(0.846)		(0.809)		(0.899)		(0.875)		(0.759)		(0.840)	
MI	-	-0.017	***	-0.014	***	-0.016	*	-0.022	***	-0.022	***	-0.028	***
		(0.000)		(0.001)		(0.054)		(0.000)		(0.000)		(0.000)	
SCLF	+	0.017	***	0.018	***	0.030	***	0.008	***	0.010	***	0.012	
		(0.000)		(0.000)		(0.001)		(0.008)		(0.007)		(0.119)	
RPT_SP	+	0.053	***	0.056	***	0.081	***	0.053	***	0.049	***	0.047	***
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
FIXED_EFFECTS		Included		Included		Included		Included		Included		Included	
Constant	?	0.142	***	0.162		0.162		-0.103	***	-0.138	***	-0.133	**
		(0.000)		(0.000)		(0.017)		(0.000)		(0.000)		(0.035)	
Adj-R2		0.107		0.100		0.116		0.129		0.129		0.120	
F-stat.		29.682		20.074		8.861		36.443		26.291		9.166	
OBS		5749		4100		1435		5749		4100		1435	

Note: P-values are in parentheses.

* Indicate significance at the 10% level.

** Indicate significance at the 5% level.

*** Indicate significance at the 1% level.

Table 11. Regression results: Endogenous test of TOP1 on ORPTs

	Expected sign	TOP1					
RPT_SALES	+	0.103	***			0.091	***
		(0.000)				(0.000)	
RPT_PURCHASES	+			0.078	***	0.055	***
				(0.000)		(0.001)	
TOP2_5	-	-0.407	***	-0.406	***	-0.405	
		(0.000)		(0.000)		(0.000)	
lnTA	?	0.028	***	0.027	***	0.028	***
		(0.000)		(0.000)		(0.000)	
LEV	?	-0.035	**	-0.036	**	-0.036	**
		(0.014)		(0.012)		(0.012)	
GROW_TA	+	0.001	***	0.001	***	0.001	***
		(0.000)		(0.000)		(0.000)	
GROW_SALES	+	0.001		0.001		0.001	
		(0.877)		(0.860)		(0.871)	
MI	-	0.019	***	0.019	***	0.020	***
		(0.000)		(0.000)		(0.000)	
SCLF	+	0.017	***	0.018	***	0.017	***
		(0.000)		(0.000)		(0.000)	
RPT_SP	+	0.044	***	0.046	***	0.042	***
		(0.000)		(0.000)		(0.000)	
FIXED_EFFECTS		Included		Included		Included	
Constant	?	-0.238	***	-0.219	***	-0.232	***
		(0.000)		(0.000)		(0.000)	
Adj-R2		0.265		0.262		0.266	
F-stat.		100.753		99.487		97.279	
OBS		6657		6657		6657	

Note: P-values are in parentheses.

* Indicate significance at the 10% level.

** Indicate significance at the 5% level.

*** Indicate significance at the 1% level.

References

- Aharony, J., Wang, J. and Yuan, H. (2010), "Tunneling as an incentive for earnings management during the IPO process in China", *Journal of Accounting and Public Policy*, Vol. 29 No. 1, pp. 1-26.
- Berkman, H., Cole, R.A. and Fu, L.J. (2009), "Expropriation through loan guarantees to related parties: Evidence from China", *Journal of Banking and Finance*, Vol. 33 No. 1, pp. 141-156.
- Berman, E.M. (2007), "Multiple regression". *Essential Statistics for Public Managers and Policy Analysts*, Second Edition, QP Press Washington, DC, pp. 224-225.
- Bowen, R.M., Rajgopal, S. and Venkatachalam, M. (2008), "Accounting discretion, corporate governance, and firm performance", *Contemporary Accounting Research*, Vol. 25 No. 2, pp. 351-405.
- Brown, P., Wan Y. and Wong, L. (2012), "The influence of state versus private ownership, and related party transactions, on firm performance: evidence from Chinese listed firms". Working paper from Accounting and Finance Association of Australia and New Zealand, Available from: <http://www.afaanz.org/openconf/2012/modules/request.php?module=oc_programandaction=view.php&id=24>. [15 July 2013].
- Chan, K.H., Lin, K.Z. and Mo, P.L. (2006), "A political-economic analysis of auditor reporting and auditor switches", *Review of Accounting Studies (RAST)* Vol. 11, pp. 21-48.
- Chen, Y., Chen, C.H. and Chen, W. (2009), "The impact of related party transactions on the operational performance of listed companies in China", *Journal of Economic Policy Reform*, Vol. 12 No. 4, pp. 285-297.
- Chen, S., Wang, K. and Li, X. (2012), "Product market competition, ultimate controlling structure and related party transactions", *China Journal of Accounting Research*, Vol. 5 No. 4, pp. 293-306.
- Chen, X., Chen, D. and Zhu, K. (2004), "Ownership structure and corporate governance: literature review and directions for future research", *China Accounting and Finance Research*, Vol. 4, pp. 1-24 (in Chinese).
- Chen, Y. and Wang, K. (2005), "Related party transactions, corporate governance and state ownership reform", *Economic Research Journal*, Vol. 4, pp. 77-86 (in Chinese).
- Cheung, Y.L., Jing, L., Lu, T., Rau, P.R. and Stouraitis, A. (2009), "Tunneling and propping up: An analysis of related party transactions by Chinese listed companies", *Pacific-Basin Finance Journal*, Vol. 17 No. 3, pp. 372-393.
- Cullinan, C.P., Wang, F., Wang, P. and Zhang, J. (2012), "Ownership structure and accounting conservatism in China", *Journal of International*

- Accounting”, Auditing and Taxation, Vol. 21 No. 1, 1-16.
13. Friedman, E., Johnson, S. and Mitton, T. (2003), “Propping and tunneling”, *Journal of Comparative Economics*, Vol. 31 No. 4, pp. 732–750.
 14. Gao, L. He, Z. and Huang, Z. (2006), “Corporate governance and tunneling”, *Economic Quarterly Journal*, Vol. 4 No. 3 (in Chinese).
 15. Gao, L. and Kling, G. (2008), “Corporate governance and tunnelling: empirical evidence from China”, *Pacific-Basin Finance Journal*, Vol. 16 No. 5, pp. 591-605.
 16. He, J. and Liu, F. (2005), “Controlling shareholder, tunnelling, and investor protection: evidence from related-party asset acquisition in mainland China”, *China Accounting and Finance Review*, Vol. 7 No. 3, pp. 136-170.
 17. Hu, S., Shen, Y. and Xu, Y. (2009), “Determinants of related-party transactions: Evidence from China’s listed companies during 2002 – 2006”, *Frontiers of Business Research in China*, Vol. 3 No. 2, pp. 190-206.
 18. Jensen, M. and Meckling, W.H. (1996), “Theory of the firm: Managerial behavior, agency costs and ownership structure”, *Journal of Financial Economics*, Vol. 3 No. 4, pp. 305-360.
 19. Jian, M. and Wong, T.J. (2010), “Propping through related party transactions”, *Review of Accounting Studies*, Vol. 15 No. 1, pp. 70-105.
 20. Jiang, G., Lee, C.M.C. and Yue, H. (2010), “Tunneling through intercorporate loans: The China experience”, *Journal of Financial Economics*, Vol. 98 No. 1, pp. 1–20.
 21. Johnson, S., La Porta, R., Lopez-de-Silanes, F. and Shleifer, A. (2000), “Tunneling”, *American Economic Review*, Vol. 90 No. 2, pp. 22–27.
 22. La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R. (2002), “Investor protection and corporate valuation”, *Journal of Finance*, Vol. 37, pp. 1147-1170.
 23. Leung, N.W. and Cheng, M. (2013), “Corporate governance and firm value: Evidence from Chinese state-controlled listed firms”, *China Journal of Accounting Research*, Vol. 6 No. 2, pp. 89-112.
 24. Li, Z., Sun, Z. and Wang, Z. (2004), “Tunneling and ownership of a firm: Evidence from controlling shareholder’s embezzlement of listed company’s funds in China”, *Accounting Research*, Vol. 12, pp. 3-13 (in Chinese).
 25. Lin, W.Y., Liu, Y.A. and Keng, I. (2010), Related party transactions, firm performance and control mechanisms: Evidence from Taiwan, *International Research Journal of Finance and Economics*, Vol. 35, pp. 82-98.
 26. Lin, Z. J. and Liu, M. (2008), “The impact of corporate governance on auditor choice: Evidence from China”, *Journal of International Accounting, Auditing and Taxation*, Vol. 18 No. 11, pp. 44-59.
 27. Liu, F., and He, J. (2004), “Ownership structure and substantial shareholders’ choice in interest realizing methods: Tentative study on tunneling in Chinese capital market”, *China Accounting Review*, 2(1), 141-158 (in Chinese).
 28. Liu, F., He, J., and Wei, M. (2004), “Controlling right, performance and tunnelling – Case study at Wuliangye”, *Management World Monthly Journal*, Vol. 8 (in Chinese).
 29. Liu, J. (2008), “Empirical analysis on determinants of unfair related-party transactions of Chinese listed companies. A Study on Unfair Related-Party Transactions of Chinese Listed Companies”, *Economic and Management Publishing House, Beijing*, pp. 109 – 129 (in Chinese).
 30. Liu, Q. and Lu, Z.J. (2007), “Corporate governance and earnings management in the Chinese listed companies: A tunneling perspective”, *Journal of Corporate Finance*, Vol. 13 No. 5, pp. 881-906.
 31. Lo, A.W.Y., Wong, R.M.K. and Firth, M. (2010), “Can corporate governance deter management from manipulating earnings? Evidence from related-party sales transactions in China”, *Journal of Corporate Finance*, Vol. 16 No. 2, pp. 225-235.
 32. Nekhili, M. and Cherif, M. (2011), “Related parties transactions and firm’s market value: the French case”, *Review of Accounting and Finance*, Vol. 10 No. 3, pp. 291-315.
 33. OECD (2012), “Related Party Transactions and Minority Shareholder Rights”, OECD Publishing. Available from: <<http://dx.doi.org/10.1787/9789264168008-en>>. [3 August 2013].
 34. Peng, W.Q., Wei, K.C.J. and Yang, Z. (2011), “Tunneling or propping: Evidence from connected transactions in China”, *Journal of Corporate Finance*, Vol. 17 No. 2, pp. 306-325.
 35. Shanghai Stock Exchange (SSE 2010a), “Research report on related party transactions of listed firms”, (working paper jointly with Fudan University) (in Chinese).
 36. Shanghai Stock Exchange (SSE 2010b), “Research on related party transactions of listed firms and regulatory measures - perspectives on corporate governance and financial performance”, (working paper jointly with Chong Qing Office, China Securities Regulatory Commission) (in Chinese).
 37. Shanghai Stock Exchange (SSE 2012), “Historical development and current status of related party transactions. China Corporate Governance Report (2011)”, Shanghai People’s Publishing House, Shanghai, pp. 34-58 (in Chinese).
 38. Shleifer, A. and Vishny, R.W. (1997), “A survey of corporate governance”, *The Journal of Finance*, Vol. 52 No. 2, pp. 737-783.
 39. Tai, B. Y., Liu, X. and Jian, M. (2007), “Related-party transactions, corporate performance, and the effectiveness of corporate governance mechanism: Evidence from the Chinese stock market”, *Journal of International Business Economics*, Vol. 7 No. 2. Available from: <http://www.freepatentsonline.com/article/Journal-International-Business-Economics/178945908.html>. [15 July 2013].
 40. Wahab, E.A.A, Haron, H., Lok, C.L. and Yahya, S. (2011), “Does corporate governance matter? Evidence from related party transactions in Malaysia”, In Kose John, Anil K. Makhija (Ed.) *International Corporate Governance, Advances in Financial Economics*, Emerald Group Publishing Limited, Bingley, Vol. 14, pp. 131-164.
 41. Xu, X. and Chen, X. (2003), “Analysis on the largest shareholders’ impact on corporate governance and performance”, *Economic Research Journal*, Vol. 2, pp. 64-74 (in Chinese).

Appendix 1

Financial impact of related party transactions

Hubei Xinghua Co., Ltd. has been listed on the Shanghai Stock Exchange (Stock code: 600886) since 1996. The firm is engaged in the production of petrochemical products. Liu and He (2004) claim that the firm was, in reality, part of the production lines of

its largest shareholder, Wubei Jingmen Petrochemical Factory in IPO in 1996. They further reported related party transactions between the firm and its controlling shareholder, China Petroleum from 1996 to 2001 as follows:

	1996	1997	1998	1999	2000	2001
Related party purchases (RMB Million)	343.9	1030.8	915.4	1011.8	1590.5	1495.5
% of related party purchases to total	92.3	96.5	88.8	88.0	98.3	86.28
Related party sales (RMB Million)	422.8	1160.6	102.5	102.0	1405.6	1761.8
% of related party sales to total	68.9	85.0	8.4	8.0	75.7	92.4
Gross profit ratio (%)	26.8	13.3	20.0	3.9	9.3	6.0

(Source: Liu and He, 2004)

Liu and He (2004) mention that there was no significant change of related party purchases over these six years, but there was a significant drop in related party sales in 1998 and 1999. The firm announced the reason for decrease in sales was as a result of the decrease in sales prices and demand in

domestic market in 1998. Therefore, the firm suffered losses from such incident and accumulated inventories. Liu and He (2004) suspect that the largest shareholder protected its own benefit at the expense of the firm.

Appendix 2

Extracts of Chinese Accounting Standard No. 39 Disclosure of related party

Chapter IV Disclosure

Article 9

An enterprise shall, in the annotations to the financial statements, disclose the following information about the parent company and subsidiaries thereof, irrespective of whether there have been transactions between them:

(1) The names of the parent company and subsidiaries thereof

Where the parent company is not the ultimate controlling party of the enterprise, it shall disclose the name of the ultimate controlling party.

Where neither the parent company nor the ultimate controlling party provides the financial statements to outsiders, it shall disclose the name of the parent company which is its closest superior parent company providing financial statements to outsiders.

(2) The nature of business, name, place of registration, and registered capital (or actually paid-in

capital, stock capital) and changes therein of the parent company and its subsidiaries; and

(3) The proportion of shares or voting rights held by the parent company in this enterprise or by this enterprise in its subsidiaries.

Article 10

Where there have been transactions between an enterprise and its related parties, it shall disclose the nature of the related party relationships, the types of transactions and the elements of transaction in the annotations. The elements of transaction shall at least include:

- (1) the amount of transactions,
- (2) the amounts, terms and conditions of outstanding items, and the information about the guaranties granted to others or obtained,
- (3) the amounts of provisions for non-performing debts under outstanding items, and
- (4) price policies.

(Source: Asian Legal Information Institute. Available from:

<<http://www.asianlii.org/cn/legis/cen/laws/asfen36doap666/>> [22 July 2013].

Appendix 3

Current practices for the reduction of related party transactions

Wuliangye Yibin Company Limited is listed on the Shenzhen Stock Exchange (Stock code: 000858). Wuliangye and its subsidiaries are engaged in the sale and manufacture of wine under the name of 'Wuliangye', in Yibin, Sichuan, China. The firm is under the control of a state-owned enterprise, the Wuliangye Group Co Ltd (the controlling party) because they are under the same management. Liu et al. (2004) estimate that the Wuliangye Group yielded private benefits of RMB9.7 billion between 1998 and 2003.

Most contemporary Chinese listed firms reorganized their corporate structure before their IPOs to reduce the magnitude of the RPTs (i.e., the possibility of tunneling and earnings management) and to ensure the independence of their management hierarchy and business models from their related parties. Following

this professional practice, in 2009, the firm announced its proposal for corporate reorganization to separate the core business from the Wuliangye Group and dispose of the non-business related investments to its controlling shareholder to improve investors' perceptions of corporate governance. For example, the firm injected additional capital to a joint venture entity, Yibin Wuliangye Liquor Sales Co Ltd, resulting in that entity becoming a key operating subsidiary in 2009 (the firm and Wuliangye Group held 95% and 5% of ownership of that entity respectively), and announcing the details and the rationale for the ongoing RPTs, including trade mark, properties and other services provided by Wuliangye Group to the firm.

The following table reports RPTs between the firm and Wuliangye Group:

	2008		2009		2010		2011	
	RMB Million	%	RMB Million	%	RMB Million	%	RMB Million	%
Related purchases/Related purchases to total sales (%)	2,132	26.9	1,043	9.4	-	-	-	-
Related sales/Related sales to total sales (%)	4,165	52.5	4,603	41.4	-	-	-	-
Related expenses/Related expenses to total sales (%)	182	2.3	227	2.0	280	1.8	315	1.5
Net advances to/(from) related parties/Net advances to/(from) related parties to total assets (%)	(369)	(2.70)	66	0.30	(122)	(0.4)	(92)	(0.3)
Acquisition of assets from related parties/Acquisition of assets from related parties to total assets (%)	3	0.00	3,827	18.40	54	0.2	4	(0.0)

(Source: The firm's annual reports from 2008 to 2011)

From the above table, it seems that the magnitudes of RPTs between the firm and its controlling party have decreased since 2010, thereby reducing the potential

threats of tunneling, propping-up and earnings management.

FINANCE AND FIRM CHARACTERISTICS IN ZIMBABWE

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Abstract

The purpose of this study was to examine the impact of firm-specific characteristics on the accessibility of firm financing in Zimbabwe using 2011 data from World Bank enterprise surveys. The results of the study show that firm characteristics in Zimbabwe determine the type of financing that is used for investment and working capital purposes. Small firms seem to rely more on internal financing as opposed to using bank funds, probably due to their small operations and lack of assets to put up as collateral. The larger firms however find it easier to access bank finance as they are much older in terms of age, have developed good relations with their financial services' providers and are also able to provide the required collateral to back their lines of credit. Both domestic and foreign-owned firms highlighted financial constraints as a major obstacle to their businesses. However foreign firms seemed to access bank loans easier than domestic firms. Also, gender seems to play a minor role in the financing decisions of the firm. It is therefore recommended that the Government engages the financial market intermediaries to find feasible business financing solutions for all sized firms, especially those owned by locals. This would lead to the much-needed economic growth through investment attraction and employment creation.

Keywords: Finance, Firm Characteristics, Zimbabwe

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1. Introduction

There is no doubt that the backbone of many developing economies is the small business sector. Firms in this sector are used to stimulate the local economy by providing employment, services and products which are sometimes not viable for larger firms to engage in. However, in order to start or grow any form of business entity, finance is essential. There are various forms of corporate finance sources available to firms, depending on a variety of factors. Finance in the business context, as described by Gitman & Zutter (2012), requires certain money decisions to be made. These decisions include how firms raise money, how they invest money to generate profits and how they decide whether to reinvest profits or distribute them to investors. For the purposes of this study, it will therefore be important to understand how these decisions guide the actions of the firms which were surveyed. Corporate finance can be used to meet either long-term firm needs (investment) or short-term needs (working capital).

Out of the 600 surveyed firms in Zimbabwe, access to finance was ranked first out ten business obstacles encountered by firms conducting business in Zimbabwe by 46.6% of the firms. This was followed by political instability (27.6%), while concerns regarding practices of the informal sector were ranked third (12.0%). Robb & Wolken (2002) acknowledged that firm size, type and age may influence the financing decisions of firms. According to them, younger firms may desire an injection of working capital for expansion projects but are unlikely to be approved as a result of their limited performance history. As a result, in its infancy, a firm is more likely to depend on internal finance or retained profits to sustain itself. This is because it does not have a track record which financial institutions can use to assess the financial health of the business. Also, smaller firms have less valuable or fewer tangible assets which can be put up as collateral for external finance such as bank loans or lines of credit. It is therefore not surprising that financial constraints were

mentioned as the leading hurdle for many of the surveyed firms. Zimbabwe is a land-locked, developing economy located in the Sub-Saharan part of Africa. It gained its independence from the British in 1980, and has since then been through many economic cycles. In the late 90s, and at the peak of its economic upswings, the Zimbabwean Government decided that some of the 1979 Lancaster House agreements had still not been honoured. These were mainly to do with land issues; hence the start of the infamous land invasions. This action shook the economy so much that the currency weakened against other major global currencies. The country went through periods of hyperinflation and high unemployment. Barely a decade later, the same Government felt that giving its people land was not empowering enough, and began considering nationalisation of foreign-owned mines, banks and other industrial firms. This resulted in a slowing down of FDI inflows as investors adopted a wait-and-see approach. Further to this, the lack of FDI inflows meant that firms had to adopt an inward-looking approach to most of their economic activities, in particular financing. The data used is from 2011, at a time when the Zimbabwean economy was at one of its worst periods. At that time, it had a gross national income (GNI) per capita of US\$680.

Zimbabwe has since 2009 adopted a multi-currency financial system. As such, it has become a cash-economy and therefore most business transactions are cash-based. Although some firms do hold cheque or savings accounts, this is more to fulfil the requirements of the tax authorities than for transaction purposes. Also, there is a general consensus that the manner in which a firm conducts its transactional accounts can assist a potential borrower or investor in making a fair assessment of

the business should it ever require a capital injection. Accounting records can be easily manipulated hence these are not heavily relied on. The need for any cash injections in Zimbabwean firms would have to come from the short-term market. Very few of the surveyed firms were listed or planning to list on the local bourse, hence equity finance was not an option for them.

Studies that apply firm-level data are limited and are primarily based on U.S firms. This study will focus on a developing country which has been plagued by various economic and political turmoil over the past few decades. In their study, Cavalluzo, Cavalluzo & Wolken (2002) noted that there are certain differences in the financing activities of female and male owned firms, and that those are often as a result of financial market imperfections. They went on to add that these differences are not necessarily as a result of discrimination against one gender, but rather a preference by the owners and managers of the firms, as well as firm-specific characteristics such as size, type and age.

We want to examine the impact of firm-specific characteristics such as firm size, firm age, ownership structure, managerial gender and location of the businesses on their access to financing in Zimbabwe, using data sourced from the World Bank Enterprise Surveys. This is deemed important as sound and appropriate investment policies such as ensuring access to finance for small business can promote local economic growth thereby reducing unemployment and poverty. For the purposes of this study, the terms “manager” and “owner” will be used interchangeably.

A snapshot of Zimbabwe’s finance-related statistics for 2011 in relation to other countries in the Sub-Saharan region and the world at large is captured in Table 1 below.

Table 1. Zimbabwe Finance-related statistics, 2011

	Zimbabwe	Region (Sub-Saharan Africa)	Global
Percentage of firms with cheque/ savings account	93.5	86.8	87.7
Percentage of firms with a bank loan/ line of credit	12.5	22.5	34.9
Proportion of loans requiring collateral	81.4	80.1	78.0
Value of loan required as collateral (% of loan amount)	261.3	155.2	170.9
Percentage of firms whose recent loan applications were rejected	23.1	18.0	13.6
Percentage of firms using banks to finance investments	13.0	15.1	25.8
Proportion of investments financed internally (%)	84.8	79.4	69.7
Proportion of investments financed by banks (%)	8.6	9.9	16.2
Proportion of investments financed by supplier credit (%)	5.9	3.6	4.7
Proportion of investments financed by equity/ stock sales (%)	0.4	2.0	4.7
Working capital external financing (%)	17.3	20.3	24.1
Percentage of firms identifying finance as a major constraint	63.5	44.9	32.5
Firm age (years)	33.3	13.1	15.3
Firm size (average number of permanent employees)	53.6	26.7	35.8
Percentage of firms with female top manager	17.6	15.3	18.5
Percentage of firms with female participation in ownership	56.3	33.1	36.6
Domestic ownership	94.2	81.2	87.5
10% or more foreign ownership	5.1	14.7	9.8

Source: World Bank Enterprise Surveys (<http://www.enterprisesurveys.org>), (2011)

From the table above, it can be assessed that there are more firms in Zimbabwe with a bank account, compared to the SSA region and the world. This is due to the higher formality of business incorporations and tighter tax authority regulation. Also, the Zimbabwean economy is highly cash-based which could explain why only 12% of the surveyed firms had bank loans at the time the survey was conducted. Other possible reasons for this low bank loan appetite are the high interest rates charged on loans (minimum 13%, AFDB, 2012), the collateral requirement on loans and the high rejection rate of loan applications for Zimbabwean firms. Further to these hindrances, of the collateralised loans, firms in Zimbabwe were expected to cede collateral up to 260% of the loan amount, compared to only 155% in SSA and 170% for the rest of the world. This high collateral requirement was an outright deterrent for many firms.

The state of the Zimbabwe economy made firm survival an ongoing battle. Although bank funding was available, it came at too high a cost. 63% of Zimbabwean firms identified access to finance as a huge obstacle in their businesses, compared to 44% in the SSA region. As such, these firms were forced to seek alternative funding sources and they hence resorted to internal finance. Internal finance was a short-term source of funding which could be used to sustain working capital requirements but not for firm growth and recapitalisation.

Looking at other firm characteristics, Zimbabwe, on average, had much older and more established firms than those for the SSA region, and a much bigger firm size averaging 54 permanent employees compared to only 27 in other SSA countries. If the Zimbabwean economy were more stable both politically and economically, this would have given the country a major economic boost. Like the other regions, Zimbabwe had a low percentage of female-run firms. In terms of the ownership structure of the surveyed firms, Zimbabwe, due to its Indigenisation Law which limits foreign ownership of companies, had 94% of the surveyed firms being domestic-owned. The average figure for SSA was slightly lower though at 81%. Foreign direct investment (FDI) in Zimbabwe hit all-time lows due to the hostile political and economic environment towards foreign ownership of firms and assets in that country.

2. Literature Review

Business success is dependent on the ability to access the required financing. Entrepreneurship and finance literature notably emphasises the existence of financial hurdles, implying that firms cannot raise external finance to fund their desired investments (e.g., Evans & Jovanovic, 1989; Fazzari et al., 1988). The evidence of firm financing is two-fold: that for well-established, older businesses as well as for start-up ventures. Hisrich & Brush (1986) identified access

to capital and mobilisation of start-up financial resources as being the greatest barriers to business formation and success. Similarly, Lee & Denslow (2004) noted that financing is problematic during the firm's early stages.

A burning question of late has been whether access to financial resources external to the firm are determined by other non-firm-specific characteristics such as the owner or manager demographics by considering other personal attributes of the firm owners and managers such as their gender and even ethnicity. Discrimination in the financial markets takes form in multiple ways from social capital to non-financial factors such as gender, race, level of education, amongst others. In his classical model of discrimination in credit markets, Becker (1957) asserted discrimination arose as a result of lenders willing to pay a premium to be associated only with a certain type of borrower. An alternative to this is the statistical model of discrimination was postulated by Phelps in 1972 when he developed a model proposing that lenders were at liberty to use borrowers' demographic attributes if those attributes were correlated to their creditworthiness. Either way, both models of discrimination are socially and legally unacceptable. However, it has also become an economic norm to identify variables which may influence the outcome of a loan application by considering these non-firm characteristics which focus on the business owner. This is the case with Cavalluzzo et al., (2002) who examined loan approval rates for female-owned firms and found evidence of gender discrimination after controlling for the applicants' financial attributes of creditworthiness and solvency. Other empirical studies by Blanchflower et al. 2003 provide evidence of financier discrimination against borrowers based on race. Raturi & Swamy (1999) also found that in Zimbabwe, access to finance was problematic for black-owned indigenous firms.

It has however been found that discrimination in the financial markets is blurred when considering gender. With the exception of Cavalluzzo et al. (2002) who found evidence of higher denial loan application rates for females while examining U.S firms owned by white males and white females; other authors find no statistically significant effect of gender on the credit access gap (Cavalluzzo & Cavalluzzo, 1998; Blanchflower et al., 2003; Storey, 2004; Cavalluzzo & Wolken, 2005). It can hence be safely concluded that in U.S firms, there is no evidence of gender discrimination being applied in the credit market but could the same conclusions be reached for other economies.

2.1 Firm characteristics influencing access to finance

There are various firm-specific features which determine access to finance. As already alluded to by Robb & Wolken (2002), the size, type and age of a

firm are important financing determinants. Depending on what variable is used to measure the size of the firm, generally, the larger the firm, the easier it is to access credit. If firm size is measured in terms of assets, borrowers are more comfortable with loaning funds to firms with high-value assets as in the event of default, these assets can be seized and sold to offset the outstanding debt. Firm age is also a critical determinant of access to finance. The more mature the firm, the longer the performance history for borrowers to use in credit assessments, hence the higher the likelihood of getting loan application approval. Younger firms may therefore not qualify for bank lines of credit because of their limited performance history. This is confirmed by the findings of Robb & Wolken (2002) where they found that larger, mature firms were more likely to have outstanding debt smaller ones. Another factor which is sometimes overlooked is the firm's own credit history, which is often difficult to distinguish from that of the owner/director. Hence, if the owner's personal finances and credit history are negative, this could have a profound bearing on the likelihood of the firm not being granted credit lines. Earlier studies by Berger & Udell (1995) also highlighted the importance of long-term relationships with bankers as a determinant for accessing finance. Such relationships and networks are believed to give borrowers a better understanding of the business requiring funding and therefore base their decisions on how long and how well the firm has conducted its transaction bank account.

2.2 Sources of finance

There are various sources of corporate funding available to business entities. Generally, a firm can utilise internal or external sources of funding to finance its operations and growth. The decision as to which type of funding to use is determined by a number of factors such as the type of firm (e.g. sole proprietor, partnership, listed company), the size of the firm, the age of the firm, the stage in the business life cycle that that firm has reached, the level of financial market development of the economy that the firm is operating in, amongst others.

Finance can either be short-term in nature, to meet operational working capital needs; or it can be long-term for investment purposes. Short-term funds can be in the form of excess cash in the firm's own bank account, a short-term bank loan or overdraft as well as supplier credit (i.e. buying inventory on favourable credit terms). Long-term capital can be used to invest in assets which will enhance the overall return to the business (Gitman & Zutter, 2012). Such assets are usually income-generating to the business operations and include machinery, equipment, vehicles and even buildings. Long-term capital can either be in the form of debt or equity. While all firms would like to enjoy a capital structure which has a mix of debt and equity, it is sometimes almost

impossible to achieve this for small firms operating in underdeveloped financial markets. The availability and cost of debt and equity is highly dependent on the degree of local financial market development. The financial markets include the money and capital markets. Various institutions and players are found in these markets to bring together savers and borrowers. The predominant money market players are financial institutions such as commercial and investment banks. The best known capital market player is the stock exchange. Most economies in the under-developed economies do not have a bond market. However, where one does exist, it is dominated by the Government. Firms therefore base their financing options by taking into consideration all of the above.

From the supply-side of finance, banks and other lenders conduct thorough creditworthiness assessments of applicants. One of the frameworks used to carry out these assessments is referred to as the 5Cs of credit (Gitman & Zutter, 2012). It entails a consideration of certain characteristics of the applicant as follows:

- Character – considers the applicant's record of meeting past obligations. This gives a potential lender an indication of how committed to fulfilling financial obligations the borrower is.
- Capacity – this is the applicant's ability to repay debt based on their current income. It is important that for whatever level of debt, the due amount can be paid from the monthly income of the applicant without prejudicing other financial obligations.
- Capital – this looks at the capital structure between debt and equity. If an applicant is already financing their business using debt, any further debt would be risky to both the lender and the borrower alike. Lenders prefer situations where the firm owner is willing to commit more of their own resources in the form of owners' equity, and lenders would then step in to provide an additional top-up amount for a specified period of time.
- Collateral – also known as security. It is the availability of fixed assets, and the willingness to cede these to lenders to back the loan. Collateral gives lenders the peace of mind that should the borrower be unable to repay the loan, they can sell the cede assets to recover as much of what is owed to them as is possible. It is for this reason that the required collateral value is often much higher than the loan value itself, sometimes up to almost double in value.
- Conditions – these are the economic and industry trends for specific transactions, for example, the interest rate charged to manufacturing firms may differ from that charged to firms in the services industry. Lenders are guided by what their competitors are doing in the market. If one lender makes borrowing easier for some sectors, then other lenders may be forced to follow suit so as not to lose their clientele.

The above principles go a long way in credit assessments of potential borrowers. They provide a basis on which to begin, although the final decision to lend money is not always solely based on this framework. There are other additional factors which lenders may choose to use to further screen borrowers.

3. Data and Variables Measurement

The World Bank's Enterprise Surveys on manufacturing and service firms in Zimbabwe is the main source of data for this study. The survey was undertaken in 2011, and involved 600 firms. These firms were drawn from fourteen (14) International Standards Classification industries in four provinces, namely, Harare, Bulawayo, Midlands and Manicaland. The industrial sectors covered in this study include food, textiles and garment, manufacturing and retail. Firm-level variables selected include the firm age, the size of the firm as measured by the number of permanent employees, the ownership structure and access to finance.

The empirical literature suggests that firm size matters, especially where foreign ownership is concerned. Descriptive statistics on the sampled firms in this study show that most of the firms that have foreign investment are larger in size than domestically owned ones. The average size of a firm with some foreign ownership is 144 employees compared to only 53 for domestic-owned firms. This may be indicative of the fact that larger firms therefore have better

access to local credit facilities and are able to finance various expansion projects than small firms.

Another variable that we have also decided to include is firm age. Our argument is that banks may be more inclined to lend to older firms because they have a longer track record in business which can be used to assess its ability to repay the loan. The number of years they have been in existence enables them to have a better knowledge and appreciation of the importance of banking relationships and networks than younger firms. Robb & Wolken (2002) concurred that younger firms require additional working capital to expand and grow their businesses but are unlikely to be approved for bank lines of credit due to their limited performance history. Descriptive statistics on Table 1 show that firms with foreign ownership are relatively slightly older than those which are domestic-owned. Although it may be true that firms gain a reputation and established networks with the passage of years, younger firms can also get the required capabilities through using short cut mechanisms such as hiring highly experienced and competent managers.

4. Results and Analysis

The objective of this study is to find out whether being old age-wise, large in size, having a female owner or manager has an effect in accessing firm financing in Zimbabwe.

Table 2. Zimbabwe Finance-related statistics by major Provinces, 2011

	Harare	Bulawayo	Midlands	Manicaland
Percentage of firms with cheque/ savings account	95.9	83.3	99.2	99.5
Percentage of firms with a bank loan/ line of credit	16.1	6.4	9.3	8.0
Proportion of loans requiring collateral	80.6	67.0	100.0	n/a
Percentage of firms not needing a loan	15.8	18.4	38.3	26.9
Percentage of firms whose recent loan applications were rejected	15.7	55.3	6.6	n/a
Percentage of firms using banks to finance investments	17.1	8.5	5.2	7.4
Proportion of investments financed internally (%)	83.7	75.7	97.5	98.2
Proportion of investments financed by banks (%)	12.3	4.2	2.5	1.9
Proportion of investments financed by equity or stock sales (%)	0.7	0.0	0.0	0.0
Percentage of firms using banks to finance working capital	15.0	12.2	7.6	5.1
Proportion of working capital financed by banks (%)	6.9	4.4	2.8	1.7
Proportion of working capital financed by supplier credit (%)	4.9	33.0	7.6	4.5
Percentage of firms identifying finance as a major constraint	66.5	58.9	44.5	72.8
Firm age	32.8	31.5	35.1	39.5
Firm size (average number of permanent employees)	61.2	49.6	39.8	29.6

Source: World Bank Enterprise Surveys (<http://www.enterprisesurveys.org>), (2011)

From the World Bank data gathered by Enterprise Surveys (2011) at provincial level, Manicaland has the highest number of firms which hold bank accounts but the lowest number of firms needing a bank loan. This is in stark contrast to the firms identifying access to finance as a major obstacle as almost 73% of Manicaland-based businesses concurred on this indicator. Because Zimbabwe is a

cash economy, it would appear that on average, over 90% of firms across all provinces hold bank accounts. Loans are not a common source of funding, probably due to the high collateral requirement, as well as the significant rate of loan application rejections. While the rejection rate was as low as 6% in the Midlands; Bulawayo-based firms experienced a significant 55% rejection rate on loan applications. The few firms in

Bulawayo that were able to obtain bank loans received them on condition that they provided 100% collateral for the loans.

With regard to the sources of finance, Harare had the highest proportion of bank-financed long-term investment, while firms in Manicaland and the Midlands depended predominantly on internal finance. No firms were financed through listed equity shares. 15% of the firms in Harare were obtaining working capital funding from banks. Supplier credit was more common among Bulawayo firms as up to 33% of their working capital needs were met through supplier credit. This is because Bulawayo-based firms had limited alternative funding options since they experienced a significantly higher bank loan application rejection rate, and where loans were approved – the conditions made it costly to the borrower as 100% of the had to be secured by collateral.

In considering finance, it is important to bear in mind the 5Cs of credit as raised in the empirical literature. This framework of credit assessment is as applicable to corporate entities as it is to individuals. Results in Table 3 below show that firm age tends to play a role in the accessibility of finance. It was found that younger firms find finance a major obstacle to their business operations. This is also supported by the fact that few, small-sized firms had a line of credit and financed up to 90% of their investments using internally-generated funds. This is further evidenced by the high loan application rejection rate of younger,

smaller firms. According to the World Bank's Enterprise Surveys (2011), a high dependence on internal funds is an indication of inefficient financial intermediation.

We also related accessibility to finance to firm ownership and gender. The purpose was to determine whether access to finance was more favourable to foreign-owned firms and those run by females as compared to domestic-owned firms and those which are male-run. It was found that firms which are foreign-owned and female-run perceive access to finance as less of an obstacle to their business operations than domestic and male-managed firms. This finding is supported by the descriptive statistics in that only 49% of surveyed firms which are foreign-owned viewed finance as a hindrance to their business, compared to 65% domestic ones. To further explain this variable, we examined firm age and found that foreign-owned firms are older and more established than domestic ones. The average age of foreign-owned firms was 45 years, while that for domestic ones was 31 years. This supports the assertion that it is easier to access various financing options including bank loans for older firms due to their longer track records and having established good networks with their bankers. As such, findings confirm that more foreign-owned firms had a line of credit, a lower loan application rejection rate and a lower proportion of internally-financed investments as compared to domestic firms.

Table 3. Zimbabwe Finance and other firm characteristics, 2011

	Firm size			Ownership structure		Female participation	
	Small (5-19 employees)	Medium (20-99 employees)	Large (100+ employees)	Domestic	10% or more foreign	Top manager is male	Top manager is female
% of firms with bank loan/ line of credit	4.2	14.0	36.6	12.2	15.2	13.3	8.7
% of loans requiring collateral	85.7	92.0	69.4	81.8	83.1	78.8	100.0
% of firms not needing a loan	18.6	18.6	25.6	18.3	30.0	18.6	24.2
% of firms whose recent loan application was rejected	35.7	21.9	4.7	24.7	12.1	26.0	11.1
Proportion of investments financed internally (%)	89.5	86.1	75.7	84.8	84.3	86.6	76.3
Proportion of investments financed using banks (%)	1.6	7.9	19.8	8.5	8.8	8.0	11.3
Proportion of investments financed using trade credit (%)	8.0	5.7	3.3	5.8	6.8	4.8	11.3
Firms complaining about finance as a major obstacle	60.9	69.3	57.9	65.3	48.5	64.7	58.1
Firm age (years)	28.6	36.4	40.8	31.8	45.9	34.4	27.9

Source: World Bank Enterprise Surveys (www.enterprisesurveys.org), (2011)

Using the same data from the 2011 survey, we found that fewer female-owned firms considered finance to be a stumbling block in their business operations, compared to their male counterparts. In line with the literature by Robb & Wolken (2002), it was found that female-owned firms were significantly younger than male-owned ones. Although the firms run by females were much younger (average 27 years) than those managed by men (34 years), there were less female-run firms with a bank line of credit and a higher fraction of firms not needing a loan. Since female-run firms did not particularly need bank loans, they therefore enjoyed a significantly lower loan application rejection rate (11%) than their male counterparts who faced a 26% rejection rate. Women-managed firms utilised more of supplier credit and banks to fund their investments while male-run firms used a higher proportion of internal financial resources (86%). These statistics portray a clearer picture of the differences in financing of firms based even on gender. The empirical literature does allude to the fact that women generally prefer not to be indebted and as a result will take up fewer bank loans to fund their businesses. The above statistics are confirmation of this this.

5. Conclusions and Policy Recommendations

The primary objective of this study was to examine the role played by firm characteristics in accessing finance. Results of this study highlight that the main firm-specific characteristics in Zimbabwe that determine access to finance are the size and age of the firm, its ownership structure, and the gender of its top management.

Based on the results, it can therefore be concluded that the age of the firm has a significant effect on the accessing of bank lines of credit by firms in Zimbabwe, irrespective of firm size. Younger firms perceive finance to be a major hurdle in the conducting of business in Zimbabwe, due to their shorter business track records and fewer networks within the banking community. Also, the larger the firm (based on number of permanent employees and not assets), the lower the likelihood that it will utilise internal financial resources for investment purposes as it has greater access to bank loans. Further to this, foreign-owned firms are generally older and more established than domestic ones and can therefore negotiate favourable loan conditions than domestic firms. Women-run firms also perceive finance as a less of a hindrance to their businesses than their male counterparts. This is because fewer female-managed firms require long term bank loans and therefore enjoy a lower loan application rejection rate. The results do further confirm that women prefer to use supplier credit and banks for working capital purposes as opposed to funding this from internal resources.

It is therefore essential for the Government, together with the financial services sector, to find affordable alternatives to commercial and investment bank loans and lines of credit to assist the smaller, younger domestic firms to capitalise their businesses without facing deterrent interest rates and absurd collateral demands. The Government, can through the Central Bank, channel cheaper funds for investing in these small to medium enterprises. This will encourage the small domestic firms to create further employment, thereby contributing to the country's economic growth. Also, capacity-building training programmes can be initiated through Non-Government Organisations wherein managers and owners of these small firms are given information and training on available financing opportunities besides the expensive bank loans. Commercial and investment banks also need to be brought on-board to support and stimulate the growth of locally-owned firms by seeking other methods of assessing and applying the 5Cs of credit, the loan rejection rate for domestic firms, for example, could be reduced by decreasing the loan amount applied for if the reason for the rejection is say insufficient collateral. Improving access to finance for domestic firms will provide a conducive environment that promotes employment creation and therefore economic growth. There is therefore a need for the Government and the private financial sector in Zimbabwe to come up with conducive policies that do not discriminate access to finance on the basis of firm age, firm ownership or gender of owner and management.

References

1. Becker, G. S., 1957. *The Economics of Discrimination*. Chicago: University Press.
2. Berger, A. N. & Udell, G. E., 1995. Relationship lending and lines of credit in small firm finance. *Journal of Business*, 68(3), pp. 351-381.
3. Blanchflower, D. G., Levine, P. B. & Zimmerman, D. J., 2003. Discrimination in the small business credit market. *Review of Economics and Statistics*, 85(4), pp. 930-943.
4. Cavalluzzo, K. S. & Cavalluzzo, L. C., 1998. Market structure and discrimination: The case of small businesses. *Journal of Money, Credit and Banking*, 30(4), pp. 771-792.
5. Cavalluzzo, K. S., Cavalluzzo, L. C. & Wolken, J. D., 2002. Competition, small business financing and discrimination. *Journal of Business*, 75(4), pp. 641-68.
6. Cavalluzzo, K. S. & Wolken, J. D., 2005. Small business loan turndowns, personal wealth and discrimination. *Journal of Business*, 78(6), pp. 2153-2177.
7. Evans, D. S. & Jovanovic, B., 1989. An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy*, 97(4), pp. 808-827.
8. Fazzari, S., Hubbard, R. G. & Petersen, B. C., 1988. Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 78(2), pp. 141-195.

9. Gitman, L. J. & Zutter, C. J., 2012. Principles of Managerial Finance. 13th ed. Essex: Pearson.
10. Hisrich, R. & Brush, C. G., 1986. The Woman Entrepreneur: Starting, Financing and Managing a Successful New Business. Lexington: Lexington Books.
11. Lee, S. & Denslow, D., 2004. A study on the major problems of .S. women-owned small businesses. Journal of Small Business Strategy, 15(2), pp. 77-89.
12. Lee, S. S., Stearns, T. M., Osteryoung, J. S. & Stephenson, H. B., 2009. A comparison of the critical success factors in women-owned business between the United States and Korea. International Entrepreneurship Management Journal, Volume 5, pp. 259-270.
13. Phelps, E. S., 1972. The statistical theory of racism and sexism. American Economic Review, 62(4), pp. 659-661.
14. Raturi, M. & Swamy, A. V., 1999. Explaining ethnic differentials in credit market outcomes in Zimbabwe. Economic Development and Cultural Change, 47(3), pp. 585-604.
15. Robb, A. & Wolken, J., 2002. Firm, Owner and Financing Characteristics: Differences between female and male owned small businesses. Finance and Economics Discussion Series.
16. Storey, D., 2004. Racial and gender discrimination in the micro firms credit market: Evidence from Trinidad and Tobago. Small Business Economics, 23(5), pp. 401-422.
17. World Bank Enterprise Surveys, 2011. Enterprise Surveys: Zimbabwe. [Online] Available at: <http://www.enterprisesurveys.org>

BEHAVIOR OF FINANCIAL MARKETS EFFICIENCY DURING THE FINANCIAL MARKET CRISIS: 2007 – 2009

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Abstract

This paper examines the behavior of financial markets efficiency during the recent financial market crisis. Using the Hurst exponent as a criterion of market efficiency we show that level of market efficiency is different for pre-crisis and crisis periods. We also classify financial markets of different countries by the level of their efficiency and reaffirm that financial markets of developed countries are more efficient than the developing ones. Based on Ukrainian financial market analysis we show the reasons of inefficiency of financial markets and provide some recommendations on their solution and thus improving the efficiency.

Keywords: Persistence, R/S Analysis, Hurst Exponent, Fractal Market Hypothesis, Efficiency of Financial Market

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1. Introduction

In time of the financial markets reforms in response to the global financial crisis consequences the process of rethinking of the theoretical concepts explaining the behavior of these markets is activated.

The Efficient Market Hypothesis (EMH), proposed by Fama (1970), has for a long time occupied the leading position in the explanation of the financial markets behavior. Even today it is a cornerstone of modern finance theory and the majority of methodological approaches to the valuation of financial instruments.

However, history shows that the EMH is not always confirmed (see Jensen (1978) and Malkiel (2003) for details) and the level of market efficiency differs for different countries (see Lo and MacKinlay (1988), Urrutia (1995), Huang, B. (1995), Hassan, Shah and Abdullah (2007), Borges (2008) and many others). In addition, during the financial crisis of 2007-2009, market participants have suffered the greatest losses in the markets that are traditionally considered to be effective (see Ball (2009)). Similar examples have been observed earlier during other crises.

These and many other examples of inconsistency of the EMH have led to the emergence and

development of alternative concepts that explain the behavior of financial markets: behavioral finance (Kahneman and Tversky (1979)), adaptive market hypothesis (first mentioned by Lo (2004)), fractal market hypothesis (FMH - see Mandelbrot, 1972, Peters, 1994) and many others.

An important role in the process of rethinking is the FMH which is seen as an alternative to the traditional EMH. The use of key categories of this hypothesis such as market persistence, noise of index series, fractality, and some specific indicators showing the state of the market such as: the Hurst exponent and fractal dimension is an important way for the formation of a new non-linear methods of modeling the behavior of the financial market during the crisis and for crises prognoses in the future. Methodology of FMH also helps to measure the level of market efficiency.

Despite a considerable amount of research already conducted on measuring the market efficiency the problem is not solved yet (Peters (1994), Daw et al. (2003), Grech and Mazur (2004), Bassler et al. (2006), McCauley et al. (2007) and many others). There is no common methodology, results differ, some aspects are discussed insufficiently etc. For example, behavior of market efficiency during crisis

in general and from the position of differences between countries is not clear even nowadays.

This paper aims to expand the results of financial markets efficiency metrics using data from different countries during different economic phases (normal and crisis). The purpose of this study is to confirm/reject hypothesis of instability of financial markets efficiency in different economic conditions.

We analyze data from different financial markets divided into two groups: developed (U.S., Japan, UK, EU) and developing (China, India, Brazil, Russia and Ukraine). As examples of concrete financial markets we choose national stock markets (as a concrete indicator stock index of the country was used), foreign exchange market (the official exchange rate fluctuations of the national currency). This allows us to get general (common) result for different countries and financial markets based on same methodology. To measure the level of market efficiency we used Hurst exponent calculated with R/S analysis. Hurst exponent close to 0.5 evidences in favor of efficiency of the market, the more Hurst exponent differs from 0.5 the less effective the market is.

The paper is organized as follows: A review of the existing literature on Fractal Market hypothesis. A section that provides the methodology followed in the study. Next follows a section that presents the results and key findings of the study. A separate section is devoted to the problems of market efficiency increasing. Last there a section on the conclusions and summary of the paper.

2. Analysis of key theoretical concepts explaining financial market behavior

The EMH used to occupy the leading position in the explanation of the financial markets behavior; it remained dominant for a long time and has been a cornerstone of modern finance theory and the majority of methodological approaches to the valuation of financial instruments.

EMH, proposed by Fama (1970), provides that a market in which prices reflect all available information is effective. According to this hypothesis, modern financial markets are informational transparent and correspond to the notion of efficient markets.

It should also be noted that the EMH describes the ideal state of the market, is easy to interpret and uses a convenient and apprehensible mathematical approaches. It is usually relevant on a variety of financial markets in the absence of financial crises. Furthermore, numerous models of evaluation of financial instruments and of their portfolios are built considering that this hypothesis is confirmed (for example CAPM - J. Treynor (1962), W. Sharpe (1964), J. Lintner (1965) and J. Mossin (1966); Black-Scholes options pricing model, F. Black, M. Scholes (1973)).

However, experience shows that the EMH is not always confirmed. In favor of its failure indicates the presence of numerous market anomalies: the excess volatility puzzle, time effects, positive serial correlation of price growth in the period up to six months and negative - in periods of three to eight years for the market indexes, a number of calendar anomalies (effect of months, effect of the year, effect of the day, effect of the week, effect of the full moon, the effect of the time of the year) etc (see Damodaran A., 2002 for details).

In addition, during the financial crisis of 2007-2009, market participants have suffered the greatest losses in the markets that are traditionally considered to be effective and with an extraordinary opportunity of a crisis from the perspective of the EMH, the markets of developed countries in particular. The crisis in these markets has become a source of propagation of shocks in the financial markets of other countries and led to a general destabilization of the world financial and economic systems.

Similar examples have been observed earlier. For example, in 1997, the Dow Jones fell in a single day by 7.7 % (the probability of such an event - one to 50 billions). In July 2002, the index dipped three times during seven trading days (the probability of this event - one chance in four trillion). October 19, 1987 (the famous «Black Monday»), the index fell by 29.2 %. This is probably one of the worst trading days in the last century. According to the standard models of financial theory such event could occur less than at one of the 1050 cases (Hudson, Richard L.; Mandelbrot, Benoît B., 2004)).

These and many other examples of inconsistency of the EMH have led to the emergence and development of alternative concepts that explain the behavior of financial markets: behavioral finance, adaptive market hypothesis (AMH), fractal market hypothesis (FMH) and many others.

According to the theory of behavioral finance efficient financial markets with equilibrium prices would not be attractive to their participants. Proceedings of the Nobel laureates in economic studies of human behavior – Kahneman and Tversky (1979) – initiated the concept of alternative finance, based on a statement that the behavior of a market is not always determined correctly and predictably, it depends on the subjective psychological factors.

The AMH was first mentioned by Lo (2004), who proves the existence of connection between the economy and sociobiological theories of evolution. This theory is some sort of compromise between the rational expectations theory and behavioral finance.

Quite often the EMH and AMH are opposed to one of the hypotheses of fractal geometry – FMH, which proposes more complex stochastic processes to be the basis of the understanding of the market essence and behavior.

Mandelbrot (1969, 1971, 1972) was the first who fixed the fact of market persistence – the ability of the

state to exist longer than the process that created it. According to his results financial markets have long-memory.

Further development of the Mandelbrots' ideas was done by Greene and Fielitz (1977). They proved presence of long-term dependence in prices of the stocks in the NY stock exchange. Booth, Kaen, and Koveos (1982) also confirmed that some financial data has long memory. Helms et al. (1984) as an object of analysis chose prices on futures and also proved the fact of market persistence.

Ideas of FMH were actively popularized by Peters (1991, 1994).

Further methodology of market persistence estimation was improved and tested on financial data of different countries, periods and time intervals.

For example, Lo (1991) substantiated the necessity of short-term memory incorporation in estimations of long-term memory. According to his results quite often long-term memory detection can be explained by mistakes in methodology caused by the presence of short-memory. Lo (1991) and other authors, who used his methodology (Fung and Lo (1993), Cheung and Lai (1993), Crato (1994)) proved the fact of the absence of long-term memory on the main financial markets.

Sufficient number of researches devoted to the problem of market persistence and long-term memory, different methodology and absence of unified one, cause further development of this problematic, especially in the context of long-term memory identification and methodology of market persistence estimation.

Important contribution in research of financial markets persistence was done by Los (2003), who analyzed the existing methodology quite carefully. According to Los (2003), one of the key indicators of the level of persistence is so called Hurst exponent. Hurst exponent was created by hydrologist Hurst (1951).

Traditional methodology of Hurst exponent estimation includes the following methods:

- rescaled range analysis (R/S analysis);
- generalized Hurst exponent approach (GHE),
- stabilogram diffusion analysis (SDA);
- detrended fluctuation analysis (DFA);
- multifractal generalization (MF-DFA);
- others.

Modern methodology of markets persistence estimation is quite diverse that is why it is important to choose appropriate one for the financial data analysis.

Some of researches were devoted to the theoretical foundations of certain methodology. In such works as an object of analysis acted not real financial data, but data artificially generated by certain algorithm. As a rule, to generate data set Monte-Carlo method was used.

Results are presented in **Appendix A**.

Results of artificially generated time-series analysis are mixed. In general advantage is given to detrended fluctuation analysis (DFA) (Weron, R. (2002), Grech and Mazur, (2005)).

Financial data time-series and their persistence were analyzed very thorough in case of different types of financial markets: stock markets (Greene and Fielitz (1977), Lo (1991), Cheung and Lai (1995), Jacobsen (1995), Opong et al. (1999), McKenzie, 2001, Costa and Vasconcelos, 2003, Los (2006), Onali and Goddard (2009), commodities markets (Cheung and Lai (1993); Barkoulas, Labys, and Onochie (1997), Crato and Ray (1999), Alvarez-Ramirez et al. (2002), Serletis and Rosenberg (2007)), FOREX (Mulligan (2000), Kim and Yoon (2004), Da Silva et al. (2007)).

More detailed results for different types of financial markets are presented in **Appendix B**.

Analysis shows that the most common object of research is stock market. As an instrument of analysis leading stock market index of the country is used.

Empirical results are mixed. This can be explained by the differences in methodology and different periods and objects of analysis.

Results differ from the statement of the presence and statistical significance of the long-term memory of the market (Greene and Fielitz (1977), Peters (1991) and Peters (1994), Hja Su, LinYang (2003), Lento (2009), Onali and Goddard (2010)) to conclusions about random nature of price fluctuations and absence of the long-term memory of the market Lo (1991), Jacobsen (1995), Berg and Lyhagen (1996), Crato and Ray (1999), Batten et al. (2003), Serletis and Rosenberg (2009)).

An important result of the analyzed researches is changing behavior of the Hurst exponent. I.e. value of H is not a fixed constant, but changes in time (Corazza and Malliaris (2002), Glenn (2007) and others).

Hurst exponent also can be used to rank the efficiency of markets (Cajueiro and Tabak (2004, 2005)) - the higher the Hurst exponent is, the lower the efficiency of the market is.

From the position of current research quite important are works by Grech and Mazur (2004) and Grech and Pamula (2008), who investigate a connection between the Hurst exponent and market crashes.

Thereby R/S analysis is one of the most popular methodologies of the financial markets' persistence estimation.

It is worth noting that the efficiency (the equilibrium state of the market) is also explained as a special case of this hypothesis, and the calculation of indicators that could be evidence in support of the existence of long-term memory (persistence) in the market and predict it is an urgent task.

Despite the wide range of existing researches, heterogeneity of their results, lack of researches devoted to dynamic analysis of market persistence

especially on the different stages of the economic cycle cause the necessity of further researches in this sphere.

So research of the market persistence depending on the state of economic system is an important scientific problem.

3. Research methodology

The method of R/S analysis was originally applied by Hurst (1951) in hydrological research and was improved by Mandelbrot (1972), Peters (1991, 1994) and other researchers of financial markets fractal nature. Compared with other approaches the method of R/S analysis is relatively simple, suitable for programming and visual interpretation.

For each sub-period range R (the difference between the maximum and minimum index within the sub-period), the standard deviation S and their average ratio are calculated. The length of the sub-period is increased and the calculation repeated until the size of the sub-period is equal to that of the original series. As a result, each sub-period is determined by the average value of R/S . The least square method is applied to these values and a regression is run, obtaining an estimate of the angle of the regression line. This estimate is a measure of the Hurst exponent, which is an indicator of market persistence (see Gachkov (2009) for more details and explanations).

To estimate persistence during the financial crisis we used the dynamic Hurst exponent calculation. We calculate Hurst exponent for different data windows. We checked different window sizes and found on the basis of the behavior of the Hurst exponent that size 300 (close to one calendar year) is the most appropriate: for narrower windows its volatility increases dramatically, whilst for wider ones it is almost constant, and therefore the dynamics are not apparent.

Having calculated the first value of the Hurst exponent (for example, Hurst exponent for the date 13.07.2007 is calculated on the data for the period from 21.04.2005 till 13.07.2007), each of the following ones is obtained by shifting forward the "data window". The chosen size of the shift is 10, which provides a sufficient number of estimates to analyze the behavior of the Hurst exponent. Therefore the second value is calculated for 27.07.2006 and characterizes the market over the period 10.05.2005 till 27.07.2006, and so on. As a result we obtain a variety of control points (Hurst exponent estimates) for different sub-samples characterized by various degrees of persistence over the analyzed period.

Hurst exponent can be defined on the interval $[0, 1]$, and is calculated within the following limits:

$0 \leq H < 0,5$ – data is fractal, FMH is confirmed, «heavy tails» of distribution, antipersistent series, negative correlation in instruments value changes, pink noise with frequent changes in direction of price

movement, trading in the market is more risky for an individual participant;

$H = 0,5$ – data is random, EMH is confirmed, movement of asset prices is an example of the random Brownian motion (Wiener process), time series are normally distributed, lack of correlation in changes in value of assets (memory of series), white noise of independent random process, traders cannot «beat» the market with the use of any trading strategy

$0,5 < H \leq 1$ – data is fractal, FMH is confirmed, «heavy tails» of distribution, persistent series, positive correlation within changes in the value of assets, black noise, trend is present in the market

Essential aspects of the practical calculation of the Hurst exponent are:

The choice of market indicators – time series for the analysis;

The choice of the study period and the interval of the graphic of selected indicator ;

Interpretation of results for the period of 1990-2007 and during the last financial crisis of 2007-2010.

The selection of market indicators in the form of an index series was carried out by us for the world's biggest developed financial markets and emerging markets. Among the developed ones the U.S., Japan, UK, EU markets have been traditionally chosen, among developing markets – China, India, Brazil, Russia and Ukraine.

The range of tools for analysis was determined by the market under investigation. For example, during the study of the stock market of each of these countries its benchmark index was selected, in the study of the foreign exchange market– the official exchange rate fluctuations of the national currency of each country to the U.S. dollar.

To illustrate the importance of both hypotheses – the EMH and FMH to explain the behavior of financial markets at different stages of their development it is important to choose the period of the study. Thus, to compare the data one should make the calculations for a certain period of operation of the financial markets in general as well as for the period of the crisis in them.

Therefore we propose to carry out calculations on separate financial markets for the earliest possible period starting from 1990s, given the homogeneity of dates.

What is concerned about the choice of the interval graphs of index fluctuations (5, 30, 60 min.), 1 day, a week, a month – within the selected periods of research we will focus on a range of 1 day, because, in our opinion, the price fluctuations of this dimension meet the objectives of the analysis better – greater frequency generates significant fluctuations of fractals, at a lower frequency analytical value of data is lost.

4. Findings

First we analyze the persistence of financial markets before the global financial crisis. The period of analysis was 1990-2007. The results are presented in Table 1.

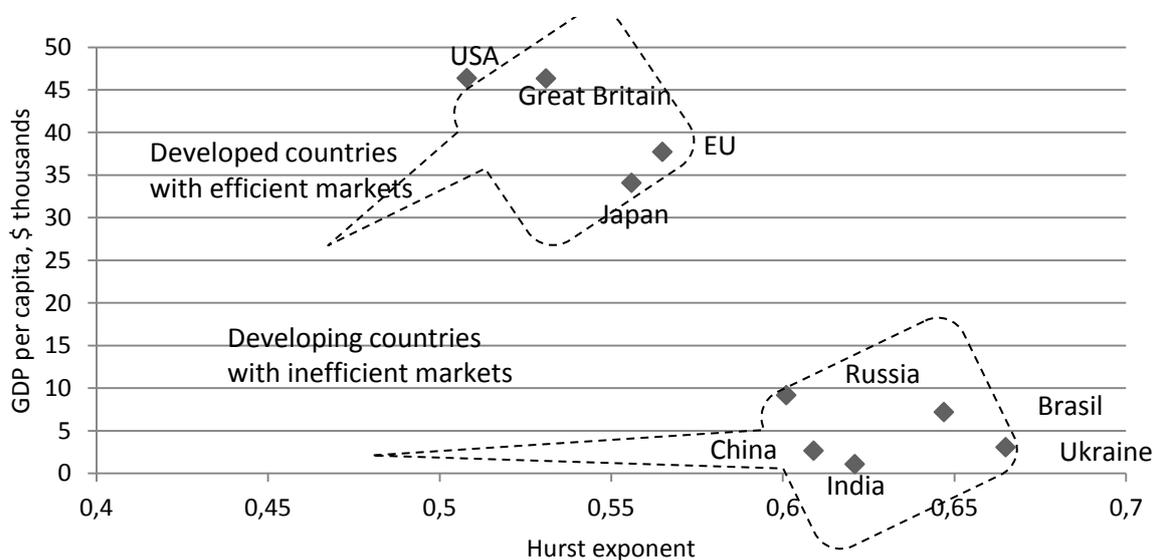
To ease the interpretation of results we provide their graphical representation which is shown in Fig.1. According to the figure two polar groups of markets

and countries are clearly observed: developed countries with high GDP per capita and the Hurst exponent close to 0.5, which indicates the adequacy of the EMH, and developing countries with low GDP per capita and the Hurst exponent tending to 1, indicating the adequacy of FMH.

Table 1. Hurst exponent characterizing the individual financial markets of developed countries and developing countries in 1990-2007

Country		Stock market		Foreign exchange market	
		Index	Hurst exponent	Currency	Hurst exponent
Developed countries	USA	DowJones	0,508	CHF	0,534
	Japan	NIKKEI	0,556	JPY	0,572
	Great Britain	FTSE	0,531	GBP ⁹	0,530
	EU	DAX	0,565	EUR	0,562
Developing countries	China	SSEC ¹⁰	0,609	YUAN ¹¹	0,46
	Brazil	Bovespa ¹²	0,647	BRL ¹³	0,634
	India	BSE SenSex ¹⁴	0,621	INR ¹⁵	0,596
	Russia	RTS ¹⁶	0,601	RUB ¹⁷	0,631
	Ukraine	PFTS	0,665	UAH ¹⁸	0,464
		UX	0,667		

Figure 1. The ratio of the Hurst exponent on the stock market with a GDP per capita of developed and developing countries



⁹Quotes from 1991 r.

¹⁰Quotes from 1997

¹¹Quotes from 1997

¹²Quotes from 1993

¹³Quotes from 1995

¹⁴Quotes from 1997

¹⁵Quotes from 1991

¹⁶Quotes from 1995

¹⁷Quotes from 2007

¹⁸Quotes from 1997

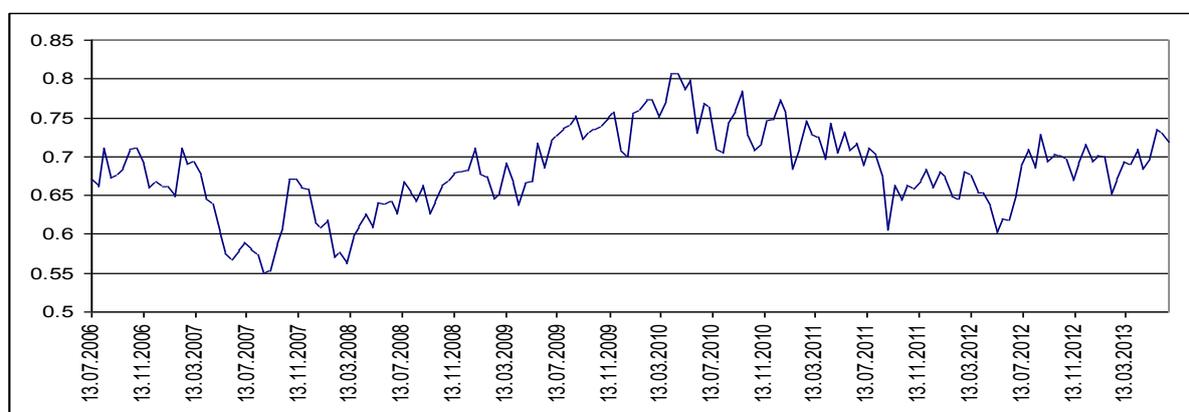
Similar conclusions can be made with analyzing the foreign exchange markets of these countries. It should be noted that the stock and foreign exchange markets of developing countries in support of the FMH are high volatility, attractive for speculates, movement of asset prices in these markets has trending nature, which also indirectly indicates an imbalance of investment horizons of the participants of these markets. We emphasize that the Hurst exponent for these markets demonstrates the presence of long-term memory (persistence) in the analyzed time series.

The next step was to analyze the behavior of the persistence of global markets during the global

financial crisis. To do this we used dynamic Hurst exponent calculation. The period of analysis was 2007-2010. This period covers both the period of «bubble» inflation and the relative market overheating, which created the preconditions for the crisis – 2007, the peak of the crisis at the end of 2008 and in 2009 and the attenuation of the crisis – 2009 - 2010.

To demonstrate the example of dynamic analysis of Hurst exponent we build the graph of the behavior of Hurst exponent for PFTS index (Ukraine stock exchange index) during financial crisis. It is presented in Fig. 2.

Figure 2. Dynamics of Hurst exponent during 2006-2013 (calculated on PFTS data with “data window” = 300, shift = 10)



Using such methodology we calculate the dynamic of Hurst exponent for different financial markets in different countries. As we are interested in estimations of Hurst exponent volatility (measure of

persistent changes) we choose maximum and minimum values of Hurst exponent during analyzed period. Results are presented in Table 2.

Table 2. Hurst exponent characterizing the individual financial markets of developed and developing countries in 2007-2010

Contry		Stock market		Currency market	
		Hurst exponent	Currency	Hurst exponent	Currency
Developed countries	USA	DowJones	Max=0.63 Min=0.49	CHF	Max=0.64 Min=0.51
	Japan	NIKKEI	Max=0.61 Min=0.49	JPY	Max=0.64 Min=0.47
	Great Britain	FTSE	Max=0.59 Min=0.50	GBP	Max=0.66 Min=0.51
	EU	DAX	Max=0.62 Min=0.45	EUR	Max=0.67 Min=0.53
Developing countries	China	SSEC	Max=0.61 Min=0.45	YUAN	Max=0.60 Min=0.44
	Brasil	Bovespa	Max=0.61 Min=0.51	BRL	Max=0.69 Min=0.48
	India	BSE SenSex	Max=0.62 Min=0.54	INR	Max=0.67 Min=0.51
	Russia	RTS	Max=0.65 Min=0.57	RUB	Max=0.64 Min=0.52
	Ukraine	PFTS	Max=0.82 Min=0.61	UAH	Max=0.62 Min=0.40
UX		Max=0.63 Min=0.49			

Graphical interpretation of the results (Figures 3 and 4) shows first of all that during the global financial

crisis the EMH was not performed neither for emerging markets nor for developed.

Figure 4. Hurst exponent on the stock markets of developed and developing countries during the crisis

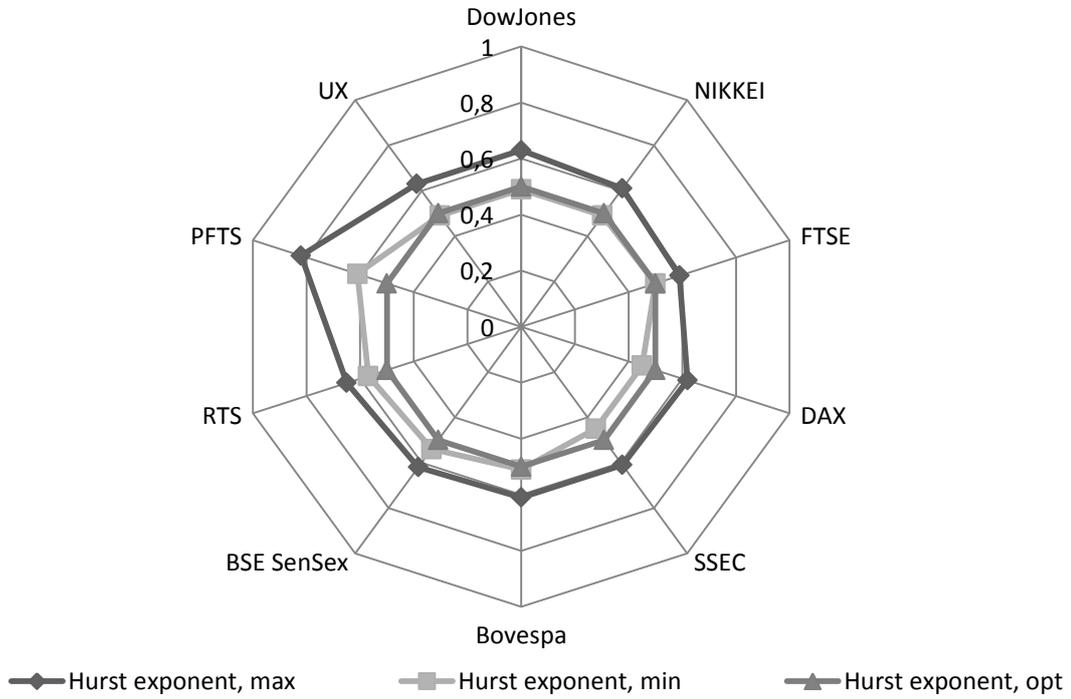
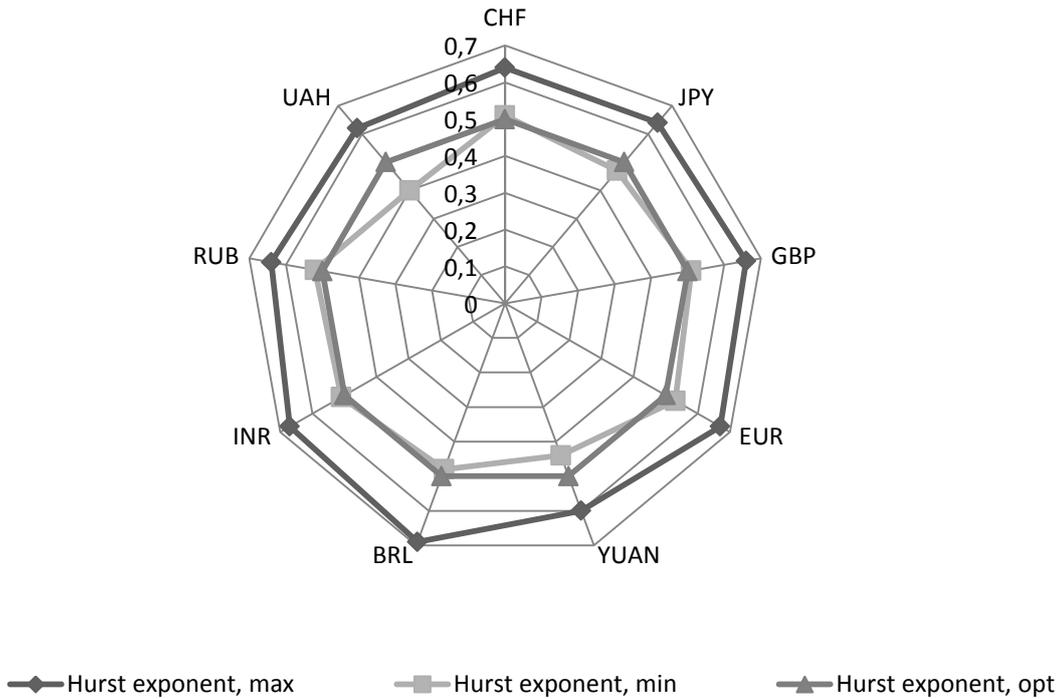


Figure 5. Hurst exponent on the currency markets of developed and developing countries during the crisis



Fluctuations in the maximum and minimum indexes of the Hurst exponent in the stock and foreign exchange markets of the countries under analyses indicated the presence in the time series of these markets the properties of the persistence and antipersistence, besides in most cases markets showed high volatility and riskiness of individual trading strategies. This fact, in its turn, indicates that FMH was fully performed during the crisis.

The results of calculation of the Hurst exponent are fully consistent with the actual data. Thus, the maximum value of the Hurst exponent in the crisis period is observed for the Ukrainian stock market (stock exchange PFTS)– 0.82. In this case, the stock market decline of the country was also a record in comparison to developed markets as well as to developing – in 2008 it was 80 % of the prior period.

At the same time, other developing markets, the Hurst exponent for which is the evidence of the violent crisis phenomena, in 2008 compared to 2007 also show a significant drop: Brazil – 56.2 %, India – 64.6 %, China – 70, 9%, Russia – 71.2 % (see Mirkin, 2008).

Concerning the foreign exchange market, one of the leaders of the fall during the global financial crisis among the currencies of the BRIC became Brazilian real. According to the Bank for International Settlements, decline in the real effective exchange rate of the currency in 2008 compared to 2007 was 20 ppt, which is quite significant against the background of a stable trend since 2002 of strengthening this currency (see Ivanova, 2013). These findings are supported by our calculations – for the time series characterizing the dynamics of the Brazilian real the Hurst exponent constitutes 0.69.

The same conclusions about the implementation of the FMH for developed countries during the crisis can be made based on the indexes of Hurst indicators confirmed by the real dynamics of the analyzed indexes. Thus, the decline in developed markets in 2008 (stock index on November 26, 2008 compared to December 31, 2007, in dollar terms) was: USA – 34.2%, Japan – 36.9%, UK – 50.2%; France – 50.2%, Germany – 50.2%, Italy – 54.5% (see Mirkin, 2008).

Achieved results may act as a basis for the formation of trading strategies for the participants of the market. The value of the Hurst exponent allows making conclusions about the current level of market efficiency. The inefficiency of the market signals about the possibility of profitable trading. For example high persistence allows using trend-oriented trading strategies. Plus low efficiency of the financial markets activates numerous market anomalies. Trading strategies, based on anomalies, also may become the source of speculative profits. So the Hurst exponent by the R/S analysis can certainly be useful to create customized strategies for traders in financial markets.

Concerning the volatility of the Hurst exponent in times of crisis, in this context we consider it

necessary to emphasize that the Hurst exponent can be used as a tool to predict the expectations of investors in general and on the macro level. Hurst exponent can act as a kind of fear index, which reflects the current market conditions, the direction of its future development and the appropriate level of uncertainty (volatility), and investor sentiment. The growth of the Hurst exponent shows continuous market inefficiencies, and conversely, the lower the exponent is – the more efficient the market gets.

As we can see, methodology of FMH can be useful in market efficiency metrics.

2. Improving the market efficiency: Case of Ukraine

As we can see, financial markets can be quite unstable from the position of their efficiency. Nevertheless it is clear that efficient state is evolutionary norm for the financial markets (see results of developed countries for pre-crisis period). That is why it is quite important to find out how to improve the efficiency of the financial markets.

Based on result of analysis we can point out, that Ukrainian financial market is the most ineffective among the analyzed ones. So we will use it as an example to find out the reasons of market inefficiency and to provide some recommendations on improving the market efficiency.

Low efficiency of Ukrainian financial market decreases investment attractiveness of Ukraine. As a result it has insufficient financing, bad credit ratings and low positions in different international rankings. For example Index of Economic Freedom (by Heritage Foundation) published in 2013 put Ukraine on the 161-st place among 185 countries. The reasons were: restrictions for investment activity, undeveloped financial sector and unsatisfied state regulation. Another example is Global Competitiveness index (by World Economic Forum): Ukraine takes 84-th place among 152 countries. The main factors of low competitiveness are poor institution infrastructure, opacity and problems with access to financial resources (see The Global Competitiveness Report 2013–2014 for details).

Among other factors that should be mentioned is distorted structure of Ukrainian stock market: OTC-part is 10 times bigger than the organized one.

The result of these and other facts concerned Ukraine is inefficient financial market with the following list of properties:

Financial market of Ukraine is small, unformed and is under construction;

It is high volatility and risky;

It has unconsolidated infrastructure;

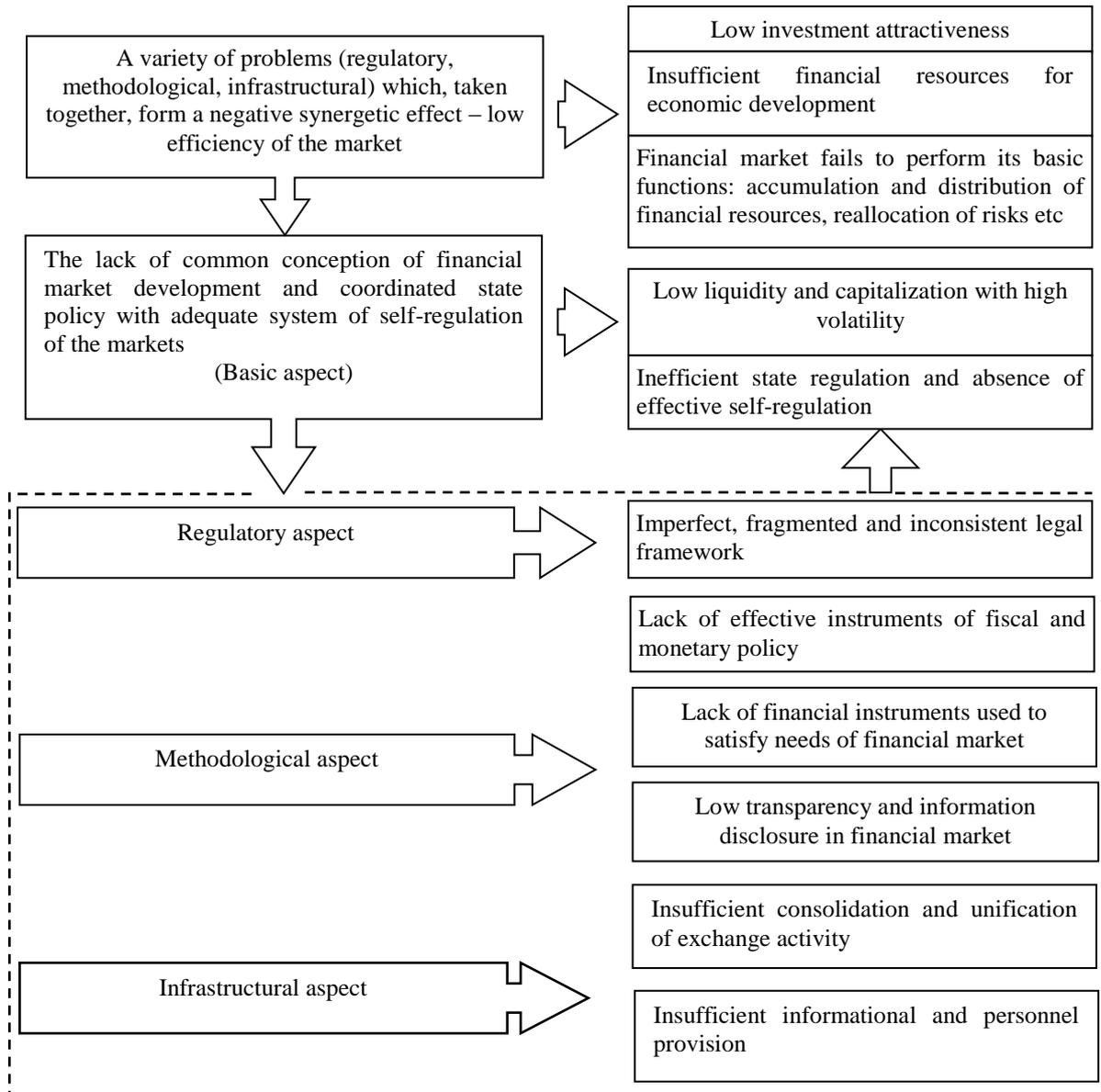
Unformed institutes of depositary and clearing activity, absence of market-makers and other element of infrastructure;

The list of financial instruments is quite limited; some of common financial operations are prohibited by regulators.

find out the reasons of inefficiency and to propose some concrete steps to solve them and thus to improve its efficiency.

We were trying to classify the main problems of Ukrainian financial market (see Fig. 6) in order to

Figure 6. The main problems of Ukrainian financial market



We provide a list of actions directed on solution of the main problems of Ukrainian financial market (see

Table 3). Their solution should improve the efficiency of financial market.

Table 3. Basic, regulatory, infrastructural and methodological aspects of improving the efficiency of Ukrainian financial market [own vision]

Directions of efficiency improving		Actions
Basic	Increased capitalization, liquidity and investment attractiveness of the financial market	Formation of favorable conditions for IPO's of Ukrainian corporations in Ukraine
		Stimulation of joint investment funds development including tax privileges
		Mitigation of issue, registration, and placement conditions of debt and equity securities
		Activation of private investors activity by increasing the financial literacy
		Formation of a favorable investment climate for foreign investors in the financial market of Ukraine
	Proper supervision and regulation of investment processes in the financial market	Harmonization of national legislation with international standards and implementation of rules and regulations in real economic life.
		Strengthening the SEC opportunities to influence the participants of financial market
		Coordination of activity between different state authorities which regulate activity on financial market
	Promotion of self-regulation in the financial market and proper protection of investors	Creation of the system of public and private protection of investors
Regulatory	Fiscal and monetary policy targeted on stimulation financial market development	Removal of legal collisions and fragmentation of the legal framework of the financial market of Ukraine, taking into account best international practices
		Implementation of unified approaches to taxation of income from investment activity
		Facilitation of the taxation of securities in terms of the double taxation of investment income of non-residents, the taxation of dividends, the rule of "30 days", etc.
		Facilitation of foreign exchange activity and active introduction of foreign exchange derivatives
Infrastructural	Improving market infrastructure and promotion of safe functioning (including depository, clearing, information systems and staffing)	Unified requirements for all exchange activity
		Implementation of modern models of trading: the DVP principle, centralized counterparty institute, uniform system of depository services in stock market, etc
		Internet-trading development as an instrument of individual investors resources obtaining, and tool of introduction of modern information technology and electronic document management among market participants
		Improving the quality of professional education among financial market participants
Methodological	Implementation of financial engineering products to expand the number of financial instruments	Provide a sufficient number of financial instruments with various combinations of risk, liquidity and profitability parameters and adapted to the needs of consumers of financial products
		Provide the institutional framework to the derivatives market development
	Improving transparency and disclosure in financial market based on generally accepted international financial reporting standards considering the best practice of corporate reports	Improving the quality of disclosure in the financial market by its participants, ensuring accuracy, completeness and timeliness of information on the basis of generally accepted IFRS
		Creation and maintenance of the actual functioning of the integrated state system of financial disclosure by issuers and other participants of financial market
		Efficient system of control on transparency of activity in financial market
Regulation of credit-rating agencies activity, provision transparency of rating procedure		

3. Conclusions

In response to the deepening impact of the crisis on the financial markets the issues explaining the behavior of the markets in general and the early prediction of a crisis for them in particular have become relevant. In the context of the search for alternative concepts of financial markets, as opposition to the EMH in the post-crisis period, the FMH becomes popular; it has got new categories and uses property of their long-term memory – so-called persistency to model the behavior of market indicators. A key indicator for its evaluation is the Hurst exponent with the R/S analysis as the highest priority calculation method.

Interpretation of the Hurst exponent for the world's developed and developing stock and foreign exchange markets led to the conclusion about the effectiveness of the implementation of the hypothesis for developed markets and FMH for developing markets in the pre-crisis period. Moreover, our calculations confirm the FMH during the crisis period for all the analyzed markets and indicators.

The results of the research substantiate the use of FMH as a basis for modeling the behavior of the financial market as well as the Hurst exponent to predict the direction of its development, has practical application both at the micro level (by the individual market participants), and macro-level (its regulators).

Based on results of research, using Ukraine as a country with extremely low level of market efficiency, we provide some recommendations on market efficiency increase. To do this we analyze the main problems of Ukrainian financial market and propose basic approaches to their solution.

References

- Alvarez-Ramirez, J., Cisneros, M., Ibarra-Valdez, C., Soriano A. (2002), "Multifractal Hurst analysis of crude oil prices", *Physica A*, Vol. 313, pp. 651-670.
- Ball Ray (2009), "The Global Financial Crisis and the Efficient Market Hypothesis: What Have We Learned?". Electronic copy available at: <http://ssrn.com/abstract=1502815>
- Barkoulas, J. T., Labys, W. C., and Onochie, J. I. (1997), "Fractional dynamics in international commodity prices", *Journal of Futures Markets*, Vol. 17 No 2, pp. 737-745.
- Barone Raffaella (2003), "From Efficient Markets to Behavioral Finance", *University of Lecce Economics Working Paper No. 46/24*
- Barunik, J., Kristoufek, L. (2010), "On Hurst exponent estimation under heavy-tailed distributions", *Physica A: Statistical Mechanics and its Applications*, Elsevier, vol. 389(18), pp. 3844-3855.
- Bassler, K., Gunaratne, G., McCauley, J., (2006), "Markov processes, Hurst exponents, and nonlinear diffusion equations: With application to finance", *Physica A*, Vol. 369, No. 2, pp. 343-353
- Batten, J. A., Ellis, C., Fetherston, T. A. (2003), "Return Anomalies on the Nikkei: Are they Statistical Illusions?", Available at SSRN: <http://ssrn.com/abstract=396680>.
- Beechey M., Gruen D. and Vickery J. (2000), "The Efficient Market Hypothesis: a Survey", *Reserve Bank of Australia Research Discussion Paper No2000-01*, January 2000, p. 4.
- Berg, L., Lyhagen, J. (1996), "Short and Long Run Dependence in Swedish Stock Returns", Available at SSRN: <http://ssrn.com/abstract=2270>.
- Black, F., Scholes, M. (1973), "The Pricing of Options and Corporate Liabilities", *Journal of Political Economy*, Vol. 81 (3), pp. 637-654.
- Booth, G. G., Kaen, F. R., Koveos, P. E. (1982), "R/S analysis of foreign exchange rates under two international monetary regimes", *Journal of Monetary Economics*, Elsevier, vol. 10(3), pp 407-415.
- Borges. M. R (2008), "Efficient Market Hypothesis in European Stock Markets", working paper series, WP 20/2008/DE/CIEF, School of Economics and Management, Technical University of Lisbon.
- Cajueiro D. O., Tabak B. M. (2004), "Ranking efficiency for emerging markets", *Chaos, Solitons and Fractals*, Vol. 22 No 2, pp. 349-352.
- Cajueiro D. O., Tabak B. M., (2005), "Ranking efficiency for emerging equity markets II", *Chaos, Solitons and Fractals*, Vol. 23 No 2, pp. 671-675.
- Cheung Y. W., Lai K. S. (1993), "Do gold market returns have long-range dependence?", *The Financial Review*, Vol. 28 No. 2, pp. 181-202.
- Cheung Y. W., Lai K. S. (1995), "A search for long-range dependence in international stock market returns", *Journal of International Money and Finance*, Vol. 14 No. 4, pp. 597-615.
- Corazza, M., Malliaris, A. G. (Tassos) (2002), "Multifractality in Foreign Currency Markets", *Multinational Finance Journal*, Vol. 6, pp. 387-401.
- Costa R. L., Vasconcelos G. L., (2003), "Long-range correlations and nonstationarity in the Brazilian stock market", *Physica A : Statistical Mechanics and its Applications*, Vol. 329 No. 1-2, pp. 231-248.
- Couillard, M. and M. Davison (2005), "A comment on measuring the hurst exponent of financial time series", *Physica A: Statistical Mechanics and its Applications*, Vol. 348, pp. 404-418.
- Crato, N. (1994), "Some international evidence regarding the stochastic memory of stock returns", *Applied Financial Economics*, Vol. 4 No. 1, pp. 33-39.
- Crato, N., Ray, B. (1999), "Memory in Returns and Volatilities of Commodity Futures' Contracts", Available at <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.42.6774>
- Da Silva S., Matsushita R., Gleria I., Figueiredo A. (2007), "Hurst exponents, power laws, and efficiency in the Brazilian foreign exchange market", *Economics Bulletin*, Vol.7 No.1, pp. 1-11.
- Damodaran, A (2012), *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* : 3rd ed., Wiley & Sons.
- Daw, C., Finney, C., Tracy, E., (2003), "A review of symbolic analysis of experimental data", *Review of Scientific Instruments*, Vol. 74, No. 2, pp. 915-930
- Ding, Z., Granger, C., and Engle, R. F. (1993), "A long memory property of stock market returns and a new model", *Journal of Empirical Finance*, Vol.1, pp. 83-106.

26. Fama, E (1970), "Efficient Capital Markets: A Review of Theory and Empirical Evidence", *Journal of Finance*, No. 25, pp. 383-417.
27. Fung, H. G. and Lo, W. C. (1993), "Memory in interest rate futures", *The Journal of Futures Markets*, Vol. 13, pp. 865-872.
28. Gabjin O., Seunghwan, K., Cheoljun, E. (2007), "Market efficiency in foreign exchange markets", *Physica A: Statistical Mechanics and its Applications*, Vol. 382 No. 1, pp. 209-212
29. Gachkov A. (2009), "Randomized R/S-analysis of financial data". Available at: <http://www.math.spbu.ru/user/gran/soi5/Gatchkov5.pdf>.
30. Glenn, L. A. (2007), "On Randomness and the NASDAQ Composite", Working Paper, Available at SSRN: <http://ssrn.com/abstract=1124991>
31. Grech D., Mazur Z. (2004), "Can one make any crash prediction in finance using the local Hurst exponent idea?", *Physica A : Statistical Mechanics and its Applications*, Vol. 336, pp.133-145.
32. Grech D., Pamula, G. (2008), "The local Hurst exponent of the financial time series in the vicinity of crashes on the Polish stock exchange market", *Physica A :Statistical Mechanics and its Applications*, Vol. 387, pp. 4299-4308.
33. Grech, D. and Mazur, Z. (2005), "Statistical properties of old and new techniques in detrended analysis of time series", *ActaPhysicaPolonica*, Vol. 36 No. 8, pp. 2403-2406.
34. Greene, M.T., Fielitz, B.D. (1977), "Long-term dependence in common stock returns", *Journal of Financial Economics*, Vol. 4, pp. 339-349.
35. Hassan, Shah and Abdullah, (2007), "Testing of Random Walks and Efficiency in an Emerging Market", *The Business Review Cambridge*, Volume 9, Nov 1
36. Helms, B. P., Kaen, F. R. and Rosenman, R. E. (1984), "Memory in commodity futures contracts", *Journal of Futures Markets*, Vol. 4, pp. 559-567.
37. Hja, S., Lin, Y. (2003), "R/ S Analysis of China Securities Markets", *Tsinghua Soence and Technology*, Vol. 8 No.5, pp. 537 – 540.
38. Huang, B., (1995), "Do Asian Stock Market Prices Follow Random Walks? Evidence From The Variance Ratio Test", *Applied Financial Economics*, 5, p. 251 – 256
39. Hudson, R. L.; Mandelbrot, B. B. (2004), *The (Mis)Behavior of Markets: A Fractal View of Risk, Ruin, and Reward*, Basic Books, New York.
40. Hurst, H.E. (1951), "Long-term storage of reservoirs: an experimental study", *Transactions of the American Society of Civil Engineers*, Vol. 116, pp. 770-799.
41. Ivanova N., Sinyakov A. (2013), "Strengthening of Brazil Real: lessons for Russia and other developing countries Center of macroeconomic research", Available at: http://www.sberbank.ru/common/img/uploaded/analytic_s/2013/cmi_30052013.pdf
42. Jacobsen, B. (1995), "Are Stock Returns Long Term Dependent? Some Empirical Evidence", *Journal of International Financial Markets, Institutions and Money*, Vol. 5, No. 2/3, Available at SSRN: <http://ssrn.com/abstract=7459>
43. Jensen Michael C. (1978), "Some Anomalous Evidence Regarding Market Efficiency", *Journal of Financial Economics*, Vol. 6, Nos. 2/3 95 - 101.
44. Kahneman, D. Tversky, A. (1979), "Prospect theory : An analysis of decisions under risk", *Econometrica*, No. 47, pp. 313-327.
45. Kandelhardt, J., S. Zschiegner, E. Koscielny-Bunde, A. Bunde, S. Havlin, and E. Stanley (2002), "Multifractal detrended fluctuation analysis of nonstationary time series", *Physica A: Statistical Mechanics and its Applications*, Vol. 316, pp.1-4.
46. Kim, K. Yoon, Seong-Min (2004), "Multifractal features of financial markets", *Physica A: Statistical Mechanics and its Applications*, Vol. 344 No.1, pp. 272-278.
47. Lento, C. (2009), "A Synthesis of Technical Analysis and Fractal Geometry - Evidence from the Dow Jones Industrial Average Components", Available at SSRN: <http://ssrn.com/abstract=1263615>.
48. Lintner, J. (1965), "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets", *Review of Economics and Statistics*, Vol. 47 No 1, pp. 13-37/
49. Lo, A. (2004), "The Adaptive Markets Hypothesis: Market Efficiency from an Evolutionary Perspective", *Journal of Portfolio Management*, Vol. 30, pp. 15-29
50. Lo, A. and C. Mackinlay, (1988), "Stock Market Do Not follow Random Walks: Evidence From a Simple Specification Test", *Review of Financial Studies*, 1, p. 41 – 66
51. Lo, A.W. (1991), "Long-term memory in stock market prices", *Econometrica*, Vol. 59, pp.1279-1313.
52. Los, C. A. (2000), Visualization of Chaos for Finance Majors, Available at SSRN: <http://ssrn.com/abstract=253357>.
53. Los, C. A. (2003), *Financial Market Risk: Measurement & Analysis*, Routledge International Studies in Money and Banking, Vol. 24, Taylor & Francis Books Ltd, London, UK.
54. Los, C. A. and Yalamova, R. M. (2006), "Multi-Fractal Spectral Analysis of the 1987 Stock Market Crash", *International Research Journal of Finance and Economics*, Vol. 1, No. 4, pp. 106-133.
55. Malkiel, Burton G. (2003), "The Efficient Market Hypothesis and Its Critics", *Journal of Economic Perspectives* 17, no. 1: 59–82
56. Mandelbrot, B (1982), *The Fractal Geometry of Nature*, W.H. Freeman, New York.
57. Mandelbrot, B. (1971), "When can price be arbitrated efficiently? A limit to the validity of the random walk and martingale models", *The Review of Economics and Statistics*, Vol. 53 No 3, pp. 225-236.
58. Mandelbrot, B. (1972), "Statistical Methodology For Nonperiodic Cycles: From The Covariance To Rs Analysis", *Annals of Economic and Social Measurement*, Vol. 1, No. 3, pp. 259-290.
59. Mandelbrot, B. (1969), "Robustness of the rescaled range R/S in the measurement of non-cycling long-run statistical dependence", *Water Resources Research*, Vol. 5. No 5, pp. 967-988.
60. Markov A. (2010), Mathematical approach to fractal properties of stock markets analysis. PhD paper, Moskow. – 165 p.
61. McKenzie, M. D. (2001), "Non-periodic Australian stock market cycles: evidence from rescaled range analysis", *The Economic Record*, Vol. 77, pp. 393-406.
62. Mirkin Y. (2008), "Russian financial sector: crisis counteraction and post-crisis development", Available at: http://www.mirkin.ru/_docs/fin_sector_russ.pdf

63. Mossin, J. (1966), "Equilibrium in a Capital Asset Market", *Econometrica*, Vol. 34, No. 4, pp. 768–783.
64. Mulligan R. F.(2000), "A fractal analysis of foreign exchange markets", *International Advances in Economic Research*, Vol. 6 (1), pp. 33-49.
65. Onali, E. and Goddard, J. (2010), "Are European Equity Markets Efficient? New Evidence from Fractal Analysis", Available at SSRN: <http://ssrn.com/abstract=1805044>.
66. Opong K. K., Mulholland G., Fox A.F., Farahmand K. (1999), "The behaviour of some UK equity indices: an application of Hurst and BDS tests". *Journal of Empirical Finance*, Vol. 6, pp.267-282.
67. Peters, E. E. (1991), *Chaos and Order in the Capital Markets: A New View of Cycles, Prices, and Market Volatility*, John Wiley and Sons, New York.
68. Peters, E. E. (1994), *Fractal Market Analysis: Applying Chaos Theory to Investment and Economics*, John Wiley and Sons, New York.
69. Podpiera, R. (2000), Efficiency of Financial Markets in Transition: The Case of Macroeconomic Releases , Available at <http://iweb.cerge-ei.cz/pdf/wp/Wp156.pdf>
70. Serletis A., Rosenberg A. A. (2007), "The Hurst exponent in energy futures prices", *Physica A: Statistical Mechanics and its Applications*, Vol. 380, pp. 325-332.
71. Serletis A., Rosenberg A. A., (2009), "Mean reversion in the US stock market. Chaos, solitons and fractals", Vol. 40, pp. 2007-2015.
72. Sharpe, W. F. (1964), "Capital asset prices: A theory of market equilibrium under conditions of risk", *Journal of Finance*, Vol.19 (3), pp. 425–442.
73. Shiller, Robert J. "From Efficient Markets to Behavioral Finance", *Journal of Economic Perspectives* 17, no. 1 (2003): 83–104.
74. Taqqu, M., W. Teverosky, and W. Willinger (1995), "Estimators for long-range dependence: an empirical study", *Fractals*, Vol 3, No. 4, pp. 785-788.
75. Teverovsky, V. Taqqu, M. S., Willinger W. (1999), "A critical look at Lo's modified R=S statistic", *Journal of Statistical Planning and Inference*, Vol. 80, pp. 211-227
76. The Global Competitiveness Report 2013–2014 - World Economic Forum // www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf
77. Treynor, J. L. (1962), "Toward a Theory of Market Value of Risky Assets". In Korajczyk R. A. (Ed.), *Asset Pricing and Portfolio Performance: Models, Strategy and Performance Metrics*, London, Risk Books, pp. 15–22.
78. Tversky, A. (1982), "Judgment under uncertainty: Heuristics and biases", Cambridge University Press, New York.
79. Ulici, M-L., Nistor I. A. (2011), "Financial Liberalization and Stock Market Efficiency", *Finance - Challenges of the Futur*, Vol. 13, pp 154-160
80. Urrutia, J. (1995), "Tests of Random Walk and Market Efficiency for Latin American Emerging Markets", *Journal of Financial Research*, 1995, pp. 299-309
81. Weron, R.(2002), "Estimating long-range dependence: finite sample properties and confidence intervals", *Physica A: Statistical Mechanics and its Applications*, Vol. 312(1), pp. 285-299.

Appendix A

Methodology of Hurst exponent calculation (artificially generated data)

Author	Type of analysis	Results
Taqqu et al., (1995)	R/S, DFA	R/S overestimates the true Hurst exponent while DFA underestimates it.
Weron, R. (2002)	R/S, DFA	DFA outperforms R/S
Kantelhardt et al., (2002)	MF -DFA	Estimates based on (Anis and Lloyd, 1976) are better than the ones of (Peters,1994).
Couillard and Davison, (2005)	R/S analysis	No long-term memory in some financial returns, suggesting that Brownian motion cannot be rejected as a model for price dynamics
Grech and Mazur, (2005)	DFA, DMA	DFA outperforms DMA
V.Teverovsky, M. Taqqu, W.Willinger(1999)	R/S	Uncover a number of serious drawbacks to using Lo's method in practice.
Lo (1991)	R/S (modified)	Provide the test for long-range dependence. Lo reported that the rescaled range analysis could confuse long-term memory with the effects of short term memory. Results consistent with the EMH

- rescaled range analysis (R/S),
- generalized Hurst exponent approach (GHE),
- detrended moving average (DMA)
- detrended fluctuation analysis (DFA)
- multifractal generalization (MF-DFA)

Appendix B
Methodology of Hurst exponent calculation (financial data)

Author	Type of analysis	Object of analysis (time period)	Results
Barunik, Jozef&Kristoufek, Ladislav, 2010	R/S, GHE, DMA, MF-DFA	S&P 500 index (1983-2009)	Rescaled range analysis (R–S) together with generalized Hurst exponent approach (GHE) are robust to heavy tails in the underlying process. MF- DFA methods as well as DMA are not appropriate for data with heavier tails and small sample size. GHE methods proved to be very useful as they show the best properties.
Hja Su, LinYang (2003)	R/S	Shanghai and Shenzhen Stock Exchanges (1991-2001)	The changes of indices and stocks in the last period have positive impact in the next period in the short run, but this impact disappears for long time. The Hurst exponents of the weekly indices of Shanghai were around 0.60 and the Hurst exponents of the weekly indices of Shenzhen were in the range of 0.65 to 0.75.
Greene and Fielitz (1977)	R/S	Securities listed on the New York Stock Exchange	Claimed to have found significant evidence for the presence of long-range dependence.
Peters, 1991 and Peters, 1994	R/S	Monthly returns on the S&P 500 from January 1950 to July 1988	Estimates the Hurst exponent to be 0.778 for monthly returns on the S&P 500 from January 1950 to July 1988 Peters (1994) introduces the Fractal Markets Hypothesis (FMH).
Corazza and Malliaris (2002).	R/S	FOREX (1972-1994)	Foreign currency markets exhibit a H that is statistically different from 0.5. H is not fixed but it changes dynamically over time.
Glenn (2007)	R/S	NASDAQ	H of 0.59 was calculated for 1-day returns on the NASDAQ. H increased monotonically to a value of 0.87 for 250-day (annual) returns.
Lento, Camillo (2009)	R/S	DJIA (1998-2008)	Tests provide evidence that the H is able to identify long-term dependencies and anti-dependence.
Onali, Enrico and Goddard, John (2010)	R/S	Mibtel (Italy) and the PX-Glob (Czech Republic).	Find evidence of long-range dependence in the log return series.
Serletis and Rosenberg (2009)	R/S	US stock market indices	Fail to find evidence of long-range dependence for four US stock market indices.
Batten, Elli, and Fetherston (2003)	R/S	Nikkei stock index daily data (1980 -2000)	The null hypothesis of no long-term dependence is accepted for the whole sample and every sub-period using the modified rescaled range test, but not using the classical rescaled adjusted range test.
Berg, Lennart and Lyhagen, Johan (1996)	R/S	Swedish stock returns monthly data (1919-1995), weekly and daily data (1980-1995)	Hardly found any evidence of long run dependence. Using three different tests that are robust to short term dependence found that the modified R/S (rescaled range) test and ARFIMA-GARCH tests provide no support for long run memory in Swedish stock returns
Lo (1991)	R/S (modified)	US stock market (1872-1986)	Cannot find the long-term dependence
Ding et al. (1993)	R/S	S&P 500	Found considerable evidence of long memory in the squared returns
Jacobsen, Ben (1995)	R/S	Indices of five European countries, USA and Japan	Rejects the conclusion of long term dependence in these series.
Barkoulas, Labys, and Onochie (1997)	R/S	Futures	Claim to have found persistent long memory in a significant group of future contracts
NunoCrato, Bonnie Ray (1999)	R/S	Commodities (1977-1997)	Find no evidence for persistent behavior in futures' returns. Find overwhelming evidence of long memory behavior for the volatility of futures' returns.

DID IFRS REPORTING BY UK FIRMS REDUCE EARNINGS MANAGEMENT?

*Medhat Naguib El Guindy**

Abstract

This paper investigates the effect of reporting under International Financial Reporting Standards (hereafter IFRS) versus reporting under UK GAAP on earnings management in the UK. Prior studies find mixed evidence regarding the effect of voluntary and mandatory adoption of IFRS on earnings quality. I test whether the effect of reporting under IFRS on earnings management is sufficient to overcome earnings management incentives. Furthermore, I test whether the effect of IFRS reporting is conditional on audit quality surrogated by audit firm size. I build the analysis on measures of discretionary accruals and earnings benchmark tests. I find evidence that reporting under IFRS generally reduces levels of earnings management and furthermore, the mitigating effect of IFRS is stronger for income decreasing than for income increasing earnings management. In addition, I find that audit quality plays a key role in IFRS reporting, with only firms audited by big four auditors having a significant IFRS reporting effect.

Keywords: Earnings Management, Discretionary Accruals, Accounting Standards, IFRS, Audit Quality

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1. Introduction

The purpose of this paper is to empirically examine the effect of financial reporting under International Financial Reporting Standards¹⁹ (hereafter IFRS) compared with UK GAAP on earnings management in the UK. Further evaluation of the effect of IFRS on earnings management is timely given the recent adoption of IFRS in many countries including mandatory IFRS adoption in Europe since 2005 according to the regulation issued by the European Parliament (1606/2002/EC). Moreover, prior literature on IFRS provides mixed evidence regarding its effect on earnings management (e.g. Van tendeloo and Vanstraelen, 2005, Barth et al., 2008, Jeanjean and Stolowy, 2008). IFRS was issued by the International Accounting Standards Board (IASB) which has the objective of developing a common set of internationally acceptable high quality accounting standards (Barth et al., 2008). In the UK, different rules were adopted for companies listed on the London Stock Exchange in its main market and the Alternative Investment Market (AIM). All group companies listed on the London Stock Exchange main market were required to prepare their consolidated financial statements under IFRS for the financial

periods starting January 2005; whereas, AIM group companies did not have to comply until January 2007²⁰. Other individual listed companies and private companies have the choice between reporting under UK GAAP or IFRS.

This paper contributes to the relevant literature in several ways. Firstly, I investigate the effect of IFRS reporting on earnings management using data from the UK. This allows this study to test the effect of the reporting of IFRS on earnings management in a setting where it was not allowed to use IFRS prior to 2005. Moreover, most recent studies tend to focus on IFRS adoption as an event study and are usually limited to the adoption year or one year after. However, I compare reporting under IFRS versus reporting under UK GAAP to test whether earnings management levels are lower for companies using IFRS versus those using UK GAAP. This implies testing whether a perceived higher quality set of accounting standards (IFRS) can play a role in mitigating earnings management practices. Most prior studies investigated the effects of IFRS reporting in a cross-country setting. However, Ball et al. (2003) argue that, “focus on standards is substantially and misleadingly incomplete because financial reporting under a given set of standards is sensitive to the

¹⁹ The term IFRS is used to include International Accounting Standards (IAS) and International Financial Reporting Standards.

²⁰ See the Companies Act 1985 (International Accounting Standards and other Accounting Amendments) Regulations 2004

incentives of the managers and auditors responsible for financial statements preparation” (Ball et al., 2003, P.236). Furthermore, Schipper (2005) argues against pooling firm-year observations from different countries unless incentives are stable and suggests holding incentives constant and allowing standards to vary in order to achieve unbiased results through a homogeneous sample.

Secondly, to the best of my knowledge, none of the previous studies test the differential effect of IFRS reporting on income increasing versus income decreasing earnings management. The prior literature uses the absolute value of discretionary accruals as a measure of earnings management (Van tendeloo and Vanstraelen, 2005) or uses other measures, such as the ratio of small profits to small losses (Jeanjean and Stolowy, 2008). However, I argue that IFRS reporting might have a different effect on earnings management levels depending on the direction of managing earnings. Due to the larger incentives to manage earnings upwards to increase net income (e.g. Peasnell et al., 2005), I expect to find the mitigating effect of IFRS reporting to be stronger for income decreasing earnings management than for income increasing earnings management. Therefore, the evidence reported in this paper fills a gap in the literature with regard to the mitigating effect of IFRS on income increasing versus income decreasing earnings management. Hence, it adds to our knowledge of whether high quality accounting standards are sufficient to improve earnings quality and overcome earnings management incentives.

Thirdly, I argue that the benefits of high quality accounting standards are more likely to be dependent on audit quality due to the greater knowledge and experience of high quality audit firms. None of the previous studies have investigated whether the effect of IFRS reporting on earnings management is conditional on audit quality. Therefore, I test whether IFRS reporting has the same mitigating effects on earnings management for firms audited by big four versus those audited by non-big four firms.

Using a sample of UK companies from 2003-2007, the empirical results reported in this paper show a significant negative association between IFRS reporting and all of the measures of earnings management used in this study which suggests that the transition from UK GAAP to IFRS has had a positive impact on earnings quality. However, the mitigating effect is greater for income decreasing earnings management as compared to income increasing earnings management. Therefore, the results suggest that higher quality accounting standards are not sufficient to overcome the relatively higher incentives to increase accounting income. Moreover, the results suggest that the reported effect of IFRS on earnings management is conditional on firms being audited by the big four auditors. The reported results are robust to alternative research

designs and alternative measures of earnings management.

The remainder of the paper is organized as follows: section 2 discusses the research background, section 3 develops hypotheses, section 4 describes the research design, section 5 reports the empirical results, section 6 describes robustness checks, and section 7 offers conclusions.

2. Research Background

Despite the fact that IFRS and UK GAAP are closely related, a number of differences exist between the two sets of standards. Horton and Serafeim (2009) discussed six differences (leases, employee benefits, share-based payments, taxation, goodwill, and financial instruments). Accounting standards tend to be more rules based if they determine every detail and treatment to be followed. However, they tend to be more principles based if they determine the major objective of the standard and leave space for professional judgment to be exercised (Schipper, 2005, Schipper and Vincent, 2003). For instance, goodwill is amortised under UK GAAP whereas it should be tested for potential impairment under IFRS. Therefore, IFRS tends to be more principles-based than UK GAAP as it guides practice through providing the substance of the standard and, therefore, allows for professional judgment. Rules-based standards create more possibilities for transaction structuring but it limits managers’ opportunistic discretion.

There is a debate in accounting research about which type of accounting standards will lead to better earnings quality (see for e.g. Nelson, 2003, Nobes, 2009). It is worth noting that the Sarbanes-Oxley Act (2002)²¹ requires the SEC to study the feasibility of shifting to a more principles-based financial reporting system, and the FASB has proposed changes designed to create a more principles-based approach to standard setting (FASB 2002) in the US. The differences between UK GAAP and IFRS have attracted many research papers; for example, Horton and Serafeim (2009) investigated the value relevance of IFRS reconciliation disclosure and find that positive adjustments are value-relevant both before and after disclosure. Moreover, Armstrong et al. (2010) found an incrementally positive reaction of the European stock market to the events associated with the adoption of IFRS in Europe and further found that investors are, generally, expecting net convergence benefits from IFRS adoption.

A limited number of prior studies have examined the effect of IFRS reporting on earnings management levels or earnings quality in general. This is due to the relatively recent adoption of IFRS in most countries. Two types of adoption have been tested in prior studies; namely, voluntary and mandatory adoption. A

²¹ Sarbanes-Oxley Act, 2002 Sarbanes-Oxley Act, Public Law No: 107-204, GPO, Washington, DC (2002).

few countries allowed voluntary adoption of IFRS prior to 2005 (e.g. Germany) while many other countries (e.g. the UK) did not allow IFRS adoption until it had become mandatory in 2005. Moreover, voluntary adoption has been investigated more extensively due to the relatively recent mandatory adoption of IFRS starting in 2005 in most countries around the world. Furthermore, investigating IFRS adoption and its effect on earnings quality is timely and important as it may provide regulators with adequate evidence of the perceived quality promised by IFRS.

In terms of the voluntary adoption of IFRS, Van tendeloo and Vanstraelen (2005) and Goncharov and Zimmermann (2006), using data for German companies, find evidence that IFRS does not significantly constrain earnings management. They conclude that companies adopting IFRS do not manage earnings less than those companies adopting German local GAAP. However, Barth et al. (2008) analysed data from 21 countries and find evidence that companies adopting IFRS voluntarily prior to 2005 generally have lower levels of earnings management than a matched sample of firms applying non US domestic accounting standards.

Analysing the mandatory adoption of IFRS, Jeanjean and Stolowy (2008) analyse the distribution of earnings in three countries (Australia, France and

the UK) and find no evidence that the pervasiveness of earnings management declined after the mandatory introduction of IFRS; Indeed, they find that earnings management increased in France. However, Christensen et al.(2008) find evidence of improved earnings quality for German firms applying IFRS voluntarily but did not find any improvement for mandatory adoption firms. Therefore, they suggest that management incentives and national institutional factors play important roles in framing financial reporting characteristics. Furthermore, Aussenegg et al.(2008) test the effect of the transition from local GAAP to IFRS on earnings management levels using data from 17 European countries between 1995 and 2005. Their results provide evidence that companies applying IFRS experience less earnings management than firms applying domestic standards. However, for the UK and northern European countries, the evidence suggests no effect of the transition from local GAAP to IFRS. They explain this by the fact that those countries already had lower levels of earnings management before IFRS adoption compared to the rest of Europe. In summary, the very limited existing evidence suggests that mandatory IFRS reporting has had no significant effect on earnings management in the UK (Jeanjean and Stolowy, 2008). Table 1 offers a brief summary of the prior literature.

Table 1. Summary of the Related Literature

Study	Type of Adoption studied	Data	Measures used	Main results
Van tendeloo and Vanstraelen (2005). European Accounting Review	Voluntary adoption	636 German firm year observations for the period from 1999-2001	Absolute value of discretionary accruals estimated using the Jones model (1991).	No evidence of lower earnings management for IFRS firms
Barth et al. (2008) Journal of Accounting Research	Voluntary adoption	1,896 firm year observations for 327 firms applied IAS from 1990 through 2003 from 21 countries	Variability in net income as a proxy for income smoothing timely loss recognition.	Evidence of higher earnings quality for IFRS firms
Jeanjean and Stolowy (2008) Journal of Accounting and Public Policy	Mandatory adoption	5051 firm year observations from Australia, France, and the UK from 2003-2007	The ratio of small reported profits to small reported losses.	No evidence of lower earnings management for IFRS firms. Earnings management increase in France.
Aussenegg et al.(2008) Working paper	Voluntary and Mandatory adoption	18,896 firm year observations from 17 European countries from 1995-2005	Earnings management index based on 15 measures for earnings management.	Some evidence of lower earnings management for IFRS firms in Germany and France but no change in earnings management in English and Scandinavian countries.
Christensen et al.(2008) Working paper	Voluntary and Mandatory adoption	310 German firm year observations for the period from 1998-2006	Variability in net income as a proxy for income smoothing timely loss recognition	Improved earnings quality for firms that voluntarily adopted IFRS prior to 2005 but not for firms that mandatorily adopted IFRS after 2005.

A number of potential explanations exist for the prior mixed results. Firstly, the voluntary adoption (Barth et al., 2008) of IFRS may be associated with specific incentives for the companies choosing to adopt IFRS. These specific incentives might lead to different conclusions compared with mandatory

adoption. Secondly, pooling data from different countries may lead to mixed results if the effect of IFRS adoption was different in some of the countries. Thirdly, different countries may experience different levels of enforcement of accounting standards and corporate governance mechanisms that may alter the

effect of IFRS adoption. Finally, the inconsistent use of earnings quality proxies in the prior literature could be one more explanation for the mixed results. For instance, Jeanjean and Stolowy (2008) used the distribution of earnings as their measure of earnings management whereas Van Tendeloo and Vanstraelen (2005) use discretionary accruals which represents a more frequently used measure of earnings management.

3. Hypotheses Development

3.1 IFRS and Earnings Management

Building on prior research, there are five arguments which suggest that reporting under IFRS will have a positive impact on earnings quality through constraining earnings management. Firstly, “The IASC Foundation, through the IASB, is committed to developing, in the public interest, a single set of high quality, global accounting standards that require transparent and comparable information in general purpose financial statements”²². Therefore, IFRS promised transparency which causes managers to act more in the interests of shareholders (Ball, 2006). Moreover, Jeanjean and Stolowy (2008) argue that IFRS reduces the amount of reporting discretion relative to many local GAAPs and, therefore, pushes firms to improve their financial reporting.

Secondly, IFRS is seen to be a more principles based set of accounting standards than UK GAAP and most other local GAAPs (Schipper, 2005). There is a debate in accounting research about which type of accounting standards is better for financial reporting (see for e.g. Schipper and Vincent, 2003, Dennis, 2008, Nelson, 2003). Rules-based standards have the potential benefit of mitigating judgement based earnings management but could increase transaction structuring earnings management (Nelson, 2003, Nobes, 2005). On the other hand, principles-based standards allow for practicing professional judgement through applying the main intent of the standard (substance over form) which prevent transaction structuring and provide auditors with the required flexibility to adjust accounting numbers to match the main intent of the standard. Overall, no set of accounting standards can be viewed as either rules-based or principles-based but standards are either more rules-based or more principles-based. If applying more principles-based standards may lead to less earnings management, I can predict lower earnings management levels for firms reporting under IFRS compared to those reporting under UK GAAP.

Thirdly, Ball et al. (2003) claim that adopting a high quality set of accounting standards is a necessary condition for accounting quality but not a sufficient

one; a key issue to ensure the implementation of a high quality set of accounting standards is the enforcement of these accounting standards. Schipper (2005) argues that financial reporting enforcement mechanisms differ considerably across the European Union and these differences are expected to continue past the mandatory adoption of IFRS. Concerning the UK enforcement system, the Financial Reporting Review Panel (FRRP) is responsible for the enforcement of IFRS in the UK and it is considered highly effective (Brown and Tarca, 2005). Therefore, I expect that the relatively stronger enforcement mechanisms in the UK compared with other countries will enhance the mandatory and voluntary reporting of IFRS. This will ensure the proper implementation of IFRS and should, therefore, lead to improving the quality of reporting earnings. I expect, therefore, that IFRS reporting in the UK might have different impact on earnings management compared to other countries and suggest that IFRS reporting should be tested in each single country on its own without pooling data from different countries with different enforcement mechanisms.

Fourthly, the comparability promised by IFRS should make financial statements more widely used by international investors and, therefore, managers will face greater responsibility and liability issues which should make them strive to constrain earnings management practices.

Finally, the implementation of IFRS would reduce the information asymmetry between informed and uninformed investors (Bushma and Smith, 2001). For example, IAS 1 ‘Presentation of Financial Statements’ requires sensitive information, such as managerial judgements and assumptions while forming the entity’s accounting policies as well as sources of estimation uncertainty that may have a material impact on the entity’s financial statements, to be appropriately disclosed and reported in the annual reports (Iatridis, 2010)

Based on the above discussion, the first hypothesis can be stated as follows:

H1: There is a negative association between IFRS reporting in the UK and the absolute value of discretionary accruals as a measure of earnings management.

3.2 Direction of Managing Earnings

Incentives to manage earnings upwards could be stronger than incentives to manage earnings downwards. Prior literature documents more use of income increasing as compared to income decreasing earnings management. For instance, Teoh et al. (1998) argue that abnormal accruals tend to be income increasing rather than income decreasing for publicly quoted companies, while DeGeorge et al. (1999) argue for the psychologically important distinction between positive and negative earnings figures. Moreover,

²² Source http://www.iasb.org/NR/rdonlyres/9F5C7C45-F8C2-4711-BF2F-C8A44949F9B3/0/constitution_proposals_pr_120508.pdf

Nelson et al. (2002) provide evidence that managers are more likely to manage earnings to increase income than to reduce income. Furthermore, Ashbaugh et al. (2003) argue that income increasing earnings management resulting in earnings overstatements are more frequent and of greater concern to auditors. I conclude from these previous research results that managers have more incentives to manage earnings upwards to increase income than to decrease it.

Therefore, due to the different relative importance of income increasing versus income decreasing earnings management, I expect the effect of IFRS reporting to be different with respect to these two directions. Although many of the earnings management studies use separate tests for positive versus negative discretionary accruals as a robustness check, in this paper the potential differential impact of reporting standards on income increasing versus income decreasing earnings management is of prime importance. Given the relatively higher incentives of management to manage earnings upwards to increase accounting income than those to manage earnings downwards to decrease income, I expect to find the association between IFRS reporting and earnings management to be stronger in cases of income decreasing earnings management than for cases of income increasing earnings management. Therefore, the second hypothesis can be stated as follows:

H2: The effect of IFRS reporting is conditional on the direction of managing earnings.

3.3 Audit Quality

Different proxies for audit quality are discussed in the prior literature (see for example; DeAngelo, 1981). The widely accepted proxy is audit firm size as prior research has found evidence that big auditors charge higher fees, have lower litigation rates, lead to stronger market reactions, and their clients have lower levels of earnings management. As earnings management levels are conditional on both accounting standards and their implementation (Van Tendeloo and Vanstraelen, 2005) and given that prior research suggests that big four auditors provide higher quality audits (Francis and Dechow, 2008, Becker et al., 1998), then the relationship between reporting under IFRS and earnings management might be conditional on audit quality. More specifically, the big four auditors are more likely to ensure higher compliance with IFRS due to their ability to invest in quality staff and procedures (DeAngelo, 1981), and the greater reputational and litigation risk of non-compliance which is associated with a client base of larger companies. Therefore, I expect to find stronger evidence of the effect of IFRS reporting for companies audited by big four auditors than companies audited by non big four auditors. Therefore, the third hypothesis can be stated as follows:

H3: The association between IFRS reporting and earnings management is conditional on audit quality surrogated by audit firm size.

4. Research Design

4.1 Earnings Management Measures

Earnings management is generally unobservable to external parties (Dechow and Skinner, 2000) and prior studies have used different measures to proxy for earnings management (e.g. Dechow et al., 1995, Burgstahler and Dichev, 1997, Peasnell et al., 2000, Kothari et al., 2005). Measures of earnings management range from discretionary accruals measures, which are the most frequently used measures in the literature, to measures of managing earnings towards a target such as loss avoidance (Dechow et al., 1999). Alternative measures estimate real earnings management activities which represent managerial decisions such as research and development costs (Cohen and Zarowin, 2010). Finally, another approach is to measure the shifting of accounting classifications as a means of affecting operating income figures (McVay, 2006). Following the related literature (Caramanis and Lennox, 2008, Francis and Yu, 2009, Dechow et al., 1995), this paper uses two main measures of earnings management - discretionary accruals and earnings benchmark tests.

4.1.1 Discretionary Accruals Measures

Discretionary accruals models have been used extensively in the prior literature to estimate earnings management levels or levels of unexpected accruals. While there is little evidence on the superiority of one model over the others (Ashbaugh et al., 2003, Myers et al., 2003), the main arguments concerning discretionary accruals models can be summarised into three categories; models depending on total accruals (Jones, 1991), current accruals (Young, 1999, Peasnell et al., 2000) and performance matched models (Kothari et al., 2005)²³.

I measure total accruals and current accruals using the cash flow statement approach as suggested by Hribar and Collins (2002) rather than the balance sheet approach due to the potential error and bias in such an approach. I define total accruals (TACC) as income before extraordinary items minus cash flows from operating activities and I define current accruals (CACC) as income before extraordinary items plus depreciation and amortisation minus cash flows from operating activities.

The Modified Jones Accruals Model

I begin by estimating a cross-sectional version of the Jones model (1991) as modified by Dechow et al.

²³ Dechow et al (2009) criticise the use of a single proxy for earnings quality which may enable finding significant results consistent with the chosen hypothesis.

(1995) for all firms i in industry j for year t . The model is

$$TACC/TA_{it-1} = \alpha_{0jt} + \alpha_{1jt} (1/TA_{it-1}) + \alpha_{2jt} (\Delta SALES_{it}/TA_{it-1}) + \alpha_{3jt} PPE_{it}/TA_{it-1} + \varepsilon_{it} \quad (1)$$

Where TA_{it-1} is the lagged total assets, $\Delta SALES_{it}$ is the change in sales scaled by lagged total assets and PPE_{it} is the gross property, plant and equipment scaled by lagged total assets. I estimate equation (1) for each 2 digit industry-year combination that has a minimum of 10 observations. All variables are scaled by lagged total assets to mitigate the effect of heteroskedasticity (Kothari et al., 2005, Daniel et al., 2008). I then calculate discretionary accruals using equation (2) as follows

$$DAMJ_{it} = TACC_{it}/TA_{it-1} - NACC_{it} \quad (2) \\ = TACC_{it}/TA_{it-1} - [\beta_{0jt} + \beta_{1jt} (1/TA_{it-1}) + \beta_{2jt} (\Delta SALES_{it} - \Delta REC)/TA_{it-1} + \beta_{3jt} PPE_{it}/TA_{it-1}]$$

Where $DAMJ_{it}$ is discretionary accruals estimated using the modified version of the Jones model, $NACC_{it}$ is normal (non discretionary) accruals, ΔREC is the change in trade receivables and β_{0jt} , β_{1jt} , β_{2jt} , and β_{3jt} are the industry-year OLS parameters estimated in equation (1). The main aspect of the Jones model is to expect normal accruals to be based on the normal pattern of accruals within each industry in each year. Dechow et al (1995) modified the model so that cash sales are not included in the calculation of nondiscretionary accruals as only credit sales are thought to be subject to income manipulation.

The Working Capital Accruals Model

While the modified Jones model includes property, plant, and equipment to explain long term accruals, mainly depreciation (Gore et al., 2007), this component is unlikely to be an effective means of managing earnings given its visibility which leads to the market's ability to observe it (Young, 1999). In addition, the use of property, plant and equipment may result in biased results due to the measurement error in the estimation of non discretionary accruals in cases of revaluation of those items under IFRS (Soderstrom and Sun, 2007). Therefore, as an additional measure of earnings management, I use the working capital (current) version of the modified Jones model as follows:

$$CACC/TA_{it-1} = \alpha_{0jt} + \alpha_{1jt} (1/TA_{it-1}) + \alpha_{2jt} (\Delta SALES_{it}/TA_{it-1}) + \varepsilon_{it} \quad (3)$$

$$DAMJC_{it} = CACC_{it}/TA_{it-1} - NACC_{it} \quad (4) \\ = CACC_{it}/TA_{it-1} - [\beta_{0jt} + \beta_{1jt} (1/TA_{it-1}) + \beta_{2jt} (\Delta SALES_{it} - \Delta REC)/TA_{it-1}]$$

Where $CACC_{it}$ is current accruals measured as income before extraordinary items plus depreciation and amortisation minus cash flows from operating activities, $DAMJC_{it}$ is the discretionary accruals for firm i in year t estimated using the current version of

the modified Jones model. All other variables are as defined earlier.

The Performance Matched Discretionary Accruals Model

Finally, Kothari et al. (2005) find evidence that discretionary accruals models might be misspecified when applied to a sample of firms experiencing extreme financial performance and suggested adding return on investment as an additional regressor to control for extreme performance. However, Dechow et al. (2009) noted that control for performance can reduce the power of the test and should only be applied when performance is an issue. Therefore, I use the performance matched discretionary accruals model as a final discretionary accruals model. I estimate the performance matched discretionary accruals model as follows:

$$CACC/TA_{it-1} = \alpha_{0jt} + \alpha_{1jt} (1/TA_{it-1}) + \alpha_{2jt} (\Delta SALES_{it}/TA_{it-1}) + \alpha_{3jt} ROA_{it-1} + \varepsilon_{it} \quad (5)$$

$$DACMM_{it} = CACC_{it}/TA_{it-1} - NACC_{it} \quad (6) \\ = CACC_{it}/TA_{it-1} - [\beta_{0jt} + \beta_{1jt} (1/TA_{it-1}) + \beta_{2jt} (\Delta SALES_{it} - \Delta REC_{it})/TA_{it-1} + \beta_{3jt} ROA_{it-1}]$$

Where ROA_{it-1} is defined as lag income before extraordinary items scaled by lagged total assets, $DACMM_{it}$ is the discretionary accruals for firm i in year t estimated using the performance matched discretionary accruals model. All other variables are defined earlier.

To capture the combined effect of both income increasing and income decreasing earnings management, the absolute value of each of the above three measures is used. Moreover, in order to capture the differential effect of IFRS on income increasing versus income decreasing earnings management, I create additional six variables for positive and negative discretionary accruals which are the positive (negative) discretionary accruals using each of the three earnings management models mentioned above.

4.1.2 Earnings Benchmark Tests

As an additional test to avoid any misspecification which might be associated with discretionary accruals models, I use meeting benchmark tests as an alternative measure of earnings quality. Prior studies document that the frequency of small profits is unusually high in comparison with the earnings distribution as a whole (Burgstahler and Dichev, 1997, Degeorge et al., 1999). Degeorge et al. (1999) suggest that firms may engage in earnings management to report small positive profits to avoid reporting a loss if unmanaged earnings would have been negative. Avoiding reporting a loss is important as it may affect relationships with creditors (Graham et al., 2005). Moreover, companies may manage earnings to avoid reporting a decline in earnings. Therefore, earnings are assumed to be of higher

quality if the firm does not systematically meet earnings benchmark targets (Francis and Yu, 2009).

I use the likelihood of firms reporting small profits and firms reporting small increases in profits as additional earnings management proxies. I created two additional variables for this purpose namely SMALL_POSITIVE and SMALL_INCREASE. SMALL_POSITIVE is a dichotomous variable defined as 1 if the company reports net income deflated by lagged total assets is between 0% and 5% and 0 otherwise. SMALL_INCREASE is a dichotomous variable defined as 1 if the increase in the company's reported net income deflated by lagged total assets is between 0% and 1% and 0 otherwise. I

use similar cut-offs to those reported in Francis and Yu (2009) and Ashbaugh et al. (2003).

4.2 Model and Control Variables

To enable hypotheses testing, I employ the following regression model

$$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \varepsilon \quad (7)$$

Where the variables are defined as follows

Variable	Definition
EM: earnings management measures	
DAMJ_ABS (DAMJP) (DAMJN)	Absolute value (Positive) (Negative) discretionary accruals measured using the modified Jones model.
DAMJC_ABS (DAMJCP) (DAMJCN)	Absolute value (Positive) (Negative) discretionary accruals measured using the current version modified Jones model.
DACMM_ABS (DAMMJP) (DAMMJN)	Absolute value (Positive) (Negative) discretionary accruals measured using the performance matched discretionary accruals measure.
SMALL_POSITIVE	1 if reported net income deflated by lagged total assets is between 0 and 5% and 0 otherwise.
SMALL_INCREASE	1 if increase in reported net income deflated by lagged total assets is between 0 and 1% and 0 otherwise.
ACC_STD	1 if the company reports under IFRS and 0 otherwise.
B4	1 if the firm is audited by big 4 and 0 otherwise.
MV	Natural log of market capitalisation.
MB	Market to book ratio measured by market capitalisation divided by total assets.
TDTA	Leverage measured by total debt divided by total assets multiplied by 100.
SHARES_CHANGE	Percentage change in number of common shares for the year.
GROWTH	Percentage change in sales for the year.
LAGLOSS	Dummy equals 1 if a firm reported a loss (negative income before extraordinary items) in the previous year and 0 otherwise.
ROA	Return on assets measured as net income divided by average total assets multiplied by 100.
CFO_ABS	Absolute value of cash flows from operations scaled by lagged total assets.
CAC_ABS	Absolute value of the lag of current accruals scaled by lagged total assets.
YEAR ₂₀₀₃₋₂₀₀₇	Year dummies

The dependent variable is earnings management, the main independent variable is the accounting standards and there are a number of control variables. Firstly, I control for audit firm size as a proxy for audit quality because previous studies found a negative association between earnings management and audit quality (e.g. Becker et al., 1998). Following prior studies, I include firm size, measured by the market value of equity, to control for the differences in the accrual behaviour of managers of large and small firms (e.g. Gul et al., 2009). Moreover, prior studies found evidence that larger firms engage less in earnings management (e.g. Ashbaugh et al., 2003) and, therefore, a negative association is expected between firm size and earnings management.

Furthermore, capital market pressure might influence earnings management and I use the market

to book ratio as a control (e.g. Francis and Yu, 2009). Following the prior literature, a positive association is expected between the market to book ratio and earnings management. In addition, DeFond and Jiambalvo (1994) find evidence that firms with higher leverage (higher debt) have greater incentives to manage earnings as a result of debt covenant constraints; I control for leverage by the ratio of total debt divided by total assets and expect to find a positive association between it and earnings management.

Prior studies control for mergers and acquisitions to capture firms' business combination activities (e.g. Ashbaugh et al., 2003). Unfortunately, I were not able to collect this variable due to database limitations as explained in section 4.3. Therefore, I computed an alternative new variable, the percentage

change in the number of shares, to proxy for business change. Companies engaging in mergers and acquisitions are expected to have incentives to increase income to benefit from share offerings. Therefore, I expect to find a positive association between a change in the number of shares and earnings management. Moreover, as an additional proxy of growth, I control for a growth in sales to capture changes in firm performance unrelated to earnings management (Gul et al., 2009, Hribar and Nichols, 2007). In addition, Francis and Yu (2009) find that firms reporting a loss in the previous year are less likely to engage in earnings management than firms reporting positive profits. Therefore, I control for previous year losses and expect a negative association with earnings management. However, the sign of LAGLOSS may differ in cases of income increasing versus income decreasing earnings management. Furthermore, I control for the return on investment to capture firm performance (Frankel et al., 2002) and I expect a negative association with earnings management measures.

Dechow et al. (1995) find a negative association between cash flows from operations and earnings management. I control for the absolute value of operating cash flows. As an alternative specification, I used the signed value of operating cash flows and the results are qualitatively similar to those reported in the paper. Finally, I control for the absolute value of current accruals to control for the normal relation between accruals in successive years (Chung and Kallapur, 2003).

4.3 Sample Selection and Data Collection

The sample of this paper comprises all UK listed active and dead companies from 2003-2007²⁴. The sample period allows the inclusion of companies which were reporting under UK GAAP and then moved to IFRS, as well as companies which were continually using UK GAAP. The sample period was selected due to two main reasons. Firstly, prior to 2003, there were some significant changes in the audit environment as a consequence of the collapse of Arthur Andersen, the Sarbanes-Oxley Act and the collapse of some very large American firms. Secondly, the years 2008 and later suffer from the global financial crisis. Therefore, I have selected a relatively stable sample period to test the hypotheses. Table 2 presents the sample selection procedures.

The initial sample consists of 8077 firm-year observations. Following the prior literature, financial companies (Standard Industry Classification code (SIC) 60-69) were excluded due to their different accruals' generating process and specific accounting

requirements (e.g. Francis and Yu, 2009, Maijor and Vanstraelen, 2006). I keep utility companies to maximise the sample which is similar to some previous studies (Lim and Tan, 2008). In order to estimate earnings management, similar to Francis and Yu (2009), I depend on three models of discretionary accruals and I impose a constraint of a minimum of 10 observations in each 2 digit SIC-year combination. I exclude any observation with revenues less than £500,000 to avoid bias resulting from inclusion of insignificant firms in the sample (Ball and Shivakumar, 2008). These procedures resulted in 5173 firm-year observations with all necessary variables required to estimate discretionary accruals models. I used this sample for the first stage of the paper to estimate all discretionary accruals variables. Finally, I delete observations with other missing data such as auditor's identity, market capitalisation and number of shares. The sample selection procedures resulted in a final sample of 2799 firm-year observations representing 688 unique firms. Table 3 presents industry/year classifications which show that I have a minimum of 10 firms in SIC 49 in years 2003 and 2004. The maximum number of firms in a single SIC-year combination is 169 in SIC 73 in year 2006.

Regarding reporting under UK GAAP and IFRS, I classified the sample into three groups: UK GAAP, mandatory IFRS, and voluntary IFRS. Data concerning accounting standards followed by firms were collected from WorldScope and cross checked with FAME database for errors. I also collected financial statement dates data from WorldScope. Firms with financial periods starting before 31st December, 2004 were all reporting under UK GAAP. In addition, individual companies and AIM companies did not have to comply with IFRS for financial periods starting before 1st January, 2007. Group listed firms with financial periods starting on or after 1st January, 2005 and reporting under IFRS were classified as mandatory IFRS reporters. Finally, individual listed companies with financial periods starting 1st January, 2005 and AIM companies with periods starting prior to 1st January, 2007 are classified as voluntary IFRS reporters if they chose to comply with IFRS. Table 4 reports yearly frequencies for each group of the three groups and shows that 67.13% of the sample is reporting under UK GAAP, 28.19% is reporting under IFRS mandatorily, and only 4.68% is reporting under IFRS voluntarily. A further check has been made and I found that all the voluntary reporters are AIM companies for financial periods starting before 1st January 2007. I have conducted the tests basically to compare reporting under IFRS versus UK GAAP. However, I have repeated all the tests with exclusion of the voluntary reporters to check if the results are robust to mandatory reporting. I found all results are qualitatively similar to those reported in the paper. Due to the relatively very small proportion of voluntary IFRS reporters, I did not conduct similar

²⁴ Mandatory adoption of IFRS started in 2005 for group companies only, while individual companies have the choice between UK GAAP and IFRS. Therefore, I have repeated my analysis using the periods from 2005-2007 and the results are qualitatively similar to those reported in the paper.

tests to compare voluntary IFRS reporting with either the expected low power of the tests resulting from the mandatory IFRS reporting or UK GAAP because of the relatively small sample.

Table 2. Sample Selection Procedures

Initial sample: Firm year observations with required financial data	8077
Exclude: Financial companies (SIC codes 60-69)	(958)
Exclude: Observations with less than 10 firms in each sic/year combination	(1159)
Exclude: Firms with sales < £500,000	(787)
Useable sample for estimating discretionary accruals	5173
Exclude: Observations with other missing data (auditor, number of shares, and market to book ratio)	(2374)
Final sample	2799

Number of unique firms=688 firms

Table 3. Classification by Year and Industry

		Year					
SIC	Industry	2003	2004	2005	2006	2007	Total
13	Oil And Gas Extraction	16	17	18	22	23	96
15	General Building Contractors	20	22	23	23	22	110
20	Food And Kindred Products	23	25	27	27	29	131
27	Printing And Publishing	17	19	19	22	19	96
28	Chemicals And Allied Products	33	37	48	55	52	225
35	Industrial Machinery And Equipment	18	21	25	27	28	119
36	Electronic & Other Electric Equipment	40	43	46	54	46	229
38	Instruments And Related Products	33	38	43	44	41	199
48	Communications	17	22	31	35	31	136
49	Electric, Gas, And Sanitary Services	10	10	16	16	15	67
50	Wholesale Trade - Durable Goods	38	39	44	48	43	212
73	Business Services	119	134	152	169	164	738
79	Amusement & Recreation Services	18	22	23	23	24	110
87	Engineering & Management Services	53	57	68	79	74	331
Total		455	506	583	644	611	2799

Table 4. Classification by Accounting Standards and Year

	Year						
Accounting Standards	2003	2004	2005	2006	2007	Total	Percentage
UK GAAP	455	506	433	312	178	1,879	67.13%
Mandatory IFRS Reporting	0	0	126	264	394	789	28.19%
Voluntary IFRS Reporting	0	0	24	68	39	131	4.68%
Total	455	506	583	644	611	2,799	100%

I collected the data using the WorldScope²⁵ and FAME²⁶ databases. All financial data and accounting standards for each company in each year were collected using WorldScope. However, Daske et al. (2007) report that the accounting standards data item on WorldScope has a classification error and we, therefore, used the same data item from FAME and

data from a sample of annual reports to provide a cross check – this further analysis provided qualitatively similar results. Turning to audit firm size, WorldScope keeps records only for the current financial period with no mention if the company changed auditors in previous years. However, the FAME database holds a data item called “previous auditors grouped” which I use to form the overall data series. All financial continuous data, including discretionary accruals measures, are winsorized at the top 1% and bottom 99% in order to avoid outlier problems (see Caramanis and Lennox, 2008, Francis and Yu, 2009).

²⁵ WorldScope is a database provided by Thomson One Banker. It is worth noting that it has data items which were previously part of Datastream.

²⁶ FAME provides comprehensive data for UK private and publicly listed companies and is maintained by the Bureau Van Dijk.

5. Empirical Results

5.1 Descriptive Statistics

Table 5 reports descriptive statistics for all data items used in the study. Results show that the average of the absolute value of the discretionary accruals measures is highest for the modified Jones model followed by the current version of the modified Jones model and finally the performance matched discretionary accruals measures. A similar pattern is presented for positive and negative discretionary accruals. For the earnings benchmark measure, an average of 19.2% of firm-year observations reported a small profit in the ratio between 0% and 5%, and an average of 8.5% of firms reported a small increase in profits in the ratio between 0% and 1%. Table 5 shows that 39.2% of the sample reported a loss in the previous year measured as a negative income before extraordinary items. As to discretionary accruals, the mean of discretionary accruals estimated using the modified Jones model, the current accruals, and the performance matched were 12.1, 11.2%, and 10.5% respectively.

As to the accounting standards followed, table 7 reports 1,879 (67.1%) firm-year observations of the sample are reporting under UK GAAP whereas 920 (32.9%) firm-year observations are reporting under IFRS. The large proportion of UK GAAP is expected because IFRS was not allowed in years 2003 and 2004. Table 7 also shows that the firm years for big four auditors comprised 942 (59.2%) of UK GAAP firms-years and 647 (40.7%) of the IFRS firms-years' whereas the non-big four audited firm years comprised 937 (77.4%) of UK GAAP firms-years and 273 (22.6%) of IFRS firms-years. In total, 1210 (43.2%) observations are audited by non-big four auditors whereas 1589 (56.8%) are audited by big four auditors. In addition, Table 8 reports 1,102 (84.5%) firm-year observations of main market firms are audited by big four auditors whereas 203 (15.5%) firm-year observations of the main market firms are audited by non-big four auditors. Furthermore, as to AIM market firms, 487 (32.5%) firm-year observations are audited by big four auditors whereas 1,007 (67.5%) firm-year observations are audited by non-big four auditors. To sum up, the pooled sample presents a reasonable diversification of accounting standards and auditor size.

Table 5: Descriptive Statistics

stats	N	Mean	Median	1 st Quartile	3 rd Quartile	Max	Min
Earnings management variables							
DAMJC_ABS	2718	0.112	0.066	0.030	0.130	0.805	0.002
DAMJ_ABS	2718	0.121	0.077	0.035	0.149	0.796	0.001
DACMM_ABS	2709	0.105	0.061	0.028	0.125	0.774	0.001
DAMJCP	1480	0.105	0.064	0.030	0.123	0.797	0.001
DAMJP	1480	0.116	0.074	0.034	0.144	0.796	0.001
DACMMP	1434	0.099	0.061	0.027	0.118	0.715	0.001
DAMJCN	1238	0.119	0.067	0.030	0.145	0.822	0.002
DAMJN	1238	0.129	0.083	0.035	0.158	0.847	0.002
DACMMN	1275	0.111	0.062	0.028	0.135	0.803	0.001
SMALL_POSITIVE	2799	0.192	0.000	0.000	0.000	1.000	0.000
SMALL_INCREASE	2799	0.085	0.000	0.000	0.000	1.000	0.000
Independent variables							
ACC_STD	2799	0.329	0.000	0.000	1.000	1.000	0.000
B4	2799	0.570	1.000	0.000	1.000	1.000	0.000
MV	2669	10.878	10.596	9.279	12.267	16.941	6.655
MB	2669	1.571	1.076	0.632	1.935	8.588	0.152
TDTA	2799	16.767	10.498	0.543	24.436	116.680	0.000
SHARES_CHANGE	2791	0.064	0.003	0.000	0.047	0.783	-0.139
GROWTH	2767	0.413	0.117	-0.008	0.345	9.416	-0.615
LAGLOSS	2799	0.392	0.000	0.000	1.000	1.000	0.000
ROA	2799	-2.066	4.905	-5.539	9.923	42.274	-110.7
CFO_ABS	2799	0.187	0.112	0.060	0.206	1.686	0.003
CAC_ABS	2782	0.098	0.054	0.025	0.110	0.871	0.001

Variable definitions:

DAMJC_ABS (DAMJCP) (DAMJCN) = Absolute value (Positive) (Negative) discretionary accruals measured using the current version of the modified Jones model. DAMJ_ABS (DAMJP) (DAMJN) = Absolute value (Positive) (Negative) discretionary accruals measured using the modified Jones model. DACMM_ABS (DAMMJP) (DAMMJN) = Absolute value (Positive) (Negative) discretionary accruals measured using the performance matched discretionary accruals measures. SMALL_POSITIVE = 1 if reported net income deflated by lagged total assets between 0 and 5% and 0 otherwise. SMALL_INCREASE = 1 if reported increase in net income deflated by lagged total assets between 0 and 1% and 0 otherwise. ACC_STD = 1 if the company reports under IFRS and 0 otherwise. B4 = 1 if the firm is audited by big 4 and 0 otherwise. MV = natural log of market capitalisation. MB = market to book ratio measured by market capitalisation divided

by total assets. *TDTA* = leverage measured by total debt divided by total assets multiplied by 100. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets multiplied by 100. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets.

Table 6 reports summary statistics for the three earnings management estimation measures used in this paper. The table shows the mean and median coefficients of the industry-year cross sectional regressions from estimating equations (1), (3), and (5). The table also reports R^2 from the (125) industry-year regressions. As expected and documented in prior studies, the coefficient of the change in revenues is positive which shows a positive association between the change in revenues and accruals (both total and current). The table also shows a negative

association between PPE (Gross property, plant, and equipment) and total accruals. Furthermore, the table reports positive association between ROA (Return on assets) and current accruals. In addition, the median R^2 is 34%, 22%, and 34% and the mean R^2 is 41%, 35%, and 43% for the modified Jones, the working capital accruals, and the performance matched discretionary accruals measures respectively. These statistics agree with previous studies (e.g. Lim and Tan, 2010).

Table 6. Coefficient Estimates in Estimating Earnings Management (Normal Accruals)

Model 1: $TACC/TA_{it-1} = \alpha_{0it} + \alpha_{1it}(1/TA_{it-1}) + \alpha_{2it}\Delta SALES_{it}/TA_{it-1} + \alpha_{3it}PPE_{it}/TA_{it-1} + \epsilon_{it}$			
Variable	N	Mean	Median
α_{0it}	125	-0.02	-0.03
α_{1it}	125	195.15	-42.47
α_{2it}	125	0.04	0.04
α_{3it}	125	-0.02	0.01
R^2	125	0.41	0.34
Model two: $CACC/TA_{it-1} = \alpha_{0it} + \alpha_{1it}(1/TA_{it-1}) + \alpha_{2it}\Delta SALES_{it}/TA_{it-1} + \epsilon_{it}$			
Variable	N	Mean	Median
α_{0it}	125	0.02	0.02
α_{1it}	125	181.17	-46.69
α_{2it}	125	0.07	0.05
R^2	125	0.35	0.22
Model three: $CACC/TA_{it-1} = \alpha_{0it} + \alpha_{1it}(1/TA_{it-1}) + \alpha_{2it}\Delta SALES_{it}/TA_{it-1} + \alpha_{3it}ROA_{it-1} + \epsilon_{it}$			
Variable	N	Mean	Median
α_{0it}	125	0.01	0.01
α_{1it}	125	265.16	12.9
α_{2it}	125	0.06	0.04
α_{3it}	125	0.22	0.14
R^2	125	0.43	0.34

Notes:

The above table represent summary statistics for the three models used in the paper to estimate discretionary accruals. The table shows the mean and median coefficients from 125 annual cross-sectional regressions. *TACC* is income before extraordinary items minus cash flows from operating activities. *TA_{it-1}* is the lagged total assets. $\Delta SALES_{it}$ is the change in sales scaled by lagged total assets. *PPE_{it}* is the gross property, plant and equipment scaled by lagged total assets. *CACC_{it}* is current accruals measured as income before extraordinary items plus depreciation and amortisation minus cash flows from operating activities. *ROA_{it-1}* is defined as lag income before extraordinary items scaled by lagged total assets.

Table 7. Classification of Firm-Years by Accounting Standards Followed and Auditor Size

Accounting Standards Followed	Auditor				Total	
	Non Big Four		Big Four			
UK GAAP	937	77.4%	942	59.2%	1,879	67.1%
IFRS	273	22.6%	647	40.8%	920	32.9%
Total	1,210	100%	1,589	100%	2,799	100%

This Panel provides sample classification showing the number of firm-years observations reporting under each set of accounting standards (UK GAAP and IFRS) and audited by big four auditors versus non big four auditors.

Table 8. Classification by Auditor Type and Type of Market

Type of Market	Auditor			
	Big Four		Non Big Four	
Main Market	1,102	84.5%	203	15.5%
AIM Market	487	32.5%	1,007	67.5%

This Panel provides sample classification showing the number of firm-years observations listed in each of the main market and AIM market and audited by big four auditors versus non big four auditors.

5.2 Univariate Tests

Table 9 presents t-tests for the difference of means between firms reporting under IFRS versus firms reporting under UK GAAP. The table illustrates that a significant difference exists for all measures of discretionary accruals using the modified Jones model, the current version of the Jones model, and the performance matched model. The results of the table support the first hypothesis and show that firms preparing their financial statements in accordance with IFRS generally have lower levels of earnings management. However, mean differences appear to be larger for negative discretionary accruals than for positive discretionary accruals. For example, positive discretionary accruals (using the working capital accruals model) for firms reporting under UK GAAP are 2.24% greater than those for firms using IFRS; whereas, the average negative discretionary accruals are 4.41% greater for firms reporting under UK GAAP than for firms reporting using IFRS (using the

current version of the Jones model). This final result agrees with the second hypothesis that IFRS reporting will have a larger effect on income decreasing earnings management than on income increasing earnings management. Similar results are reported using the modified Jones model and the performance matched discretionary accruals measures.

Table 10 also reports yearly t-tests for the years 2005, 2006, and 2007 to test whether there are significant differences between the absolute value of discretionary accruals reported under UK GAAP versus those reported under IFRS in each individual year. I did the tests only for years beginning in 2005 because IFRS adoption was not allowed before 2005. I report evidence that the differences in earnings management levels are not confined to the adoption year but extend for every year after which suggests that reporting under IFRS generates less earnings management.

Table 9. Univariate Tests (Pooled sample)

Variable	UK GAAP		IFRS		Difference in means	t-statistics
	Obs	Mean	Obs	Mean		
Absolute value of discretionary accruals - All						
DAMJC_ABS	1827	0.122294	891	0.090017	0.032277	5.7135***
DAMJ_ABS	1827	0.133241	891	0.097386	0.035855	6.3544***
DACMM_ABS	1819	0.114792	890	0.085021	0.029771	5.5281***
Absolute value of discretionary accruals - Positive						
DAMJCP	994	0.112664	486	0.090216	0.022448	3.0964***
DAMJP	969	0.125817	511	0.097052	0.028765	3.9905***
DACMMP	981	0.106447	453	0.084287	0.02216	3.1942***
Absolute value of discretionary accruals - Negative						
DAMJCN	833	0.133916	405	0.089751	0.044165	4.9793***
DAMJN	858	0.142399	380	0.097835	0.044564	4.9036***
DACMMN	838	0.124108	437	0.085669	0.038439	4.6571***

Table 10. Univariate Tests (Yearly)

Variable	UK GAAP		IFRS		Difference in means	t-statistics
	Obs	Mean	Obs	Mean		
Absolute value of discretionary accruals – Current version of the Jones model						
2005	418	.1316297	145	.0817688	.0498609	3.5684***
2006	303	.1421692	320	.091547	.0506222	4.7153***
2007	174	.1487926	423	.0915919	.0572007	4.6996***

*** $p < 0.01$

Variable definitions:

DAMJ_ABS (DAMJP) (DAMJN) = Absolute value (Positive) (Negative) discretionary accruals measured using the modified Jones model. DAMJC_ABS (DAMJCP) (DAMJCN) = Absolute value (Positive) (Negative) discretionary accruals measured using the current version of the modified Jones model. DACMM_ABS (DAMMJP) (DAMMJN) = Absolute value (Positive) (Negative) discretionary accruals measured using the performance matched discretionary accruals measures.

5.3 Correlations

Table 11 presents a correlation matrix using Pearson and Spearman correlations coefficients. I present Variance Inflation Factors (VIF) in the last column to check for collinearity issues. The reported results show no potential multicollinearity issues given that the maximum VIF is 2.04. The absolute value of the discretionary accruals estimated using the current version of the modified Jones model is significantly and negatively correlated with the accounting standards adopted by firms suggesting that companies reporting under IFRS have lower earnings management than those reporting under UK GAAP.

Similar correlations (un-tabulated) are reported for all other measures of earnings management.

The table also shows a significant positive correlation (19%) between the accounting standards adopted by firms and whether they are audited by big four auditors. A possible explanation for this result is that IFRS is mandatory for group companies and most of these companies are audited by big four auditors due to size considerations. This last argument also explains the positive correlation (35%) between accounting standards and market value (size variable) and also explains the relatively high correlation (58%) between the big four auditor variable and market value.

Table 11. Pearson (above) / Spearman (below) Correlations

Variable	DAMJC_ABS	ACC_STD	B4	MV	MB	TDTA	SHARES_CHANGE	GROWTH	LAGLOSS	ROA	CFO_ABS	CAC_ABS	VIF
DAMJC_ABS	1.00	-0.11	-0.20	-0.20	0.21	0.08	0.20	0.21	0.18	-0.26	0.39	0.33	
ACC_STD	-0.09	1.00	0.19	0.35	-0.04	0.01	-0.07	-0.05	-0.18	0.16	-0.07	-0.10	1.88
B4	-0.19	0.19	1.00	0.57	-0.06	0.11	-0.16	-0.11	-0.17	0.17	-0.18	-0.16	1.56
MV	-0.20	0.35	0.59	1.00	0.06	0.10	-0.19	-0.08	-0.38	0.36	-0.13	-0.23	2.04
MB	0.15	0.02	-0.02	0.18	1.00	-0.11	-0.02	0.15	0.12	-0.19	0.41	0.17	1.36
TDTA	-0.05	0.05	0.13	0.19	-0.28	1.00	0.05	-0.05	0.04	-0.07	0.00	0.13	1.08
SHARES_CHANGE	0.08	-0.01	-0.06	-0.05	0.09	0.00	1.00	0.27	0.26	-0.27	0.27	0.17	1.24
GROWTH	0.11	0.00	-0.13	0.00	0.25	-0.05	0.22	1.00	0.16	-0.14	0.29	0.06	1.19
LAGLOSS	0.16	-0.18	-0.17	-0.39	0.02	-0.04	0.19	0.01	1.00	-0.51	0.19	0.24	1.53
ROA	-0.10	0.20	0.15	0.41	0.17	0.02	-0.22	0.12	-0.57	1.00	-0.35	-0.23	1.66
CFO_ABS	0.17	-0.04	-0.10	-0.02	0.47	-0.11	0.08	0.22	0.04	0.09	1.00	0.32	1.61
CAC_ABS	0.27	-0.10	-0.18	-0.23	0.14	-0.01	0.06	0.04	0.18	-0.06	0.14	1.00	1.21

Coefficients in bold are significant at the 0.01 level

Variable definitions:

DAMJC_ABS = Absolute value of discretionary accruals measured using the current version of the modified Jones model. ACC_STD = 1 if the company reports under IFRS and 0 otherwise. B4 = 1 if the firm is audited by big 4 and 0 otherwise. MV = natural log of market capitalisation. MB = market to book ratio measured by market capitalisation divided by total assets. TDTA = leverage measured by total debt divided by total assets multiplied by 100. SHARES_CHANGE: proportion change in number of common shares for the year. GROWTH = proportion change in sales for the year. LAGLOSS = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. ROA = return on assets measured as net income divided by average total assets multiplied by 100. CFO_ABS = Absolute value of cash flows from operations scaled by lagged of total assets. CAC_ABS = Absolute value of the lag of current accruals scaled by lagged of total assets.

5.4 Regression Results

The results in Tables 12, 13, 14, and 15 are estimated using Ordinary Least Squares (OLS) and in Tables 16 and 17 the results are based on probit regression - all results are reported using White adjusted standard errors. All models are significant at the 1% level (p -value < 0.01) and include year dummies for all years from 2003-2007 to control for the years (2003 and 2004) when IFRS was not adopted.

5.4.1 Discretionary Accruals Regression Results

The results reported in Table 12 show there is a negative relationship (significant at 5% and 10%

confidence intervals) between IFRS reporting and discretionary accruals estimated using the three measures described earlier. The results support the first hypothesis that IFRS reporting mitigates earnings management in general. The results also show a significant negative association between the big four auditor variable and earnings management which aligns with the prior literature (Becker et al., 1998). The control variable results are largely in line with expectations. More specifically, the results show a negative association between firm size (measured by the natural log of market value) and earnings management suggesting that bigger firms manage earnings less. Whereas for earning management incentives, the results suggest a positive association between earnings management and each of the market

to book ratio, leverage and the change in number of shares variables. These results are in the expected direction and show that firms with relatively high capital market incentives and high leverage have higher levels of earnings management.

The results suggest that companies experiencing high growth in sales have relatively higher earnings management levels. However, firms reporting losses in the previous year do not have a significant association with earnings management levels. The

results suggest, however, that firms reporting a higher return on assets have lower levels of earnings management. Finally, the results suggest a positive association between earnings management levels and operating cash flows and lagged current accruals which agree with expectations. These results, in general, support the first hypothesis that IFRS reporting has a positive impact on earnings quality through mitigating earnings management levels.

Table 12. OLS Results of Absolute Value of Discretionary Accruals

$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \mathcal{E}$				
VARIABLES	Predicted sign	(1)	(2)	(3)
		Model Damjc_abs	Model Damj_abs	Model Dacmm_abs
ACC_STD	?	-0.014** (-2.116)	-0.012* (-1.863)	-0.013* (-1.938)
B4	-	-0.014** (-2.405)	-0.011* (-1.722)	-0.015*** (-2.694)
MV	-	-0.003** (-2.265)	-0.004*** (-2.933)	-0.003* (-1.887)
MB	+	0.006*** (2.579)	0.006** (2.453)	0.004* (1.662)
TDTA	+	0.000** (2.542)	0.000*** (2.805)	0.000* (1.898)
SHARES_CHANGE	+	0.073*** (2.783)	0.068*** (2.688)	0.077*** (2.932)
GROWTH	+	0.012*** (3.035)	0.010*** (2.864)	0.010** (2.548)
LAGLOSS	-	-0.007 (-1.100)	-0.007 (-1.033)	-0.002 (-0.242)
ROA	-	-0.001** (-2.541)	-0.001*** (-2.677)	-0.001** (-2.422)
CFO_ABS	+	0.104*** (4.019)	0.091*** (3.659)	0.102*** (4.165)
CAC_ABS	+	0.201*** (6.549)	0.221*** (7.593)	0.212*** (6.858)
Year dummies		Yes	Yes	Yes
Constant		0.102*** (7.099)	0.120*** (8.085)	0.094*** (6.755)
Observations		2574	2574	2574
R-squared		0.251	0.239	0.254
Adj. R-squared		0.246	0.234	0.250

Robust t-statistics in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

DAMJ_ABS = Absolute value discretionary accruals measured using the modified Jones model. *DAMJC_ABS* = Absolute value discretionary accruals measured using the current version modified Jones model. *DACMM_ABS* = Absolute value discretionary accruals measured using the performance matched discretionary accruals measures. *ACC_STD* = 1 if the company reports under IFRS and 0 otherwise. *B4* = 1 if the firm is audited by big 4 and 0 otherwise. *MV* = natural log of market capitalisation. *MB* = market to book ratio measured by market capitalisation divided by total assets. *TDTA* = leverage measured by total debt divided by total assets multiplied by 100. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets. *YEAR₂₀₀₃₋₂₀₀₇* = year dummies.

5.4.2 Signed Discretionary Accruals

In order to test the second hypothesis regarding the different effects of IFRS reporting on income increasing versus income decreasing earnings

management, I partition the sample into observations with positive discretionary accruals and observations with negative discretionary accruals. The regression results reported in Table 13 for positive discretionary accruals suggest no significant association between

IFRS reporting and earnings management levels; whereas, the results reported in Table 14 suggest a significant association between IFRS reporting and income decreasing earnings management. These results confirm the second hypothesis that due to the relatively higher incentives for income increasing earnings management versus incentives for income decreasing earnings management, IFRS reporting is not sufficient to reduce positive discretionary accruals.

In terms of other variables, Tables 13 and 14 suggest that big four auditors impose higher constraints on positive discretionary accruals than on

negative discretionary accruals – supporting the notion that income increasing earnings management are likely to be perceived as being more important than income decreasing earnings management. Similar significant results are found for the market to book ratio and shares change variables for positive discretionary accruals but not for negative discretionary accruals. As discretionary accruals are measured with error, I have repeated the tests with the exclusion of discretionary accruals in the range of 1% to -1% and the results are qualitatively similar to those reported in the chapter.

Table 13. OLS Results of Positive Discretionary Accruals

$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \mathcal{E}$				
VARIABLES	Predicted sign	(1) Model Damjcp	(2) Model Damjp	(3) Model dacmmp
ACC_STD	?	-0.005 (-0.550)	0.003 (0.290)	-0.004 (-0.507)
B4	-	-0.024*** (-3.527)	-0.019*** (-2.665)	-0.020*** (-2.867)
MV	-	-0.005** (-2.552)	-0.007*** (-3.546)	-0.003 (-1.520)
MB	+	0.007** (2.092)	0.008** (2.454)	0.006* (1.736)
TDTA	+	0.000** (2.295)	0.000* (1.893)	0.000 (1.027)
SHARES_CHANGE	+	0.104*** (3.135)	0.085*** (2.887)	0.105*** (3.247)
GROWTH	+	0.010* (1.797)	0.012** (2.348)	0.009* (1.824)
LAGLOSS	-	0.007 (0.844)	-0.002 (-0.213)	0.010 (1.283)
ROA	+	0.002*** (5.385)	0.002*** (4.808)	0.001*** (4.379)
CFO_ABS	+	0.191*** (5.061)	0.170*** (4.716)	0.175*** (4.852)
CAC_ABS	+	0.182*** (4.964)	0.219*** (6.249)	0.227*** (5.688)
Year dummies		Yes	Yes	Yes
Constant		0.071*** (3.695)	0.110*** (5.430)	0.057*** (2.874)
Observations		1394	1391	1361
R-squared		0.304	0.281	0.323
Adj. R-squared		0.297	0.273	0.316

Robust t-statistics in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

DAMJP = Positive discretionary accruals measured using the modified Jones model. *DAMJCP* = Positive discretionary accruals measured using the current version modified Jones model. *DAMMJP* = Positive discretionary accruals measured using the performance matched discretionary accruals measures. *ACC_STD* = 1 if the company reports under IFRS and 0 otherwise. *B4* = 1 if the firm is audited by big 4 and 0 otherwise. *MV* = natural log of market capitalisation. *MB* = market to book ratio measured by market capitalisation divided by total assets. *TDTA* = leverage measured by total debt divided by total assets multiplied by 100. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets multiplied by 100. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets. *YEAR₂₀₀₃₋₂₀₀₇* = year dummies.

Table 14. OLS Results of Negative Discretionary Accruals
$$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \mathcal{E}$$

		(1)	(2)	(3)
VARIABLES	Predicted sign	Model Damjcn	Model Damjn	Model dacmmn
ACC_STD	?	-0.017*	-0.019**	-0.021**
		(-1.697)	(-1.987)	(-2.160)
B4	-	-0.002	0.001	-0.010
		(-0.243)	(0.069)	(-1.110)
MV	-	-0.003	-0.003	-0.002
		(-1.316)	(-1.199)	(-0.922)
MB	+	0.003	-0.000	0.000
		(0.670)	(-0.068)	(0.057)
TDTA	+	0.001*	0.001**	0.000
		(1.816)	(2.077)	(1.278)
SHARES_CHANGE	+	0.030	0.031	0.028
		(0.797)	(0.787)	(0.785)
GROWTH	+	0.012**	0.008*	0.008
		(2.284)	(1.667)	(1.489)
LAGLOSS	-	-0.007	0.003	-0.001
		(-0.687)	(0.335)	(-0.062)
ROA	-	-0.002***	-0.002***	-0.002***
		(-5.775)	(-5.146)	(-5.475)
CFO_ABS	+	0.090**	0.087**	0.079**
		(2.474)	(2.355)	(2.231)
CAC_ABS	+	0.219***	0.219***	0.174***
		(5.443)	(5.207)	(4.263)
Year dummies		Yes	Yes	Yes
Constant		0.099***	0.114***	0.071***
		(4.417)	(4.902)	(3.624)
Observations		1180	1183	1213
R-squared		0.321	0.300	0.289
Adj. R-squared		0.313	0.291	0.280

Robust t-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

DAMJN = Negative discretionary accruals measured using the modified Jones model. *DAMJCN* = Negative discretionary accruals measured using the current version modified Jones model. *DAMMJN* = Negative discretionary accruals measured using the performance matched discretionary accruals measures. *ACC_STD* = 1 if the company reports under IFRS and 0 otherwise. *B4* = 1 if the firm is audited by big 4 and 0 otherwise. *MV* = natural log of market capitalisation. *MB* = market to book ratio measured by market capitalisation divided by total assets. *TDTA* = leverage measured by total debt divided by total assets multiplied by 100. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets multiplied by 100. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets. *YEAR*₂₀₀₃₋₂₀₀₇ = year dummies.

5.4.3 Audit Quality Effect

Table 15 reports the results of partitioning the sample into firms audited by big four auditors and firms audited by non-big four auditors. The results suggest a significant negative association between IFRS reporting and earnings management levels for firms audited by big four auditors but not for firms audited by non-big four auditors. The result supports the third hypothesis and I explain the relationship by the

relatively higher quality and experience of big four auditors compared with non-big four auditors – the higher quality enabling a better utilisation of IFRS as compared to UK GAAP. Table 15 also suggests that the effect of capital market incentives (market to book ratio, share change and growth variables) on earnings management is weaker for firms audited by big four auditors than those audited by non-big four auditors.

Table15. OLS Results of Big Four versus Non Big Four Subsamples
$$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \varepsilon$$

VARIABLE	Predicted sign	(1) Model Non b4 Damjc_abs	(2) Model b4 Damjc_abs	(3) Model Non b4 Damj_abs	(4) Model b4 Damj_abs	(5) Model Non b4 Dacmmabs	(6) Model b4 Dacmm_abs
ACC_STD	?	-0.012 (-1.064)	-0.020** (-2.249)	-0.007 (-0.702)	-0.023** (-2.471)	-0.009 (-0.857)	-0.019** (-2.245)
MV	-	-0.005 (-1.535)	-0.002 (-1.346)	-0.005 (-1.529)	-0.004** (-2.141)	-0.005 (-1.558)	-0.001 (-0.749)
MB	-	0.012*** (3.332)	0.002 (0.520)	0.012*** (3.146)	0.000 (0.132)	0.010*** (2.744)	-0.000 (-0.038)
TDTA	+	0.001* (1.676)	0.000** (1.967)	0.000 (1.452)	0.001*** (2.601)	0.001* (1.778)	0.000 (1.014)
SHARES_C HANGE	+	0.109*** (2.878)	0.028 (0.853)	0.098*** (2.774)	0.035 (0.991)	0.119*** (3.215)	0.024 (0.680)
GROWTH	+	0.013*** (2.828)	0.009 (1.268)	0.011** (2.553)	0.009 (1.313)	0.011** (2.455)	0.007 (0.983)
LAGLOSS	-	-0.019* (-1.861)	-0.001 (-0.117)	-0.017* (-1.679)	0.001 (0.110)	-0.015 (-1.467)	0.005 (0.601)
ROA	-	-0.000 (-0.812)	-0.001*** (-3.040)	-0.000 (-1.159)	-0.001*** (-2.737)	-0.000 (-0.957)	-0.001*** (-2.767)
CFO_ABS	-	0.104*** (3.224)	0.100** (2.380)	0.082*** (2.676)	0.110*** (2.689)	0.099*** (3.262)	0.108*** (2.636)
CAC_ABS	+	0.242*** (5.212)	0.149*** (3.849)	0.278*** (6.530)	0.154*** (4.163)	0.229*** (5.002)	0.186*** (4.544)
Year dummies		Yes	Yes	Yes	Yes	Yes	Yes
Constant		0.092*** (2.754)	0.094*** (5.076)	0.101*** (3.109)	0.118*** (5.886)	0.094*** (2.924)	0.078*** (4.416)
Observations		1084	1490	1084	1490	1084	1490
R-squared		0.253	0.202	0.247	0.194	0.251	0.206
Adj. R- squared		0.243	0.195	0.237	0.186	0.241	0.198

Robust t-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

DAMJ_ABS = Absolute value discretionary accruals measured using the modified Jones model. *DAMJC_ABS* = Absolute value discretionary accruals measured using the current version modified Jones model. *DACMM_ABS* = Absolute value discretionary accruals measured using the performance matched discretionary accruals measures. *ACC_STD* = 1 if the company reports under IFRS and 0 otherwise. *B4* = 1 if the firm is audited by big 4 and 0 otherwise. *MV* = natural log of market capitalisation. *MB* = market to book ratio measured by market capitalisation divided by total assets. *TDTA* = leverage measured by total debt divided by total assets. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year items and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets multiplied by 100. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets. *YEAR*₂₀₀₃₋₂₀₀₇ = year dummies.

5.4.4 Earnings Benchmark Tests

Table 16 reports the probit regression results for the effect of IFRS reporting on the probability of reporting a small positive profit. The results suggest a significant negative association between IFRS reporting and *SMALL_POSITIVE* (at the 0.01 level) which means that companies adopting IFRS are less likely to engage in earnings management practices to avoid reporting a loss. In addition, the results of splitting the sample into firms audited by big four

auditors and non-big four auditors suggest that only firms audited by big four auditors show a significant negative association between IFRS reporting and reporting small positive profits. These results confirm the discretionary accruals results reported in the previous section and support hypothesis three which argues that audit quality plays a key role in ensuring IFRS reporting and, therefore, firms audited by big four auditors are more likely to benefit from IFRS reporting and show a mitigating effect of IFRS.

Table 17 reports profit regression results for the effect of reporting under IFRS on the probability of reporting small increases in profit. The results suggest a significant negative association between IFRS reporting and SMALL_INCREASE (at 0.05 level) which means that companies adopting IFRS are less likely to engage in earnings management practices to report small increases in profit between 0% and 1%. Furthermore, in the same vein as above, the results of

splitting the sample into firms audited by big four auditors and non-big four auditors suggest that only firms audited by big four auditors show a significant negative association between IFRS reporting and reporting small increases in profits. These results again confirm the results reported in the previous section related to hypothesis three and suggest that the results are not sensitive to the choice of discretionary accruals measures.

Table 16. Probit Regression Results of Probability of Reporting a Small Profit

$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \mathcal{E}$				
VARIABLES		(1)	(2)	(3)
	Predicted sign	Model	Model	Model
		small_positive	Non B4	B4
ACC_STD	?	-0.235*** (-2.582)	-0.078 (-0.571)	-0.302** (-2.391)
B4	-	0.082 (1.058)		
MV	-	0.009 (0.442)	0.005 (0.124)	0.018 (0.820)
MB	+	-0.397*** (-5.156)	-0.275*** (-3.035)	-0.542*** (-6.688)
TDTA	+	0.006*** (2.982)	0.006* (1.857)	0.005** (2.392)
SHARES_CHANGE	+	-0.635** (-2.300)	-0.872** (-2.247)	-0.402 (-1.062)
GROWTH	+	-0.001 (-0.020)	0.008 (0.180)	-0.032 (-0.445)
LAGLOSS	-	-0.136* (-1.695)	-0.208 (-1.603)	-0.079 (-0.771)
ROA	+	0.014*** (6.796)	0.017*** (5.902)	0.013*** (4.345)
CFO_ABS	+	-2.761*** (-4.707)	-1.785*** (-2.681)	-3.818*** (-6.177)
CAC_ABS	+	-0.549 (-1.404)	-0.086 (-0.171)	-1.201** (-1.988)
Constant		-0.144 (-0.705)	-0.348 (-0.805)	0.097 (0.353)
Year dummies		Yes	Yes	Yes
Observations		2620	1097	1523
Pseudo R ²		0.1541	0.1494	0.1686

Robust z-statistics in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

SMALL_POSITIVE = 1 if reported net income deflated by lagged total assets between 0 and 5% and 0 otherwise. ACC_STD = 1 if the company reports under IFRS and 0 otherwise. B4 = 1 if the firm is audited by big 4 and 0 otherwise. MV = natural log of market capitalisation. MB = market to book ratio measured by market capitalisation divided by total assets. TDTA = leverage measured by total debt divided by total assets multiplied by 100. SHARES_CHANGE: proportion change in number of common shares for the year. GROWTH = proportion change in sales for the year. LAGLOSS = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. ROA = return on assets measured as net income divided by average total assets multiplied by 100. CFO_ABS = Absolute value of cash flows from operations scaled by lagged of total assets. CAC_ABS = Absolute value of the lag of current accruals scaled by lagged of total assets. YEAR₂₀₀₃₋₂₀₀₇ = year dummies.

Table17. Probit Regression Results of Probability of Reporting a Small Increase in Profit

$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12-16} YEAR_{2003-2007} + \varepsilon$				
VARIABLES		(1)	(2)	(3)
	Predicted sign	Model small_increase	Model Non B4	Model B4
ACC_STD	?	-0.261** (-2.429)	-0.118 (-0.735)	-0.323** (-2.063)
B4	-	-0.139 (-1.446)		
MV	-	0.086*** (3.622)	0.043 (0.809)	0.106*** (3.704)
MB	+	-0.187*** (-2.742)	-0.176* (-1.729)	-0.136* (-1.890)
TDTA	+	-0.003 (-1.236)	0.001 (0.336)	-0.006* (-1.763)
SHARES_CHANGE	+	-0.127 (-0.386)	-0.117 (-0.252)	-0.230 (-0.481)
GROWTH	+	0.033 (0.823)	0.036 (0.695)	0.018 (0.380)
LAGLOSS	-	-0.797*** (-7.823)	-0.785*** (-5.310)	-0.857*** (-5.922)
ROA	-	-0.001 (-0.574)	0.001 (0.411)	-0.001 (-0.275)
CFO_ABS	+	-0.621 (-1.162)	-0.004 (-0.011)	-2.418*** (-3.306)
CAC_ABS	+	-1.086** (-2.088)	-1.132* (-1.732)	-1.543* (-1.958)
Constant		-1.417*** (-5.752)	-1.306** (-2.399)	-1.463*** (-4.505)
Year dummies		Yes	Yes	Yes
Observations		2620	1097	1523
Pseudo R ²		0.1155	0.1200	0.1258

Robust z-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

SMALL_INCREASE = 1 if reported net income deflated by lagged total assets between 0 and 1% and 0 otherwise. *ACC_STD* = 1 if the company reports under IFRS and 0 otherwise. *B4* = 1 if the firm is audited by big 4 and 0 otherwise. *MV* = natural log of market capitalisation. *MB* = market to book ratio measured by market capitalisation divided by total assets. *TDTA* = leverage measured by total debt divided by total assets multiplied by 100. *SHARES_CHANGE*: proportion change in number of common shares for the year. *GROWTH* = proportion change in sales for the year. *LAGLOSS* = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. *ROA* = return on assets measured as net income divided by average total assets multiplied by 100. *CFO_ABS* = Absolute value of cash flows from operations scaled by lagged of total assets. *CAC_ABS* = Absolute value of the lag of current accruals scaled by lagged of total assets. *YEAR*₂₀₀₃₋₂₀₀₇ = year dummies.

6. Robustness Checks

I have conducted a number of robustness and sensitivity checks as follows. Firstly, I have included utility companies to maximize the sample. However, some previous earnings management studies (e.g. Francis and Yu, 2009) exclude utilities firms due to their different accruals structure. Therefore, I have repeated the tests with the exclusion of utility companies. Secondly, while I have used three of the discretionary accruals measures to conduct the main tests, I have repeated the tests using the Jones model (Jones, 1991). In addition, while I used a minimum of

10 firms for each SIC-year combination as a condition for a firm to be included in the sample in the estimation stage of the discretionary accruals measures, I have repeated the tests using a minimum of 20 firms in each SIC-year combination. In addition, I have repeated the tests excluding year 2005 because the first year of IFRS adoption may be regarded as a transition period in which reported earnings may be affected by transitional changes. For all the above mentioned tests, results (untabulated²⁷) are

²⁷ All untabulated results are available upon request from the authors.

qualitatively similar to those reported in the paper which suggest that the results are robust to all the above mentioned robustness tests.

The second group of robustness checks I conducted is concerned with a number of econometric issues. For the discretionary accruals tests, the use of discretionary accruals as a dependent variable may raise issues for the normality assumption of ordinary least squares regression. Therefore, I have repeated the tests using the natural logarithm of discretionary accruals. Moreover, I have repeated the tests using the maximum likelihood random effects model for the same reason as this technique does not require normality. In the earnings benchmark tests, I used probit regression in the main tests because the dependent variable in these models is a dummy variable which takes a value of 0 and 1; I have repeated the earnings benchmark tests using logistic regression. For all the above mentioned tests, the

results (untabulated) are qualitatively similar to those reported in the paper.

In addition, the sample contained firm-year observations for UK listed firms and includes firms listed in the main market and AIM. I have repeated the tests with the inclusion of an additional control variable to control for the type of market on which the firm is listed and the results reported in table 18 are qualitatively similar to those reported in the paper. However, when I conducted separate tests for the main market and AIM subsamples (untabulated), the results show stronger relationship between earnings management and IFRS for the AIM subsample. This may be explained as a result of the initially higher levels of earnings management for AIM firms compared with main market firms, and I believe this research topic is worth further exploration.

Table 18. Profit Regression Results of Probability of Reporting a Small Profit and Small Increase in Profit

$EM = \beta_0 + \beta_1 ACC_STD_{i,t} + \beta_2 B4_{i,t} + \beta_3 MV_{i,t} + \beta_4 MB_{i,t} + \beta_5 TDTA_{i,t} + \beta_6 SHARES_CHANGE_{i,t} + \beta_7 GROWTH_{i,t} + \beta_8 LAGLOSS_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} CFO_ABS_{i,t} + \beta_{11} CAC_ABS_{i,t} + \beta_{12} TYPE_{i,t} + \beta_{13-17} YEAR_{2003-2007} + \mathcal{E}$		
	(1)	(2)
VARIABLES	Model	Model
	SMALL_POSITIVE	SMALL_INCREASE
ACC_STD	-0.269*** (-2.818)	-0.391*** (-3.210)
B4	0.067 (0.854)	-0.200** (-1.966)
MV	-0.004 (-0.160)	0.044 (1.624)
MB	-0.392*** (-5.094)	-0.175*** (-2.617)
TDTA	0.006*** (3.001)	-0.003 (-1.178)
SHARES_CHANGE	-0.613** (-2.219)	-0.064 (-0.194)
GROWTH	0.004 (0.101)	0.045 (1.150)
LAGLOSS	-0.136* (-1.693)	-0.794*** (-7.701)
ROA	0.014*** (6.772)	-0.001 (-0.589)
CFO_ABS	-2.775*** (-4.794)	-0.640 (-1.217)
CAC_ABS	-0.534 (-1.367)	-0.977* (-1.888)
TYPE	0.108 (1.095)	0.405*** (3.302)
Year dummies	Yes	Yes
Constant	-0.032 (-0.145)	-1.048*** (-3.892)
Observations	2620	2620
Pseudo R ²	0.1546	0.1234

Robust z-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Variable definitions:

SMALL_POSITIVE = 1 if reported net income deflated by lagged total assets between 0 and 5% and 0 otherwise.

SMALL_INCREASE = 1 if reported net income deflated by lagged total assets between 0 and 1% and 0 otherwise. ACC_STD

= 1 if the company reports under IFRS and 0 otherwise. $B4 = 1$ if the firm is audited by big 4 and 0 otherwise. MV = natural log of market capitalisation. MB = market to book ratio measured by market capitalisation divided by total assets. $TDTA$ = leverage measured by total debt divided by total assets multiplied by 100. $SHARES_CHANGE$: proportion change in number of common shares for the year. $GROWTH$ = proportion change in sales for the year. $LAGLOSS$ = dummy equals 1 if firm reported a loss in the previous year and 0 otherwise. ROA = return on assets measured as net income divided by average total assets multiplied by 100. CFO_ABS = Absolute value of cash flows from operations scaled by lagged of total assets. CAC_ABS = Absolute value of the lag of current accruals scaled by lagged of total assets. $TYPE = 1$ if the firm/year is listed on the London Stock Exchange main market and 0 if listed in London Stock Exchange AIM market. $YEAR_{2003-2007}$ = year dummies.

Using panel data sets always raise concerns regarding the reliability of results and possibilities of autocorrelation and heteroscedasticity. To test if the results are subject to this limitation, I have repeated the tests using the Newey-West regression with correction for first order autocorrelation and heteroscedasticity (used in Francis and Yu, 2009). Moreover, I used the two way clustering approach suggested by Petersen (2009) to obtain standard errors corrected for firm id and year. Some recent studies (e.g. Caramanis and Lennox, 2008) used truncated regression because discretionary accruals measures are truncated at zero. Therefore, I have repeated the tests using this type of regression and the results are qualitatively similar to those presented here. Overall, the results from the previously mentioned different estimation techniques suggest that the findings of this paper are not sensitive to a specific type of regression or estimation method.

Finally, regarding model specification, there is no agreement in accounting research on a specific set of control variables to be used either in the discretionary accruals tests or the earnings benchmark tests. Therefore, I have repeated the tests with the inclusion of total assets instead of market capitalisation. I have also tested the models by dropping return on assets because it has been argued that it may be affected by earnings management which could bias the results (McNichols, 2000). Moreover, I used current loss instead of lagged loss. The results are robust to these different model specifications.

7. Conclusions

The purpose of this study has been to test empirically (with a range of robustness checks) the effect of IFRS reporting on earnings management in the UK. I find that IFRS reporting has a mitigating effect on earnings management and that this mitigation effect is stronger for income decreasing earnings management than for income increasing earnings management; this is because of the relatively higher incentives to manage earnings upwards as compared to managing earnings downwards. I also find evidence that the effect of IFRS reporting on earnings management is conditional on audit quality.

The results reported in this paper agree with prior results of Barth et al (2008), Horton and Serafeim (2009), and Christensen et al.(2008) but disagree with the results reported in Van tendeloo and

Vanstraelen (2005), Jeanjean and Stolowy (2008), and Aussenegg et al.(2008). Given the limitations discussed in this paper, the results conclude that reporting via relatively higher quality accounting standards will result in lower levels of earnings management especially in cases of strong enforcement mechanisms as the case in the UK.

A significant assumption in the tests is that the incentives to manage earnings were constant under both UK GAAP and IFRS. However, it is worth noting that IFRS adoption could have led to a change in management incentives to manage earnings. For example, net income reported under IFRS has become more volatile and hence, the focus on managing the bottom-line net income may have changed. While testing this argument empirically lies outside the scope of the paper, it represents a potential extension to the current research.

The results of this paper have implications for earnings management research. Prior earnings management studies extensively use the absolute value of discretionary accruals as a measure of the combined effect of earnings management and use positive and negative discretionary accruals for robustness checks. The results reported in this study suggest that the effect of some variables can be different when comparing income increasing versus income decreasing earnings management. For example, I document a significant big four auditor effect on positive discretionary accruals but not for negative discretionary accruals. Therefore, there is evidence of the need to use separate tests for both directions of managing earnings.

This study has broader policy implications. The results suggest that reporting under IFRS results in significantly lower levels of earnings management and, therefore, better earnings quality. However, this improvement might be limited depending on firms' incentives to manage earnings and audit quality. The results compared reporting IFRS with reporting under UK GAAP. These results need to be generalised to other countries with caution as the effects of IFRS could be different from one country to the other depending on other factors such as the quality of enforcement or other corporate governance mechanisms.

The current work could be extended in a number of directions by future research. One possible area for future research is to examine whether the effect of IFRS reporting is conditional on auditor industry experience rather than just a big four/non big four quality variable. A second possible issue for

consideration is the analysis of individual IFRSs to check differences against local GAAP and determine if any differences allow for more or less earnings management. Thirdly, further research could test the effect of the mandatory adoption and reporting in other countries combined with investigating the enforcement of IFRS in these countries. Finally, further research could test differences between main market and AIM market with regard to IFRS adoption.

References

1. Ajona, I. A., dallo, f. L. & alegria, s. S. 2008. Discretionary accruals and auditor behaviour in code-law contexts: an application to failing spanish firms. *European accounting review*, 17, 641 - 666.
2. Ali, m. 2005. A synthesis of empirical research on international accounting harmonization and compliance with international financial reporting standards. *Journal of accounting literature*, 24, 1.
3. Armstrong, c. S., barth, m. E., jagolinzer, a. D. & riedl, e. J. 2010. Market reaction to the adoption of ifrs in europe. *Accounting review*, 85, 31-61.
4. Ashbaugh, h., lafond, r. & mayhew, b. W. 2003. Do nonaudit services compromise auditor independence? Further evidence. *Accounting review*, 78, 611-639.
5. Aussenegg, w., inwinkl, p. & schneider, g. T. 2008. Earnings management and local vs. International accounting standards of european public firms. *Ssrn eLibrary*.
6. Ball, r. 2006. International financial reporting standards (ifrs): pros and cons for investors. *Accounting & business research*, 36, 5-27.
7. Ball, r., robin, a. & wu, j. S. 2003. Incentives versus standards: properties of accounting income in four east asian countries. *Journal of accounting and economics*, 36, 235-270.
8. Ball, r. & shivakumar, l. 2008. Earnings quality at initial public offerings. *Journal of accounting and economics*, 45, 324-349.
9. Barth, m. E., landsman, w. R. & lang, m. H. 2008. International accounting standards and accounting quality. *Journal of accounting research*, 46, 467-498.
10. Becker, c. L., defond, m. L., jiambalvo, j. & subramanyam, k. R. 1998. The effect of audit quality on earnings management. *Contemporary accounting research*, 15, 1-24.
11. Brown, p. & tarca, a. 2005. A commentary on issues relating to the enforcement of international financial reporting standards in the eu. *European accounting review*, 14, 181-212.
12. Burgstahler, d. & dichev, i. 1997. Earnings management to avoid earnings decreases and losses. *Journal of accounting & economics*, 24, 99.
13. Caramanis, c. & lennox, c. 2008. Audit effort and earnings management. *Journal of accounting and economics*, 45, 116-138.
14. Christensen, h. B., lee, e. & walker, m. 2008. Incentives or standards: what determines accounting quality changes around ifrs adoption? *Ssrn eLibrary*.
15. Chung, h. & kallapur, s. 2003. Client importance, nonaudit services, and abnormal accruals. *Accounting review*, 78, 931-955.
16. Cohen, d. A. & zarowin, p. 2010. Accrual-based and real earnings management activities around seasoned equity offerings. *Journal of accounting and economics*, 50, 2-19.
17. Daniel, n. D., denis, d. J. & naveen, l. 2008. Do firms manage earnings to meet dividend thresholds. *Journal of accounting and economics*, 45, 2-26.
18. Deangelo, l. E. 1981. Auditor size and audit quality. *Journal of accounting and economics*, 3, 183-199.
19. Dechow, p. M., ge, w. & schrand, c. M. 2009. Understanding earnings quality: a review of the proxies, their determinants and their consequences. *Ssrn eLibrary*.
20. Dechow, p. M. & skinner, d. J. 2000. Earnings management: reconciling the views of accounting academics, practitioners, and regulators. *Accounting horizons*, 14, 235-250.
21. Dechow, p. M., sloan, r. G. & sweeney, a. P. 1995. Detecting earnings management. *The accounting review*, 70, 193.
22. Defond, m. L. & jiambalvo, j. 1994. Debt covenant violation and manipulation of accruals. *Journal of accounting and economics*, 17, 145-176.
23. Degeorge, f., patel, j. & zeckhauser, r. 1999. Earnings management to exceed thresholds. *The journal of business*, 72, 1.
24. Dennis, i. 2008. A conceptual enquiry into the concept of a 'principles-based' accounting standard. *The british accounting review*, 40, 260-271.
25. Francis, j. R. & dechun, w. 2008. The joint effect of investor protection and big 4 audits on earnings quality around the world. *Contemporary accounting research*, 25, 157-191.
26. Francis, j. R. & yu, m. D. 2009. Big 4 office size and audit quality. *Accounting review*, 84, 1521-1552.
27. Frankel, r. M., johnson, m. F. & nelson, k. K. 2002. The relation between auditors' fees for nonaudit services and earnings management. *Accounting review*, 77, 71.
28. Goncharov, i. & zimmermann, j. 2006. Do accounting standards influence the level of earnings management? Evidence from germany. *Ssrn eLibrary*.
29. Gore, p., pope, p. F. & singh, a. K. 2007. Earnings management and the distribution of earnings relative to targets: uk evidence. *Accounting & business research*, 37, 123-149.
30. Graham, j. R., harvey, c. R. & rajgopal, s. 2005. The economic implications of corporate financial reporting. *Journal of accounting and economics*, 40, 3-73.
31. Gul, f. A., fung, s. Y. K. & jaggi, b. 2009. Earnings quality: some evidence on the role of auditor tenure and auditors' industry expertise. *Journal of accounting and economics*, 47, 265-287.
32. Horton, j. & serafeim, g. 2009. Market reaction to and valuation of ifrs reconciliation adjustments: first evidence from the uk. *Review of accounting studies*.
33. Hribar, p. & collins, d. W. 2002. Errors in estimating accruals: implications for empirical research. *Journal of accounting research*, 40, 105-134.
34. Hribar, p. & nichols, d. C. 2007. The use of unsigned earnings quality measures in tests of earnings management. *Journal of accounting research*, 45, 1017-1053.
35. Iatridis, g. 2010. IFRS adoption and financial statement effects: the UK case. *International research journal of finance and economics*, 38, 165-172.
36. Jeanjean, t. & stolowy, h. 2008. Do accounting standards matter? An exploratory analysis of earnings management before and after ifrs adoption. *Journal of accounting and public policy*, 27, 480-494.

37. Jones, j. 1991. Earnings management during import relief investigations. *Journal of accounting research*, 29, 193-228.
38. Kothari, s. P., andrew, j. L. & charles, e. W. 2005. Performance matched discretionary accrual measures. *Journal of accounting & economics*, 39, 163.
39. Lim, c.-y. & tan, h.-t. 2008. Non-audit service fees and audit quality: the impact of auditor specialization. *Journal of accounting research*, 46, 199-246.
40. Lim, c.-y. & tan, h.-t. 2010. Does auditor tenure improve audit quality? Moderating effects of industry specialization and fee dependence. *Contemporary accounting research*, 27, 923-957.
41. Maijor, s. & vanstraelen, a. 2006. Earnings management within europe: the effects of member state audit environment, audit firm quality and international capital markets. *Accounting and business research*, 36, 33.
42. McNichols, m. F. 2000. Research design issues in earnings management studies. *Journal of accounting and public policy*, 19, 313-345.
43. Earnings management using classification shifting: an examination of core earnings and special items, 2006. Article. Directed by mcvay, s. E.: american accounting association.
44. Myers, j. N., myers, l. A. & omer, t. C. 2003. Exploring the term of the auditor-client relationship and the quality of earnings: a case for mandatory auditor rotation? *Accounting review*, 78, 779-799.
45. Nelson, m. W. 2003. Behavioral evidence on the effects of principles- and rules-based standards. *Accounting horizons*, 17, 91-104.
46. Nelson, m. W., elliot, j. A. & tarpiey, r. L. 2002. Evidence from auditors about managers' and auditors' earnings management decisions. *Accounting review*, 77, 175.
47. Nobes, c. 2009. The importance of being fair: an analysis of ifrs regulation and practice - a comment. *Accounting & business research*, 39, 415-427.
48. Nobes, c. W. 2005. Rules-based standards and the lack of principles in accounting. *Accounting horizons*, 19, 25-34.
49. Peasnell, k. V., pope, p. F. & young, s. 2000. Detecting earnings management using cross-sectional abnormal accruals models. *Accounting and business research*, 30, 313.
50. Peasnell, k. V., pope, p. F. & young, s. 2005. Board monitoring and earnings management: do outside directors influence abnormal accruals? *Journal of business finance & accounting*, 32, 1311-1346.
51. Petersen, m. 2009. Estimating standard errors in finance panel data sets: comparing approaches. *Review of financial studies*, 22, 435.
52. Schipper, k. 2005. The introduction of international accounting standards in europe: implications for international convergence. *European accounting review*, 14, 101-126.
53. Schipper, k. & vincent, l. 2003. Earnings quality. *Accounting horizons*, 17, 97-110.
54. Soderstrom, n. & sun, k. 2007. Ifrs adoption and accounting quality: a review. *European accounting review*, 16, 675-702.
55. Teoh, s. H., welch, i. & wong, t. J. 1998. Earnings management and the underperformance of seasoned equity offerings. *Journal of financial economics*, 50, 63-99.
56. Van tendeloo, b. & vanstraelen, a. 2005. Earnings management under german gaap versus ifrs. *European accounting review*, 14, 155-180.
57. Young, s. 1999. Systematic measurement error in the estimation of discretionary accruals: an evaluation of alternative modelling procedures. *Journal of business finance & accounting*, 26, 833-862.

TECHNICAL TRADING REVISITED: EVIDENCE FROM THE ASIAN STOCK MARKETS

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Abstract

We examine the forecasting power and profitability of moving average (MA) and trading range break (TRB) rules for the daily prices of ten Asian stock indices from January 1990 to September 2012 using bootstrap tests. The results confirm the predictive ability of MA rules whereas the picture uncovered by the TRB rules is more mixed. The MA rules consistently generate positive excess returns after transaction costs, with highest magnitudes often achieved for less developed markets. However, more developed markets surprisingly seem to be far from informationally efficient as well. Furthermore, short-term variants of the trading rules outperform systematically long-term variants.

Keywords: Technical Trading Rules, Moving Averages, Trading Range Break, Bootstrap Tests, Asian Stock Markets

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1. Introduction

Technical analysis may be simply defined as a variety of methods which aspire to predict the price movements of financial instruments based on historical data. Technical analysts aim at identifying trends at an early stage and maintaining their positions until they see signs of a trend reversal. However, if price trends could be exploited profitably by means of technical analysis, the Efficient Market Hypothesis (EMH) established by Fama (1970) would be violated. This hypothesis states that prices on efficient capital markets fully reflect all information and adjust immediately to new information arrivals. Furthermore, Fama (1970) subclassifies three forms of efficiency: the weak form, in which the information set comprises only historical capital markets data; the semistrong form, in which the information set includes all publicly available information; and the strong form, in which the information set extends to all available information. Therefore, if market participants could deploy profitably technical trading rules, efficiency is not inherent in capital markets even in its weak form. Due to its neglect of the EMH, the perception of technical analysis in the academic world tends to be rather lukewarm. However, the studies of Taylor and Allen (1992) and Menkhoff and Taylor (2007) show the prominent position it possesses in investment practice.

Park and Irwin (2007) review the international evidence on the profitability of technical analysis and show that extant studies are not able to provide conclusive evidence advocating the benefits of technical trading strategies. More specifically, out of 95 considered studies published in the period between 1960 and 2004, 56 studies find positive results regarding technical trading strategies, 20 studies obtain negative results, and 19 studies provide mixed results. As the seminal study of Brock et al. (1992) dates back 20 years, we intend to test whether the rules described in their paper do still exhibit predictive power although being well-known and examine for this purpose ten Asian stock indices.

Probably the most popular contribution in the area of Asian markets can be assigned to Bessembinder and Chan (1995). Their results show that moving average (MA) and trading range break (TRB) rules are quite successful in the emerging markets of Malaysia, Thailand and Taiwan. In contrast, they exhibit less explanatory power in more developed markets such as

Hong Kong and Japan in the period between 1975 and 1989. The results of Harvey (1995a) and Harvey (1995b) that compare expected returns and volatility levels across markets document that returns are more predictable in emerging than in developed markets. A number of studies test the random walk hypothesis for Asian markets and establish inter-temporal predictability which can be exploited by sophisticated

investors. Lima and Tabak (2000) reject the random walk hypothesis for Singapore and Chinese Class B shares for a sample period from 1992 through 2000. A mean-reverting behavior is observed by Nam et al. (2003) for nine markets in the Pacific basin from 1982 and 1999. Hoque et al. (2007) show that the stock markets of Indonesia, Malaysia, the Philippines, Singapore and Thailand exhibit a significant mean-reverting and predictable behavior from 1990 to 2004 while Taiwan and Korea are characterized by largely unpredictable patterns.

The debate on the predictability of returns has also triggered a substantial amount of empirical research on the performance of technical trading rules in Asian markets. We review these studies and show that the question about the sustainable profitability of technical trading in this region remains still open. Overall, it appears that technical analysis is more attractive in emerging than in developed markets but its predictive power and economic exploitability seem to diminish in the course of time. Therefore, it is of interest to examine whether the attractiveness of technical analysis continues to hold for most recent sample periods. A variety of financial instruments is available to implement such simple trading strategies as we propose. Equity index futures exist at least for the “more developed” markets in our sample and meanwhile, Exchange Traded Funds which track the performance of all markets under consideration are accessible for foreign investors.

Our study contributes to the existent literature with an analysis whether technical analysis possesses forecasting power which can be economically exploited in terms of excess returns above buy-and-hold by applying the trading rules of Brock et al. (1992) and Bessembinder and Chan (1995) to a very recent, broad sample of ten popular Asian stock indices. Moreover, since we employ data from January 1990 to September 2012, we extend the existing literature by examining a sample period spanning the various financial crises of the new millennium. To assess the significance of the attained results, bootstrap tests are applied. The profitability of the trading rules is evaluated by taking transaction costs into account. To avoid data-snooping concerns emerging from potential non-synchronous trading, we also report results obtained with the one-day lag adjustment proposed by Bessembinder and Chan (1995).

The paper is arranged as follows: Section 2 reviews the literature on technical trading tests in Asian markets. Section 3 presents the sample, the trading rules and employed methods of analysis. The empirical results are presented in Section 4, followed by a discussion and comparison with extant studies (Section 5). The final section concludes.

2. Literature Review

In the following, the focus is set on results based on a methodology similar to that of Brock et al. (1992) and Bessembinder and Chan (1995) and data from Asian

markets²⁸. The research in this domain can be broadly divided into two subgroups according to whether transaction costs are taken into account in the analysis or not. To begin with studies focusing on the predictive ability of technical trading rules without implications for their profitability, Gunasekarage and Power (2001) apply variable length moving average (VMA) rules and fixed length moving average (FMA) rules to the market indices of India, Sri Lanka, Bangladesh and Pakistan for the period from 1990 to 2000 and show that they have predictive ability with India exhibiting the lowest performance, probably due to being the largest market in the region. Wong et al. (2003) confirm that MA rules can be used to generate significantly positive returns with the Singapore equity index market between 1974 and 1994. Chang et al. (2006) present evidence that various VMA, FMA and TRB rules applied to the Taiwan equity index market from 1983 to 2002 exhibit pronounced predictive power. McKenzie (2007) tests VMA, FMA and TRB rules for 17 emerging markets (seven of which Asian) over the period of 1986 to 2003. His results show that some of the trading rules considered are able to earn significant returns but the forecasting accuracy decreases for more recent sample periods.

It becomes obvious that research not accounting for profitability of trading rules for the most part confirms the existence of predictive patterns which can be uncovered with simple trading rules. A number of studies extend the analysis by taking transaction costs into account. However, they contribute to the discussion whether any potential patterns in past price information can be used to generate profits for Asian markets with contradictory results.

Starting with studies which confirm the profitability of technical trading, Ito (1999) applies the same set of technical rules as Brock et al. (1992) to the Japanese, US, Canadian, Indonesian, Mexican and Taiwanese equity indices over the period from 1980 to 1996 documenting the stronger forecast power for emerging than for developed markets where trading rules remain profitable relative to the buy-and-hold strategy after transaction costs. Ahmed et al. (2000) establish that emerging markets have predictable and economically profitable patterns using VMA rules for Taiwan, Thailand, and the Philippines from 1994 to 1999. Tian et al. (2002) provide support for the profitability of VMA, FMA and TRB rules for the Chinese stock market from 1992 to 2000. Lai et al. (2003) show that the predictability of technical trading rules can be translated into profits for the equity index market in Malaysia from 1977 to 1999. Lam et al. (2007) apply VMA, FMA and TRB rules to the Hang Seng Index (Hong Kong) from 1972 to 2006 and show that average returns remain high after transaction costs

²⁸ Further studies treating momentum, contrarian portfolio strategies or order submission behavior when conducting technical trading investments in Asia can be found in Hameed and Kusunadi (2002), Hameed and Ting (2000) and Wang et al. (2012), respectively

but the considered trading rules work better before 1986. Ming-Ming and Siok-Hwa (2006) observe that VMA, FMA and TRB rules offer many profit opportunities for market participants in eight Asian markets from 1988 to 2003, but consistent with market efficiency, the moving averages rules have less or no value in the more developed Japanese stock market. Finally, Lento (2007) tests VMA, FMA, TRB and filter rules for Australia, India, Indonesia, Korea, Japan, Hong Kong, Singapore and Taiwan from 1987 to 2005 and demonstrate that profits can be generated especially in the markets of India, Hong Kong, Indonesia, Korea, Singapore, and Taiwan.

In contrast, a large number of further studies reject the profitability of trading rules for Asian equity markets. Following the results of Bessembinder and Chan (1995), Ratner and Leal (1999) examine VMA rules in ten emerging Latin American and Asian stock markets from 1982 to 1995 and find that the VMA trading rules may be profitable in Taiwan, Thailand and Mexico but nowhere else. Coutts and Cheung (2000) apply moving average oscillator and TRB rules to the Hong Kong equity index market for the period from 1985 to 1997 showing that transaction costs eliminate any abnormal returns. Similar conclusions are drawn by Chang et al. (2004) for the case of VMA and TRB rules applied to 11 markets (9 of them Asian) from 1991 through 2004. Furthermore, Cai et al. (2005) use VMA and TRB rules for the US, the UK, Japan, Hong Kong, and China from 1969 to 2003 and establish that they have predictive ability and profitability during the 1970's but that this ability has largely disappeared by the 1990's. Chen et al. (2009) investigate the potential effects data snooping can have on trading rules and argue that after accounting for transaction costs and a non-synchronous trading bias, economic profits are unlikely to be earned for all markets under consideration (Hong Kong, Indonesia, South Korea, Malaysia, Singapore, Taiwan, Thailand, and Japan) from 1975 to 2006. Lastly, Yu et al. (2013) explore whether VMA, FMA and TRB rules can outperform a simple buy-and-hold strategy after adjusting for transaction costs from 1991 to 2008 in the case of Malaysia, Singapore, Thailand, Indonesia, and the Philippines. Their results show that even if technical trading is slightly profitable in Thailand, there is no evidence of profitability in any of the other markets and the average additional returns generated by the trading signals decrease in the course of time.

To sum up, the discussion about the economic benefits of applying simple technical trading rules to Asian markets, especially after taking transaction costs into account, is still open. Overall, technical trading rules prove to be more attractive in emerging than in developed markets but their predictive power and profitability appear to diminish with the advancing market development in recent years. Moreover, none of the presented studies includes the period after 2008 following the global financial crisis. The current paper fills this void and addresses the ongoing debate with

most recent data for ten Asian countries.

3 Data and methodology

3.1 Stock Indices

The market indices examined in this study are the Hang Seng Index for Hong Kong, the Jakarta Composite Index for Indonesia, the Korea Composite Stock Index for South Korea (in the following referred to as Korea), the Kuala Lumpur Composite Index for Malaysia, the Taiwan Stock Exchange Capitalization Weighted Stock Index for Taiwan, the Stock Exchange of Thailand Index for Thailand, the Bombay Stock Exchange Sensitive Index for India, the Karachi Stock Exchange 100 Index for Pakistan, the Colombo Stock Exchange Price Index for Sri Lanka and the Tokyo Stock Price Index for Japan. The sample includes the period from January 1, 1990 to September 30, 2012. The data were obtained from Datastream.

Table 1 contains summary statistics for one-day returns for these indices showing that the sample covers assets with very different characteristics in terms of return and price variation over time. The mean returns for all markets except Japan and Taiwan are positive. The Korean stock market is the most volatile during the sample period under consideration, followed by India and Taiwan.

3.2 Methodology

The term technical analysis is an umbrella for literally hundreds of different rules and concepts. Practitioners depending on these rules for their investment decisions are almost certainly going to use a combination of various rules or will not solely rely on technical analysis (see Taylor and Allen 1992). Therefore, the methodology we use in this study is rather basic as we only look at variable length moving averages and trading range breaks. Although practitioners may accuse us of being too simplistic, the intention of this paper is not to optimize combinations of trading rules but to test whether a set of well-known and well-researched basic rules is able to outperform a buy-and-hold strategy. Furthermore, as we limit our rules to the sets of researchers like Brock et al. (1992) and Bessembinder and Chan (1995), we are able to directly compare our results with the existing literature.

Our set of moving average rules comprises cross-over systems. Cross-over systems need an input of at least two moving averages of different lengths of the price series. Buy (sell) signals are generated whenever the short moving average (SMA) crosses the long moving average (LMA) from below (above). To take so-called whiplashes into account, a percentage band around the long moving average may be used. The term whiplash refers to the tendency of the SMA to cross the LMA multiple times before a significant trend is established. Using bands means that the signal is not generated when the LMA is crossed but when the upper band is crossed from below

(Buy signal) or the lower band from above (Sell signal). We run our tests with SMA of 1, 2 and 5 days, LMA of 50, 150 and 200 days and bands of 0% and 1%, resulting in a total of 18 rules.

The second type of rules is trade range breaks. The basic idea is that price series of financial instruments tend to form certain levels of support to the downside and resistance to the upside. A support level is interpreted as a price where strong demand for the assets sets in, probably because investors perceive it to be a cheap buy at that price. This demand pushes the price upwards. If the price happens to fall below the support level, technical analysts expect a further depreciation of the price and interpret this as a Sell signal. Within our set of rules the support level is given by the lowest price observed over a specified time span of t days with $t = 25, 50, 100, 150, 200$. Therefore, a Sell signal is generated whenever the current price drops below the lookback period's lowest price. The reasoning for the resistance levels goes along the same line. Once the price is approaching the resistance level, a strong selling pressure, that is an increased supply of assets, starts. Technical analysts argue that investors show a tendency to break even, therefore all those who bought at or near the up-to-now highest price try to sell to prevent losses in case of depreciating prices. If this selling pressure is overcome and the price rises above the resistance level, this is interpreted as a strong Buy signal. We use the highest prices over the last 25, 50, 100, 150 and 200 days as resistance levels.

A critical point when implementing a technical system is the time span between the signal generation and the actual trade. Given the current technological situation, it can be assumed that an investor is able to react immediately whenever a signal occurs. However, one may argue that time gaps between signal and trade execution can arise due to technological deficiencies, especially in emerging markets, or simply because the investor needs some time to update his rules. We therefore also check the performance of the rules when considering a lag of one trading day before an order is executed.

Any discussion of technical analysis would be incomplete without further insights into the profitability of the systems. An even weakly efficient market would rule out any successful application of technical analysis. This does not mean that an investor loses money by using technical rules but he would not be better off than by simply using a buy-and-hold strategy. Therefore, we take the buy-and-hold strategy as benchmark to test whether technical analysis is profitable or not. The investor is assumed to go long the market when a Buy signal is in effect and to short the market when a Sell signal appears. It should be stressed that this is just one possibility of how to implement a trading strategy. Furthermore, we assume that each order leads to transaction costs of 0.1 %, a figure that seems reasonable even for rather small investors. Having defined the strategy this way, the adjusted excess return (AER) is computed as

follows:

$$AER = \sum_{i=1}^{N_B} r_{B,i} - \sum_{j=1}^{N_S} r_{S,j} - \sum_{t=1}^N r_t - 2 \cdot (S_B + S_S) \cdot C^{TAC} \quad (1)$$

In equation (1), $r_{B,i}$ and $r_{S,j}$ are Buy and Sell returns while N_B , N_S and N are the Buy days, Sell days and total number of days ($N_B + N_S = N$), respectively. Therefore, the third term on the right-hand side of the equation is just the buy-and-hold return which is our benchmark. S_B and S_S are the numbers of Buy and Sell signals, C^{TAC} are the transaction costs. We double the number of signals to calculate the total transaction costs because a signal leads to the closing of the existing position, for example exiting the long position, and to the opening of a new position, for example a short position.

To test the statistical significance of the obtained results, we use a bootstrap methodology. The basic methodology was developed by Efron and Tibshirani (1986) and, in the field of technical analysis, was also applied in the study by Brock et al. (1992), for example. The bootstrap helps to overcome some shortfalls of traditional t-tests because it does not demand normally distributed returns, which is rather doubtful for our sample as Table 1 indicates,

and independent samples. The original return series is resampled by randomly drawing with replacement. This creates new time series of returns in which dependencies among the original returns are likely to be destroyed. The rule used to create the bootstrap samples is basically the random walk model of stock prices.

Afterwards, the trading rules are applied to the bootstrap sample. By comparing the results with those of the original series, it is possible to derive a simulated p -value or an approximated achieved significance level. If the rules perform as well for the bootstrap samples as for the original data set, the results would be deemed not significant. As in Efron and Tibshirani (1993), the achieved significance level (ASL) is computed as:

$$ASL = \frac{\#\{t(S^{*i}) \geq t(S)\}}{B}, \quad i = 1, \dots, B, \quad B = 1000, \quad (2)$$

with t being the statistic of interest, for example the return for Buy periods.

4. Results

The results for the trading rules are given in tables 2 to 9. All tables are structured as follows. Results for mean Buy and Sell returns across the relevant trading rules are displayed in the columns labelled as \bar{r}_B and \bar{r}_S . The standard deviations of the Buy and Sell returns are presented in the columns labelled σ_B and σ_S , respectively. AER is the adjusted excess return, as defined in equation (1). Sig denotes the number of trading signals. The statistical significance of the

results from each rule is assessed using a bootstrapping methodology with 1 000 samples. The values in parentheses below each value of mean returns, standard deviations and adjusted excess returns denote the percentage of the bootstrap samples which achieved a value higher than that of the trading rule applied to the original price time series.

4.1 MA Rules

The MA rules differ by the length of the short and long period and by the size of the band. For example, the notation (1,50,0) implies that the SMA period is one day, the LMA is calculated over 50 days, and the band is zero percent. We report the results for all 18 rules separately if an order is executed on the same day when a signal is generated. When the order is executed one day later, the rules with the same LMA and band are grouped together and only average values are presented, in order to save space²⁹. This approach results in six categories, with (50,0) for example denoting mean values of the tests obtained with SMA periods of 1, 2 and 5 days and a band of 0%.

To start with the case of the simultaneous generation and execution of trading signals, it becomes obvious that the moving average rules have a strong forecasting power. Across all countries, the difference between mean Buy and mean Sell returns is positive without exception. The statistical significance of $\bar{r}_B - \bar{r}_S$, however, varies across the individual markets. All 18 trading rules are significant at the 5 % level for Pakistan, Indonesia, Malaysia and Sri Lanka. 16 (15) rules are significant at the 5 % level while the remaining 2 (3) are significant at the 10% level for Korea (Hong Kong). For the remaining markets, the results are slightly more ambiguous. Taiwan, Thailand, Japan and India have 7, 6, 9 and 12 (12, 10, 12 and 13) rules significant at the 5 % (10 %) level, respectively. The insignificant results are obtained mostly with a LMA of 200 whereas when the LMA is based on the prices over the last 50 trading days, the trading rules provide significant results in all but one case – (5, 50, 1) for Japan. This holds for both trading with a band of 1% or without a band. The results also show that with the exception of just a few combinations in the Thai and Japanese market, there is a negative mean return when Sell signals are in effect. Therefore, the technical trading rules not only separate days of higher and lower returns but are able to point out periods of falling prices.

The standard deviations of the Buy periods are significantly lower than those of the Sell periods with p-values of 0.000 in most of the cases. This means that no bootstrapped series' standard deviation exceeds the one of the original series. Obviously, the trading rules are able to identify periods of low volatility with Buy signals indicating that the obtained positive returns are not to be interpreted as a compensation for bearing risk. This is consistent with the results of Brock et al. (1992). Only exception is the stock index market of Sri

Lanka for which the hypothesis that the standard deviations of the Buy periods are significantly lower than of Sell periods is rejected for all 18 rules. For LMA periods of 50 days, σ_B and σ_S have a very similar magnitude while for all other rules σ_B is much higher than σ_S . This discrepancy to all other markets may be due to the fact that the daily returns in Sri Lanka are much less volatile compared to all other considered markets (Table 1).

We next address the degree to which traders using MA rules could have earned trading profits in excess of the buy-and-hold strategy after transaction costs. The analysis uncovers a picture consistent with the results on general forecasting power. All 18 trading rules are significantly profitable at the 5% level for Pakistan, Indonesia, Malaysia and Sri Lanka. All MA rules for Korea and Hong Kong are significantly profitable at the 10% level and the AERs of the remaining countries are mixed. Taking a closer look, there is a strikingly clear pattern: The predominant portion of profits is achieved with a LMA period of the shortest length, 50 days. For this set of rules, negative AERs are documented only for India. Overall, it holds that the shorter the length of SMA and LMA periods, the higher the number of trading signals, with trading rules of a 1% band exhibiting a lower number of signals than their counterparts without a band. Nevertheless, the rules with LMA of 50 days generate profits after trading costs of the highest magnitude and significantly outperform the buy-and-hold position in most of the cases whereas the lowest AERs are often obtained with the rules with LMA period of 200 days.

When undertaking a comparison with the results obtained with a lag of one day, it becomes clear that the strategies with a one-day lag, which might be necessary due to delays in trading, reduce but does not eliminate the predictive power of the technical rules. The difference $\bar{r}_B - \bar{r}_S$ remains positive on average for all countries, but for the (200,0) set of rules applied to the Indian stock market. Again, the standard deviations of the Buy periods are significantly lower than those of the Sell periods, except for Sri Lanka. Most importantly, even though of a lower magnitude, the average AERs of Pakistan, Indonesia, Malaysia and Sri Lanka (Korea and Hong Kong) remain significant at the 5% (10 %) level. Thailand, Taiwan and India still offer profitable opportunities with the sets of (50,0) and (50,1) trading rules. Japan is an exception only being profitable at the 10 % level for the (150,0), on average.

4.2 TRB Rules

The results of the trade range break rules are reported in Tables 7, 8 and 9. Five different lookback periods with immediate order execution and a one day lag are investigated. The column labelled "Rule" gives the number of days in the lookback period (25, 50, 100, 150 or 200). The rest of the tables is organized as described above.

In general, we find the results for the TRB to be

²⁹The complete results are available upon request

mixed and their performance inferior to the MA rules. Although the difference between the mean Buy return and the mean Sell return is positive for all tested combinations with the exception of India (two rules) and Taiwan (three rules), the bootstrap significance level is much lower than for the MA. For nine out of ten markets, the short lookback periods of 25 or 50 days perform the best, the exception being Japan where we obtain the best results for the 200 days lookback period. Furthermore, the shortest lookback periods lead often to the only significant results at the 5 % or 10 % level, only Sri Lanka and Pakistan show a 1% significance for all rules. Even though the results are less pronounced for the TRB than for the MA rules, it is obvious that those rules that work with short-term market trends show the highest predictive power in the Asian markets. In contrast to the MA rules, TRB Sell periods do not always result in negative mean returns. Hong Kong, Korea and India exhibit positive mean Sell returns. On the other hand, four out of ten rules for the Japanese market exhibit negative mean Buy returns. That means these TRB rules are not able to reverse the negative tendency of the Japanese stock market that can be deducted from the negative unconditional mean return given in Table 1.

As for the MA rules, standard deviations during Buy periods tend to be lower than for Sell periods except for Sri Lanka where it is the other way round and India where we do not find much of a difference between Buy and Sell standard deviations. Again, this indicates that higher returns on Buy days do not come at the cost of taking a higher risk.

Taking a closer look at the profitability of the TRB rules gives a mixed picture. Overall, the 25 and 50 days lookback periods tend to be the most profitable combinations, sometimes being the only rules that are able to beat the buy-and-hold strategy we use as benchmark. Profitability is especially poor for the markets in Hong Kong (only one profitable rule out of ten) and India (two profitable rules). On the other hand, the market of Sri Lanka is not only very profitable for all of the TRB rules, but these profits are also significant at the 1 %-level. The rules are significantly profitable in Pakistan, Malaysia (except for 200 days), Thailand (except for 150 days) and Indonesia (except for 200 days), too. For Taiwan and Korea, the TRB rules with 25, 50 and 100 days work quite well, yielding AERs of almost 400% in the case of Taiwan. However, the longer the lookback period, the more the AERs and the significance deteriorate. One should also note that the Japanese market exhibits extremely high AERs as well, with magnitudes ranging from 150% to 300% above buy-and-hold. However, only five AERs are significant at the 10%-level when we test with the bootstrap, probably due to the long-lasting bear market in Japan.

With very few exceptions (lookback periods of 25 days for Malaysia and of 200 days for Japan and Thailand) the lagged rules' performance does not match that of the rules that are immediately executed,

no matter if we look at the predictive power measured by $r_B - r_S$ or at the AERs. The same is true for the significance of the results. In the case of Hong Kong and India, a lag of one day between signal and trade leads to no rule showing positive AERs any more. Although some of the profits are lost in most markets, even when considering the time lag we still find especially the short rules to show predictive power and positive AERs. AERs of around 400 % can be found in Taiwan, Indonesia and Thailand. Japan, Pakistan, Sri Lanka and Malaysia all show around or more than 250% for the shortest rule. Although the Korean market trails the seven markets just mentioned, we still record AERs of 100% to 150 % for 50 and 100 day lookback periods. Therefore the argument that non-synchronous trading eliminates the usefulness of technical trading rules cannot be supported for most of the Asian markets in the TRB case with short lookback periods.

5. Discussion

Based on a very recent sample spanning almost 23 years, our results confirm the conclusions of Bessembinder and Chan (1995) that technical trading rules have predictive power for changes in Asian stock market indices from 1975 to 1989 which indicates that these markets remain informationally inefficient, even 20 years later. This result is at odds with the studies for example of Cai et al. (2005) and Yu et al. (2013) who argue that the short term predictive ability and profitability of Asian markets diminishes with the course of time. Furthermore, our findings also contradict to Chang et al. (2004) and Yu et al. (2013), who conclude that transaction costs tend to eliminate the trading profits implying weak form efficiency in most Asian stock markets. Our results show that the predictability of technical trading rules can be translated into significant excess returns after taking trading costs into account even for developed markets like Japan. In addition, sophisticated traders may have earned significant profits in the markets under consideration even during the last two decades which are doubtlessly marked by a distinctive liberalization. Furthermore, we confirm the results of Bessembinder and Chan (1995) and Ito (1999) that the significant forecast power of the trading rules is not completely eliminated by accounting for potential delays in trading. For our sample, it still holds that executing Buy and Sell orders with one day lag exhibits a pronounced forecast power and leads to statistically significant profits, especially with shorter-term rules.

The existence of a specific set of rules which consistently outperforms the buy-and-hold strategy is a further issue of controversy in existing literature. Our findings differ from those of McKenzie (2007) who argues that no trading rule systematically has a significant forecasting accuracy. For our broad and very recent sample, rules with a LMA period of 50 days consistently outperform all other rules, especially in terms of AER, while TRB rules of the shortest lookback periods perform the best. Thus, our results are more in

line with Cai et al. (2005), Lam et al. (2007) and Yu et al. (2013) who document that the short-term variants of the trading rules have better predictive ability than their longer-term counterparts. In addition, our results support the prevailing belief that on average TRB rules tend to perform worse than MA trading rules (e.g. Chang et al., 2004, Ming-Ming and Siok-Hwa, 2006 Lam et al., 2007). A reason for the underperformance of the TRB rules may be that they detect upward and downward trends later than the MA rules do. An upward trend, for example, may start way below the price used as resistance level. The Buy signal, however, is only generated when the highest price of the lookback period is exceeded. When the MA crossover appears below that the resistance level, the MA rules have a good chance to outperform the TRB rules.

Although our results indicate that technical analysis is more profitable in less developed markets like Pakistan, Sri Lanka and Indonesia, we do obtain good results for developed markets like Hong Kong, Taiwan, Korea and Japan as well, even though less significant in the case of Japan. The better results in the emerging markets may be due to inefficiencies in the information processing in these countries. However, the profits obtained by using very simple and well-known trend-following rules based on historic prices in rather developed markets are a contradiction to the Efficient Market Hypothesis and are at odds with newer studies like Cai et al. (2005), Lento (2007), and Ming-Ming and Siok-Hwa (2006). Even though it is difficult to name one reason to explain this phenomenon with certainty, the ever growing use of algorithmic trading devices in today's markets may be a driving force behind the pronounced market trends we witnessed over the last two decades. Computer-based trading systems seem to amplify and prolong existing trends, and this leads to the successful application of technical analysis as is the case for the Asian markets we research.

6. Conclusion

This study investigates whether simple moving average and trading range break rules can forecast stock index movements and outperform a simple buy-and-hold strategy after adjusting for transaction costs over the period from January 1990 to September 2012. Although we use rather simple rules without optimizing the parameters, we are able to show that technical trading rules have predictive power in various Asian stock markets. Furthermore, this forecasting power can be exploited by implementing a long-short strategy that beats a buy-and-hold investor even when transaction costs and non-synchronous trading are taken into account. A very remarkable point in favor of the technical rules is that, with the exception of Sri Lanka, they identify periods of above-average returns without simultaneously raising the level of risk. Just the other way round, an investor

who enters the market on Buy signals can expect a lower standard deviation than a buy-and-hold investor. Thus, our results confirm that the findings of Bessembinder and Chan (1995) still hold in very recent sample periods. We also document that for our sample, the short-term variants of the technical trading rules are consistently more useful in predicting stock price movements than their long-term counterparts. MA rules with a long moving average period of 50 days consistently outperform all other rules, especially in terms of adjusted excess returns. TRB rules of the shortest lookback periods perform the best, with the TRB rules being generally less predictive and profitable than the MA rules. Considering that the highest excess returns are not widely and arbitrarily spread over the different rules across the countries under consideration provides evidence, along with the conducted bootstrap tests, that there is a distinctive pattern which can be successfully exploited by the participants in these markets. This result may have significant economic implications.

Although we often find the highest adjusted excess returns in emerging markets, developed markets like Taiwan, Korea and Japan seem to be far from being informationally efficient. This is a rather surprising result of our study as one would expect technical analysis to lose its predictive power the more technologically advanced the market is. In fact, faster means of communication may indeed favor the use of technical analysis as algorithmic trading intensifies trends. If this is the case, markets may never be fully efficient and there will be a chance to exploit this inefficiency even with the simple rules used in this paper.

References

1. Ahmed, P., Beck, K. and Goldreyer, E. (2000), "Can moving average technical trading strategies help in volatile and declining markets? A study of some emerging Asian markets", *Managerial Finance*, Vol. 6, pp. 49-62.
2. Bessembinder, H. and Chan, K. (1995), "The profitability of technical trading rules in the Asian stock markets", *Pacific-Basin Finance Journal*, Vol. 3, pp. 257-284.
3. Brock, W., Lakonishok, J. and LeBaron, B. (1992), "Simple technical trading rules and the stochastic properties of stock returns", *The Journal of Finance*, Vol. 47, pp. 1731-1764.
4. Cai, B., Cai, C. and Keasey, K. (2005), "Market efficiency and returns to simple technical trading rules: Further evidence from U.S., U.K., Asian and Chinese stock markets", *Asia-Pacific Financial Markets*, Vol. 12, pp. 45-60.
5. Chang, E.J., Lima, E.J.A. and Tabak, B.M. (2004), "Testing for predictability in emerging equity markets", *Emerging Markets Review*, Vol. 5, pp. 295-316.
6. Chang, Y.-H., Metghalchi, M. and Chan, C.-C. (2006) "Technical trading strategies and cross-national information linkage: The case of Taiwan stock market", *Applied Financial Economics*, Vol. 16, pp. 731-743.
7. Chen, C.-W., Huang, C.-S. and Lai, H.-W. (2009), "The impact of data snooping on the testing of technical

- analysis: An empirical study of Asian stock markets”, *Journal of Asian Economics*, Vol. 20, pp. 580–591.
8. Coutts, J.A. and Cheung, K.C. (2000), “Trading rules and stock returns: Some preliminary short run evidence from the Hang Seng 1985-1997”, *Applied Financial Economics*, Vol. 10, pp. 579–586.
 9. Efron, B. and Tibshirani, R. (1986), “Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy”, *Statistical Science*, Vol. 1, pp. 54–75.
 10. Efron, B. and Tibshirani, R. (1993), *An introduction to the bootstrap*, Chapman and Hall, New York.
 11. Fama, E. (1970), “Efficient capital markets: a review of theory and empirical work”, *The Journal of Finance*, Vol. 25, pp. 383–417.
 12. Gunasekarage, A., Power, D.M., 2001. The profitability of moving average trading rules in South Asian stock markets. *Emerging Markets Review* 2, 17–33.
 13. Hameed, A. and Kurnadi, Y. (2002), “Momentum Strategies: Evidence from the Pacific Basin Stock Markets”, *Journal of Financial Research*, Vol. 25, pp. 383–397.
 14. Hameed, A. and Ting, S. (2000), “Trading volume and short horizon contrarian profits: Evidence from the Malaysian market”, *Pacific Basin Finance Journal*, Vol. 8, pp. 67–84.
 15. Harvey, C. (1995a), “The cross-section of volatility and autocorrelation in emerging markets. *Finanzmarkt und Portfolio Management*”, Vol. 9, pp. 12–34.
 16. Harvey, C. (1995b), “Predictable risk and returns in emerging markets”, *Review of Financial Studies*, Vol. 8, pp. 773–816.
 17. Hoque, H.A.A.B., Kim, J.H. and Pyun, C.S. (2007), “A comparison of variance ratio tests of random walk: A case of Asian emerging stock markets”, *International Review of Economics and Finance*, Vol. 16, pp. 488–502.
 18. Ito, A. (1999), “Profits on technical trading rules and time-varying expected returns: Evidence from Pacific-Basin equity markets”, *Pacific-Basin Finance Journal*, Vol. 7, pp. 283–330.
 19. Lai, M-M, Balachandher, K.G and Nor, F.M. (2003), “An examination of the random walk model and technical trading rules in the Malaysian stock market”, *Quarterly Journal of Business and Economics*, Vol. 41, pp. 81–97.
 20. Lam, K., Yeung, H.F. and Cheung, W.M.Y. (2007), “The profitability of simple technical trading strategies: The case of Hong Kong”. 20th Australasian Finance & Banking Conference 2007 Paper, available at SSRN: <http://ssrn.com/abstract=1008740>.
 21. Lento, C. (2007), “Tests of technical trading rules in the Asian-Pacific equity markets: A bootstrap approach”, *Academy of Financial and Accounting Studies Journal*, Vol. 11, pp. 51–73.
 22. Lima, E.J.A. and Tabak, B.M. (2004), “Testing of the random walk hypothesis for equity markets: Evidence from China, Hong Kong and Singapore”, *Applied Economic Letters*, Vol. 11, pp. 255–258.
 23. McKenzie, M.D. (2007), “Technical trading rules in emerging markets and the 1997 Asian currency crises”, *Emerging Markets Finance and Trade*, Vol. 43, pp. 46-73.
 24. Menkhoff, L. and Taylor, M. (2007), “The obstinate passion of foreign exchange professionals: Technical analysis”, *Journal of Economic Literature*, Vol. 45, pp. 936–972.
 25. Ming-Ming, L. and Siok-Hwa, L. (2006), “The profitability of the simple moving averages and trading range breakout in the Asian stock markets”, *Journal of Asian Economics*, Vol. 17, pp. 144-170.
 26. Nam, K., Pyun, C.S. and Kim, S.W. (2003), “Is asymmetric mean-reverting pattern in stock returns systematic? Evidence from Pacific-basin markets in the short-horizon”, *Journal of International Financial Markets, Institutions and Money*, Vol. 13, pp. 481–502.
 27. Park, C.-H. and Irwin, S.H. (2007), “What do we know about the profitability of technical analysis?” *Journal of Economic Surveys*, Vol. 21, pp. 786–826.
 28. Ratner, M. and Leal, R. (1999), “Tests of technical trading strategies in the emerging equity markets of Latin America and Asia”, *Journal of Banking and Finance*, Vol. 23, pp. 1881–1905.
 29. Taylor, M. and Allen, H. (1992), “The use of technical analysis in the foreign exchange market”, *Journal of International Money and Finance*, Vol. 11, pp. 304–314.
 30. Tian, G.G., Wan, G.H. and Guo, M. (2002), “Market efficiency and the returns to simple technical trading rules: New evidence from U.S. equity market and Chinese equity markets”, *Asia-Pacific Financial Markets*, Vol. 9, pp. 241–258.
 31. Wang, Z. -M., Chiao, C. and Chiao, Y.-T. (2012), “Technical analyses and order submission behaviors: Evidence from an emerging market”, *International Review of Economics and Finance*, Vol. 24, pp. 109–128.
 32. Wong, W.-K., Manzur, M. and Chew, B.-K. (2003), “How rewarding is technical analysis? Evidence from Singapore stock market”, *Applied Financial Economics*, Vol. 13, pp. 543–551.
 33. Yu, H., Nartea, G.H., Gan, C. and Yao, L.J. (2013), “Predictive ability and profitability of simple technical trading rules: Recent evidence from Southeast Asian stock markets”, *International Review of Economics and Finance*, Vol. 25, pp. 356–371.

Appendix A

Table A.1 Data characteristics

Market	N	Mean	SD	Skewness	Kurtosis
Hong Kong	5626	0.000354	0.016825	-0.002590	11.958471
India	5400	0.000588	0.018165	0.107642	10.230747
Indonesia	5567	0.000426	0.015520	-0.046499	11.885647
Japan	5597	-0.000244	0.013629	-0.114810	8.791536
Malaysia	5611	0.000188	0.013884	0.369284	48.052167
Pakistan	5349	0.000610	0.015846	-0.264936	8.552016
Korea	5580	0.000173	0.019341	0.029495	7.467575
Sri Lanka	5427	0.000641	0.011819	0.446092	26.579753
Taiwan	5593	-0.000046	0.018108	-0.106490	6.537791
Thailand	5574	0.000067	0.017112	-0.032203	9.264072

Table A.2 Test results for MA rules for Korea and Pakistan

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Korea Lag 0							Pakistan Lag 0						
1,50,0	0.000978	-0.000725	0.001703	0.016806	0.021978	3.137967	285	0.001557	-0.000725	0.002282	0.014137	0.018064	2.599874	279
	(0.001)	(0.999)	(0.001)	(1.000)	(0.000)	(0.001)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,50,0	0.000848	-0.000579	0.001427	0.016726	0.022072	2.475197	237	0.001631	-0.000827	0.002458	0.014115	0.018068	3.197556	205
	(0.003)	(0.998)	(0.003)	(1.000)	(0.000)	(0.003)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,50,0	0.000736	-0.000449	0.001185	0.016760	0.022056	1.950846	167	0.001606	-0.000776	0.002382	0.014276	0.017874	3.116667	145
	(0.019)	(0.988)	(0.016)	(1.000)	(0.000)	(0.017)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,150,0	0.000646	-0.000272	0.000918	0.015751	0.023201	0.974656	165	0.001259	-0.000460	0.001719	0.014566	0.018256	1.497928	119
	(0.033)	(0.949)	(0.036)	(1.000)	(0.000)	(0.059)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,150,0	0.000630	-0.000252	0.000883	0.015734	0.023216	0.963062	123	0.001220	-0.000393	0.001614	0.014596	0.018224	1.277701	103
	(0.033)	(0.936)	(0.048)	(1.000)	(0.000)	(0.070)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,150,0	0.000697	-0.000339	0.001037	0.015746	0.023216	1.481339	71	0.001183	-0.000326	0.001509	0.014746	0.018014	1.089499	71
	(0.015)	(0.969)	(0.021)	(1.000)	(0.000)	(0.038)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,200,0	0.000647	-0.000316	0.000964	0.015718	0.023119	1.282303	119	0.001262	-0.000557	0.001820	0.014805	0.018241	1.808550	87
	(0.033)	(0.962)	(0.036)	(1.000)	(0.000)	(0.043)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,200,0	0.000703	-0.000387	0.001091	0.015712	0.023127	1.699402	79	0.001277	-0.000573	0.001849	0.014828	0.018183	1.920049	65
	(0.016)	(0.977)	(0.021)	(1.000)	(0.000)	(0.027)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,200,0	0.000583	-0.000235	0.000818	0.015881	0.022981	1.019876	57	0.001163	-0.000357	0.001520	0.014848	0.018170	1.177465	51
	(0.045)	(0.937)	(0.052)	(1.000)	(0.000)	(0.060)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,50,1	0.000819	-0.000558	0.001378	0.016796	0.022057	2.483536	167	0.001480	-0.000558	0.002038	0.014216	0.017901	2.216370	141
	(0.005)	(0.996)	(0.004)	(1.000)	(0.000)	(0.005)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,50,1	0.000740	-0.000458	0.001198	0.016759	0.022074	2.023180	149	0.001487	-0.000615	0.002102	0.014164	0.018032	2.449348	121
	(0.010)	(0.992)	(0.008)	(1.000)	(0.000)	(0.009)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,50,1	0.000714	-0.000428	0.001142	0.016776	0.022060	1.945540	111	0.001274	-0.000285	0.001559	0.014380	0.017768	1.043643	113
	(0.016)	(0.988)	(0.013)	(1.000)	(0.000)	(0.012)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,150,1	0.000646	-0.000273	0.000919	0.015723	0.023230	1.141943	83	0.001202	-0.000353	0.001554	0.014637	0.018153	1.187010	75
	(0.021)	(0.955)	(0.024)	(1.000)	(0.000)	(0.051)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
002,150,1	0.000639	-0.000262	0.000901	0.015730	0.023212	1.119532	69	0.001158	-0.000261	0.001418	0.014638	0.018125	0.869085	65
	(0.026)	(0.952)	(0.030)	(1.000)	(0.000)	(0.054)		(0.001)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,150,1	0.000639	-0.000271	0.000910	0.015760	0.023238	1.177487	55	0.001153	-0.000253	0.001406	0.014828	0.017861	0.875136	47
	(0.024)	(0.952)	(0.030)	(1.000)	(0.000)	(0.052)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,200,1	0.000644	-0.000316	0.000960	0.015755	0.023114	1.391549	61	0.001175	-0.000377	0.001552	0.014926	0.018040	1.235496	59
	(0.022)	(0.968)	(0.021)	(1.000)	(0.000)	(0.036)		(0.000)	(0.999)	(0.000)	(1.000)	(0.000)	(0.000)	
2,200,1	0.000673	-0.000345	0.001018	0.015818	0.023009	1.568878	47	0.001196	-0.000417	0.001612	0.014870	0.018127	1.397652	49
	(0.015)	(0.979)	(0.014)	(1.000)	(0.000)	(0.026)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,200,1	0.000569	-0.000209	0.000778	0.015867	0.022929	0.935443	43	0.001177	-0.000343	0.001520	0.014979	0.017897	1.195978	33
	(0.039)	(0.930)	(0.056)	(1.000)	(0.000)	(0.076)		(0.000)	(0.999)	(0.000)	(1.000)	(0.000)	(0.000)	

Table A.2 Continued

	Korea Lag 1							Pakistan Lag 1						
50,0	0.000706	-0.000411	0.001117	0.016794	0.022021	1.646562	229.67	0.001486	-0.000614	0.002100	0.014263	0.017926	2.264576	209.67
	(0.018)	(0.985)	(0.018)	(1.000)	(0.000)	(0.018)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
150,0	0.000641	-0.000272	0.000913	0.015736	0.023219	1.054537	119.67	0.001156	-0.000280	0.001436	0.014801	0.017942	0.861055	97.67
	(0.032)	(0.950)	(0.039)	(1.000)	(0.000)	(0.056)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
200,0	0.000605	-0.000257	0.000862	0.015825	0.023032	1.063058	85.00	0.001165	-0.000367	0.001533	0.014885	0.018123	1.175496	67.67
	(0.032)	(0.962)	(0.034)	(1.000)	(0.000)	(0.041)		(0.001)	(0.999)	(0.001)	(1.000)	(0.000)	(0.001)	
50,1	0.000675	-0.000382	0.001058	0.016751	0.022094	1.660161	142.33	0.001340	-0.000381	0.001721	0.014323	0.017837	1.439510	125.00
	(0.019)	(0.981)	(0.018)	(1.000)	(0.000)	(0.019)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
150,1	0.000611	-0.000235	0.000846	0.015782	0.023190	0.975671	69.00	0.001125	-0.000210	0.001335	0.014803	0.017912	0.677242	62.33
	(0.036)	(0.941)	(0.049)	(1.000)	(0.000)	(0.064)		(0.001)	(0.998)	(0.002)	(1.000)	(0.000)	(0.002)	
200,1	0.000582	-0.000226	0.000808	0.015872	0.022970	0.988157	50.33	0.001138	-0.000297	0.001435	0.014974	0.017957	0.979187	47.00
	(0.034)	(0.946)	(0.041)	(1.000)	(0.000)	(0.057)		(0.001)	(0.997)	(0.002)	(1.000)	(0.000)	(0.003)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.3 Test results for MA rules for Indonesia and Malaysia

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Indonesia Lag 0							Malaysia Lag 0						
1,50,0	0.001522 (0.000)	-0.001276 (1.000)	0.002798 (0.000)	0.013225 (1.000)	0.018051 (0.000)	5.426094 (0.000)	213	0.000854 (0.000)	-0.000755 (1.000)	0.001609 (0.000)	0.011133 (1.000)	0.016970 (0.000)	2.900483 (0.000)	303
2,50,0	0.001374 (0.000)	-0.001054 (1.000)	0.002429 (0.000)	0.013206 (1.000)	0.018079 (0.000)	4.505624 (0.000)	179	0.000751 (0.001)	-0.000616 (1.000)	0.001367 (0.000)	0.010747 (1.000)	0.017343 (0.000)	2.422397 (0.000)	215
5,50,0	0.001335 (0.000)	-0.001010 (1.000)	0.002345 (0.000)	0.013247 (1.000)	0.018062 (0.000)	4.368429 (0.000)	135	0.000901 (0.000)	-0.000833 (1.000)	0.001734 (0.000)	0.010628 (1.000)	0.017450 (0.000)	3.548440 (0.000)	146
1,150,0	0.000906 (0.003)	-0.000548 (1.000)	0.001454 (0.000)	0.013074 (1.000)	0.018939 (0.000)	1.963265 (0.000)	119	0.000666 (0.001)	-0.000527 (1.000)	0.001194 (0.000)	0.009841 (1.000)	0.018586 (0.000)	2.036148 (0.000)	119
2,150,0	0.000822 (0.009)	-0.000408 (1.000)	0.001230 (0.001)	0.013081 (1.000)	0.018950 (0.000)	1.428426 (0.000)	103	0.000619 (0.002)	-0.000453 (1.000)	0.001072 (0.000)	0.009873 (1.000)	0.018568 (0.000)	1.779076 (0.000)	89
5,150,0	0.000861 (0.008)	-0.000475 (1.000)	0.001336 (0.000)	0.013314 (1.000)	0.018669 (0.000)	1.775549 (0.000)	63	0.000570 (0.006)	-0.000375 (1.000)	0.000945 (0.001)	0.009958 (1.000)	0.018479 (0.000)	1.500909 (0.001)	63
1,200,0	0.000873 (0.003)	-0.000369 (1.000)	0.001242 (0.001)	0.013083 (1.000)	0.018970 (0.000)	1.214793 (0.002)	101	0.000552 (0.011)	-0.000432 (0.999)	0.000985 (0.002)	0.009760 (1.000)	0.019384 (0.000)	1.397959 (0.005)	103
2,200,0	0.000865 (0.006)	-0.000350 (0.999)	0.001215 (0.002)	0.013196 (1.000)	0.018810 (0.000)	1.194760 (0.004)	77	0.000535 (0.014)	-0.000400 (0.999)	0.000934 (0.002)	0.009836 (1.000)	0.019324 (0.000)	1.321885 (0.006)	79
5,200,0	0.000831 (0.007)	-0.000296 (0.997)	0.001127 (0.003)	0.013305 (1.000)	0.018696 (0.000)	1.015667 (0.004)	57	0.000480 (0.035)	-0.000292 (0.990)	0.000773 (0.013)	0.009957 (1.000)	0.019182 (0.000)	0.972734 (0.024)	57
1,50,1	0.001290 (0.000)	-0.000968 (1.000)	0.002259 (0.000)	0.013146 (1.000)	0.018214 (0.000)	4.127789 (0.000)	139	0.000643 (0.003)	-0.000478 (1.000)	0.001121 (0.001)	0.010526 (1.000)	0.017610 (0.000)	1.933841 (0.000)	126
2,50,1	0.001210 (0.000)	-0.000860 (1.000)	0.002071 (0.000)	0.013198 (1.000)	0.018187 (0.000)	3.656891 (0.000)	123	0.000744 (0.000)	-0.000621 (1.000)	0.001365 (0.000)	0.011350 (1.000)	0.016846 (0.000)	2.618993 (0.000)	112
5,50,1	0.001047 (0.000)	-0.000639 (1.000)	0.001686 (0.000)	0.013383 (1.000)	0.018049 (0.000)	2.675135 (0.000)	101	0.000809 (0.000)	-0.000746 (1.000)	0.001555 (0.000)	0.010586 (1.000)	0.017651 (0.000)	3.170188 (0.000)	88
1,150,1	0.000769 (0.029)	-0.000330 (0.997)	0.001099 (0.007)	0.013099 (1.000)	0.018991 (0.000)	1.161159 (0.004)	73	0.000589 (0.006)	-0.000389 (0.998)	0.000978 (0.003)	0.009889 (1.000)	0.018437 (0.000)	1.607542 (0.002)	53
2,150,1	0.000780 (0.026)	-0.000352 (1.000)	0.001131 (0.003)	0.013106 (1.000)	0.018995 (0.000)	1.263350 (0.002)	63	0.000520 (0.023)	-0.000285 (0.994)	0.000805 (0.012)	0.009925 (1.000)	0.018428 (0.000)	1.155709 (0.008)	53
5,150,1	0.000761 (0.025)	-0.000317 (0.999)	0.001078 (0.003)	0.013506 (1.000)	0.018495 (0.000)	1.163594 (0.002)	45	0.000441 (0.065)	-0.000164 (0.960)	0.000605 (0.050)	0.010022 (1.000)	0.018334 (0.000)	0.631346 (0.046)	53
1,200,1	0.000814 (0.013)	-0.000251 (0.997)	0.001065 (0.005)	0.013346 (1.000)	0.018585 (0.000)	0.846287 (0.005)	61	0.000527 (0.022)	-0.000375 (0.998)	0.000902 (0.002)	0.009806 (1.000)	0.019277 (0.000)	1.301141 (0.007)	51
2,200,1	0.000790 (0.013)	-0.000211 (0.995)	0.001001 (0.005)	0.013362 (1.000)	0.018570 (0.000)	0.697652 (0.005)	55	0.000465 (0.045)	-0.000257 (0.990)	0.000721 (0.024)	0.009866 (1.000)	0.019224 (0.000)	0.872110 (0.022)	45
5,200,1	0.000760 (0.020)	-0.000153 (0.994)	0.000913 (0.010)	0.013355 (1.000)	0.018549 (0.000)	0.495696 (0.009)	43	0.000474 (0.041)	-0.000278 (0.988)	0.000752 (0.016)	0.009973 (1.000)	0.019144 (0.000)	0.963642 (0.019)	37

Table A.3 Continued

	Indonesia Lag 1							Malaysia Lag 1						
50,0	0.001266	-0.000908	0.002174	0.013287	0.018029	3.819001	175.67	0.000855	-0.000765	0.001620	0.010229	0.017764	3.094935	220.67
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
150,0	0.000782	-0.000338	0.001120	0.013353	0.018628	1.169082	95.00	0.000539	-0.000331	0.000870	0.009920	0.018526	1.222749	90.33
	(0.019)	(0.998)	(0.003)	(1.000)	(0.000)	(0.002)		(0.017)	(0.996)	(0.006)	(1.000)	(0.000)	(0.007)	
200,0	0.000813	-0.000237	0.001050	0.013300	0.018669	0.828042	78.33	0.000472	-0.000265	0.000737	0.009924	0.019222	0.847358	79.67
	(0.013)	(0.995)	(0.005)	(1.000)	(0.000)	(0.005)		(0.044)	(0.985)	(0.023)	(1.000)	(0.000)	(0.023)	
50,1	0.001040	-0.000616	0.001656	0.013378	0.018028	2.545594	121.00	0.000770	-0.000670	0.001440	0.010470	0.017680	2.825948	108.67
	(0.003)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
150,1	0.000752	-0.000300	0.001051	0.013467	0.018549	1.068841	60.33	0.000480	-0.000227	0.000707	0.009980	0.018375	0.869929	53.00
	(0.029)	(0.999)	(0.007)	(1.000)	(0.000)	(0.002)		(0.030)	(0.987)	(0.019)	(1.000)	(0.000)	(0.018)	
200,1	0.000779	-0.000164	0.000943	0.013371	0.018517	0.601727	53.00	0.000451	-0.000219	0.000670	0.009970	0.019125	0.753693	44.33
	(0.021)	(0.988)	(0.014)	(1.000)	(0.000)	(0.011)		(0.043)	(0.979)	(0.029)	(1.000)	(0.000)	(0.031)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.4 Test results for MA rules for Sri Lanka and Taiwan

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Sri Lanka Lag 0							Taiwan Lag 0						
1,50,0	0.001839	-0.000761	0.002600	0.011645	0.011939	3.504349	189	0.000913	-0.001107	0.002020	0.015250	0.020575	5.462464	265
	(0.000)	(1.000)	(0.000)	(0.717)	(0.386)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,50,0	0.001676	-0.000578	0.002254	0.011730	0.011884	2.653682	149	0.000868	-0.001055	0.001923	0.015271	0.020551	5.304832	211
	(0.000)	(1.000)	(0.000)	(0.637)	(0.424)	(0.000)		(0.001)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,50,0	0.001540	-0.000427	0.001968	0.012065	0.011534	1.928620	127	0.000681	-0.000858	0.001539	0.015629	0.020282	4.347790	157
	(0.000)	(1.000)	(0.000)	(0.247)	(0.666)	(0.000)		(0.001)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
1,150,0	0.001375	-0.000506	0.001881	0.012601	0.009878	2.303876	91	0.000401	-0.000208	0.000609	0.014664	0.020020	0.722455	189
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.037)	(0.786)	(0.088)	(1.000)	(0.000)	(0.227)	
2,150,0	0.001315	-0.000439	0.001754	0.012602	0.009886	1.993940	79	0.000413	-0.000220	0.000633	0.014655	0.020015	0.887198	139
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.028)	(0.810)	(0.077)	(1.000)	(0.000)	(0.200)	
5,150,0	0.001206	-0.000317	0.001523	0.012604	0.009899	1.422029	63	0.000404	-0.000205	0.000610	0.014839	0.019820	0.927089	85
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.031)	(0.785)	(0.088)	(1.000)	(0.000)	(0.225)	
1,200,0	0.001465	-0.000569	0.002034	0.012699	0.009735	2.646289	77	0.000284	-0.000003	0.000288	0.014330	0.019480	-0.360451	189
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.074)	(0.480)	(0.236)	(1.000)	(0.000)	(0.526)	
2,200,0	0.001381	-0.000470	0.001851	0.012697	0.009764	2.189768	65	0.000296	-0.000018	0.000314	0.014393	0.019431	-0.193604	141
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.069)	(0.502)	(0.211)	(1.000)	(0.000)	(0.502)	
5,200,0	0.001289	-0.000365	0.001655	0.012798	0.009634	1.702400	53	0.000257	0.000029	0.000228	0.014415	0.019411	-0.322799	91
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.097)	(0.418)	(0.281)	(1.000)	(0.000)	(0.570)	
1,50,1	0.001618	-0.000485	0.002102	0.011720	0.011906	2.290658	109	0.000867	-0.001072	0.001939	0.015280	0.020584	5.465956	149
	(0.000)	(1.000)	(0.000)	(0.636)	(0.419)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
2,50,1	0.001494	-0.000346	0.001840	0.011781	0.011864	1.597386	99	0.000781	-0.000980	0.001761	0.015297	0.020579	5.004811	133
	(0.000)	(1.000)	(0.000)	(0.579)	(0.436)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
5,50,1	0.001498	-0.000369	0.001867	0.011974	0.011650	1.724493	85	0.000589	-0.000767	0.001356	0.015826	0.020142	3.929948	111
	(0.000)	(1.000)	(0.000)	(0.337)	(0.583)	(0.000)		(0.003)	(1.000)	(0.001)	(1.000)	(0.000)	(0.001)	
1,150,1	0.001251	-0.000385	0.001636	0.012550	0.009940	1.740544	61	0.000388	-0.000184	0.000573	0.014711	0.019898	0.815924	89
	(0.000)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.039)	(0.756)	(0.091)	(1.000)	(0.000)	(0.249)	
2,150,1	0.001166	-0.000280	0.001446	0.012563	0.009947	1.244062	57	0.000506	-0.000314	0.000820	0.014724	0.019897	1.525742	71
	(0.000)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.016)	(0.898)	(0.039)	(1.000)	(0.000)	(0.115)	
5,150,1	0.001133	-0.000259	0.001391	0.012547	0.009939	1.141375	47	0.000435	-0.000244	0.000679	0.014791	0.019891	1.178788	55
	(0.000)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.024)	(0.828)	(0.075)	(1.000)	(0.000)	(0.187)	
1,200,1	0.001386	-0.000466	0.001852	0.012744	0.009711	2.228193	43	0.000321	-0.000046	0.000367	0.014394	0.019405	0.068200	79
	(0.000)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.066)	(0.548)	(0.195)	(1.000)	(0.000)	(0.451)	
2,200,1	0.001335	-0.000413	0.001747	0.012720	0.009750	1.970718	37	0.000307	-0.000029	0.000336	0.014471	0.019334	0.005923	69
	(0.000)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.066)	(0.524)	(0.212)	(1.000)	(0.000)	(0.470)	
5,200,1	0.001228	-0.000298	0.001526	0.012821	0.009609	1.401216	37	0.000307	-0.000028	0.000335	0.014498	0.019296	0.038592	51
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.062)	(0.527)	(0.204)	(1.000)	(0.000)	(0.472)	

Table A.4 Continued

	Sri Lanka Lag 1							Taiwan Lag 1						
50,0	0.001534	-0.000421	0.001954	0.011822	0.011812	1.836954	155.00	0.000714	-0.000886	0.001600	0.015612	0.020292	4.390891	211.00
	(0.000)	(1.000)	(0.000)	(0.529)	(0.468)	(0.000)		(0.001)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
150,0	0.001174	-0.000289	0.001463	0.012608	0.009894	1.247636	77.67	0.000422	-0.000208	0.000630	0.014663	0.019972	0.849354	137.67
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.029)	(0.779)	(0.081)	(1.000)	(0.000)	(0.233)	
200,0	0.001305	-0.000381	0.001686	0.012770	0.009672	1.746585	65.00	0.000259	0.000026	0.000233	0.014426	0.019401	-0.410491	140.33
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.100)	(0.427)	(0.273)	(1.000)	(0.000)	(0.567)	
50,1	0.001426	-0.000280	0.001706	0.011848	0.011804	1.250722	97.67	0.000681	-0.000861	0.001541	0.015666	0.020277	4.384703	131.00
	(0.000)	(1.000)	(0.000)	(0.488)	(0.488)	(0.000)		(0.003)	(0.999)	(0.002)	(1.000)	(0.000)	(0.001)	
150,1	0.001095	-0.000214	0.001309	0.012555	0.009946	0.913006	55.00	0.000484	-0.000271	0.000754	0.014745	0.019867	1.315868	71.67
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.016)	(0.854)	(0.056)	(1.000)	(0.000)	(0.154)	
200,1	0.001216	-0.000276	0.001492	0.012810	0.009639	1.286008	39.00	0.000300	-0.000022	0.000322	0.014489	0.019316	-0.028652	66.33
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.080)	(0.512)	(0.214)	(1.000)	(0.000)	(0.482)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.5 Test results for MA rules for Thailand and Japan

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Thailand Lag 0							Japan Lag 0						
1,50,0	0.001092 (0.000)	-0.001059 (1.000)	0.002151 (0.000)	0.015067 (1.000)	0.019151 (0.000)	4.907813 (0.000)	273	0.000318 (0.001)	-0.000674 (0.998)	0.000992 (0.002)	0.010648 (1.000)	0.015756 (0.000)	3.365254 (0.002)	330
2,50,0	0.001093 (0.000)	-0.001063 (1.000)	0.002156 (0.000)	0.015118 (1.000)	0.019109 (0.000)	5.033290 (0.000)	217	0.000260 (0.004)	-0.000626 (0.992)	0.000886 (0.005)	0.010702 (1.000)	0.015737 (0.000)	3.229807 (0.009)	250
5,50,0	0.001005 (0.000)	-0.000958 (1.000)	0.001963 (0.000)	0.015215 (1.000)	0.019026 (0.000)	4.664316 (0.000)	137	0.000050 (0.063)	-0.000440 (0.893)	0.000490 (0.079)	0.010921 (1.000)	0.015580 (0.000)	2.294096 (0.110)	177
1,150,0	0.000353 (0.091)	-0.000273 (0.940)	0.000627 (0.072)	0.014848 (1.000)	0.019412 (0.000)	0.996003 (0.067)	207	0.000268 (0.008)	-0.000540 (0.974)	0.000808 (0.011)	0.010724 (1.000)	0.015414 (0.000)	3.095535 (0.026)	130
2,150,0	0.000378 (0.086)	-0.000306 (0.955)	0.000684 (0.060)	0.014914 (1.000)	0.019369 (0.000)	1.282621 (0.055)	141	0.000188 (0.016)	-0.000478 (0.937)	0.000666 (0.029)	0.010901 (1.000)	0.015322 (0.000)	2.774958 (0.061)	100
5,150,0	0.000281 (0.162)	-0.000186 (0.884)	0.000467 (0.132)	0.015158 (1.000)	0.019119 (0.000)	0.785854 (0.128)	97	0.000272 (0.006)	-0.000544 (0.981)	0.000816 (0.006)	0.011038 (1.000)	0.015247 (0.000)	3.236117 (0.023)	70
1,200,0	0.000221 (0.229)	0.000008 (0.673)	0.000214 (0.265)	0.014670 (1.000)	0.019210 (0.000)	-0.425233 (0.337)	193	0.000111 (0.043)	-0.000384 (0.846)	0.000495 (0.070)	0.010538 (1.000)	0.015235 (0.000)	2.063852 (0.180)	144
2,200,0	0.000186 (0.278)	0.000055 (0.569)	0.000130 (0.334)	0.014661 (1.000)	0.019190 (0.000)	-0.597334 (0.446)	167	0.000046 (0.066)	-0.000335 (0.761)	0.000381 (0.127)	0.010803 (1.000)	0.015096 (0.000)	1.827243 (0.261)	112
5,200,0	0.000135 (0.345)	0.000121 (0.467)	0.000014 (0.440)	0.014803 (1.000)	0.019055 (0.000)	-0.782764 (0.522)	107	0.000043 (0.081)	-0.000331 (0.755)	0.000374 (0.136)	0.010929 (1.000)	0.015015 (0.000)	1.886548 (0.277)	74
1,50,1	0.001088 (0.000)	-0.001065 (1.000)	0.002153 (0.000)	0.015073 (1.000)	0.019164 (0.000)	5.193280 (0.000)	133	0.000174 (0.010)	-0.000553 (0.975)	0.000728 (0.014)	0.010763 (1.000)	0.015710 (0.000)	2.967976 (0.030)	162
2,50,1	0.001051 (0.000)	-0.001010 (1.000)	0.002061 (0.000)	0.015345 (1.000)	0.018899 (0.000)	4.981127 (0.000)	113	0.000062 (0.051)	-0.000453 (0.919)	0.000516 (0.062)	0.010899 (1.000)	0.015613 (0.000)	2.412813 (0.090)	150
5,50,1	0.000942 (0.000)	-0.000863 (1.000)	0.001805 (0.000)	0.015447 (1.000)	0.018781 (0.000)	4.315399 (0.000)	95	-0.000095 (0.195)	-0.000318 (0.698)	0.000223 (0.230)	0.011031 (1.000)	0.015535 (0.000)	1.668217 (0.304)	119
1,150,1	0.000335 (0.108)	-0.000252 (0.928)	0.000587 (0.089)	0.014858 (1.000)	0.019404 (0.000)	1.104007 (0.081)	99	0.000162 (0.028)	-0.000451 (0.921)	0.000613 (0.038)	0.010728 (1.000)	0.015366 (0.000)	2.710235 (0.081)	66
2,150,1	0.000259 (0.183)	-0.000161 (0.854)	0.000420 (0.164)	0.015020 (1.000)	0.019252 (0.000)	0.687162 (0.151)	83	0.000153 (0.027)	-0.000444 (0.922)	0.000597 (0.043)	0.010971 (1.000)	0.015238 (0.000)	2.678599 (0.078)	60
5,150,1	0.000353 (0.083)	-0.000268 (0.925)	0.000621 (0.078)	0.015244 (1.000)	0.019015 (0.000)	1.268455 (0.080)	63	0.000134 (0.029)	-0.000432 (0.899)	0.000567 (0.052)	0.011090 (1.000)	0.015184 (0.000)	2.616063 (0.101)	50
1,200,1	0.000153 (0.318)	0.000098 (0.500)	0.000055 (0.408)	0.014709 (1.000)	0.019165 (0.000)	-0.660193 (0.481)	101	0.000038 (0.087)	-0.000327 (0.761)	0.000365 (0.137)	0.010602 (1.000)	0.015184 (0.000)	1.868058 (0.275)	72
2,200,1	0.000199 (0.265)	0.000037 (0.594)	0.000162 (0.319)	0.014719 (1.000)	0.019148 (0.000)	-0.347028 (0.402)	85	-0.000012 (0.118)	-0.000290 (0.675)	0.000278 (0.189)	0.010837 (1.000)	0.015053 (0.000)	1.668436 (0.356)	58
5,200,1	0.000250 (0.175)	-0.000028 (0.712)	0.000278 (0.234)	0.014861 (1.000)	0.018976 (0.000)	-0.003983 (0.296)	65	-0.000050 (0.151)	-0.000261 (0.583)	0.000211 (0.241)	0.011006 (1.000)	0.014953 (0.000)	1.507606 (0.437)	52

Table A.5 Continued

	Thailand Lag 1							Japan Lag 1						
50,0	0.001030	-0.000984	0.002014	0.015409	0.018845	4.642480	209.00	0.000053	-0.000433	0.000485	0.010944	0.015572	2.117813	252.33
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.076)	(0.869)	(0.094)	(1.000)	(0.000)	(0.126)	
150,0	0.000344	-0.000270	0.000614	0.015145	0.019138	1.019782	148.33	0.000194	-0.000482	0.000677	0.010978	0.015283	2.787442	100.00
	(0.090)	(0.937)	(0.070)	(1.000)	(0.000)	(0.076)		(0.023)	(0.943)	(0.033)	(1.000)	(0.000)	(0.060)	
200,0	0.000189	0.000031	0.000158	0.014880	0.018959	-0.502998	155.67	0.000003	-0.000303	0.000306	0.010886	0.015050	1.657133	110.00
	(0.274)	(0.595)	(0.335)	(1.000)	(0.000)	(0.430)		(0.106)	(0.700)	(0.159)	(1.000)	(0.000)	(0.319)	
50,1	0.001023	-0.000972	0.001995	0.015522	0.018732	4.782653	113.67	-0.000021	-0.000370	0.000349	0.011113	0.015476	1.958197	143.00
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.139)	(0.772)	(0.173)	(1.000)	(0.000)	(0.223)	
150,1	0.000291	-0.000204	0.000495	0.015199	0.019075	0.831846	81.67	0.000134	-0.000430	0.000564	0.011076	0.015187	2.576681	58.67
	(0.138)	(0.899)	(0.115)	(1.000)	(0.000)	(0.114)		(0.033)	(0.889)	(0.055)	(1.000)	(0.000)	(0.111)	
200,1	0.000230	-0.000022	0.000252	0.014926	0.018908	-0.108722	83.67	-0.000035	-0.000273	0.000238	0.010943	0.014999	1.580784	60.67
	(0.212)	(0.692)	(0.255)	(1.000)	(0.000)	(0.327)		(0.163)	(0.602)	(0.239)	(1.000)	(0.000)	(0.414)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.6 Test results for MA rules for Hong Kong and India

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	
Hong Kong Lag 0								India Lag 0							
1,50,0	0.000781 (0.011)	-0.000270 (0.998)	0.001051 (0.004)	0.013593 (1.000)	0.020741 (0.000)	0.571923 (0.003)	325	0.001235 (0.000)	-0.000193 (0.999)	0.001428 (0.000)	0.016555 (1.000)	0.020069 (0.000)	0.390296 (0.001)	261	
2,50,0	0.000777 (0.010)	-0.000269 (0.998)	0.001046 (0.005)	0.013588 (1.000)	0.020777 (0.000)	0.723291 (0.004)	245	0.001092 (0.006)	-0.000013 (0.989)	0.001105 (0.007)	0.016717 (1.000)	0.019916 (0.000)	-0.363382 (0.010)	215	
5,50,0	0.000697 (0.030)	-0.000149 (0.991)	0.000847 (0.017)	0.013588 (1.000)	0.020767 (0.000)	0.337616 (0.011)	169	0.001153 (0.002)	-0.000168 (0.998)	0.001320 (0.002)	0.017459 (0.986)	0.019170 (0.012)	0.464620 (0.002)	141	
1,150,0	0.000695 (0.027)	-0.000228 (0.993)	0.000923 (0.012)	0.013435 (1.000)	0.021508 (0.000)	0.617199 (0.011)	157	0.000985 (0.008)	-0.000211 (0.998)	0.001196 (0.002)	0.016793 (1.000)	0.019872 (0.001)	0.595755 (0.002)	149	
2,150,0	0.000607 (0.063)	-0.000085 (0.977)	0.000692 (0.036)	0.013397 (1.000)	0.021565 (0.000)	0.088099 (0.027)	125	0.001028 (0.005)	-0.000271 (0.998)	0.001299 (0.003)	0.016783 (1.000)	0.019873 (0.000)	0.941329 (0.002)	105	
5,150,0	0.000629 (0.051)	-0.000115 (0.980)	0.000744 (0.027)	0.013566 (1.000)	0.021331 (0.000)	0.315604 (0.024)	75	0.000920 (0.025)	-0.000112 (0.994)	0.001032 (0.009)	0.016983 (1.000)	0.019632 (0.002)	0.332323 (0.006)	71	
1,200,0	0.000595 (0.086)	-0.000092 (0.978)	0.000687 (0.040)	0.013428 (1.000)	0.022163 (0.000)	0.081890 (0.030)	125	0.000691 (0.235)	0.000409 (0.768)	0.000282 (0.231)	0.015026 (1.000)	0.020640 (0.000)	-2.147133 (0.281)	115	
2,200,0	0.000601 (0.074)	-0.000101 (0.978)	0.000701 (0.037)	0.013480 (1.000)	0.022072 (0.000)	0.194966 (0.026)	85	0.000583 (0.443)	0.000538 (0.620)	0.000045 (0.401)	0.015168 (1.000)	0.020541 (0.000)	-2.703354 (0.486)	95	
5,200,0	0.000617 (0.063)	-0.000125 (0.983)	0.000742 (0.030)	0.013666 (1.000)	0.021791 (0.000)	0.353258 (0.020)	53	0.000610 (0.389)	0.000506 (0.666)	0.000104 (0.341)	0.015213 (1.000)	0.020511 (0.000)	-2.482638 (0.437)	63	
1,50,1	0.000746 (0.028)	-0.000265 (0.997)	0.001011 (0.010)	0.013482 (1.000)	0.021144 (0.000)	0.811222 (0.005)	167	0.001086 (0.008)	0.000001 (0.983)	0.001084 (0.011)	0.016659 (1.000)	0.019964 (0.000)	-0.320971 (0.016)	161	
2,50,1	0.000691 (0.033)	-0.000177 (0.992)	0.000868 (0.018)	0.013497 (1.000)	0.021121 (0.000)	0.457704 (0.012)	155	0.001263 (0.000)	-0.000291 (1.000)	0.001554 (0.000)	0.017406 (0.989)	0.019190 (0.004)	1.067304 (0.000)	125	
5,50,1	0.000684 (0.050)	-0.000174 (0.988)	0.000858 (0.022)	0.013579 (1.000)	0.021101 (0.000)	0.528344 (0.018)	109	0.001071 (0.012)	-0.000058 (0.987)	0.001129 (0.012)	0.017652 (0.937)	0.018930 (0.041)	0.036975 (0.013)	111	
1,150,1	0.000608 (0.083)	-0.000081 (0.966)	0.000689 (0.049)	0.013399 (1.000)	0.021493 (0.000)	0.161435 (0.038)	81	0.000948 (0.034)	-0.000153 (0.987)	0.001101 (0.018)	0.016857 (1.000)	0.019787 (0.000)	0.479458 (0.011)	85	
2,150,1	0.000640 (0.058)	-0.000120 (0.974)	0.000759 (0.035)	0.013429 (1.000)	0.021366 (0.000)	0.363839 (0.030)	65	0.000911 (0.048)	-0.000094 (0.984)	0.001005 (0.023)	0.016866 (1.000)	0.019766 (0.000)	0.255172 (0.017)	73	
5,150,1	0.000606 (0.094)	-0.000086 (0.966)	0.000692 (0.056)	0.013605 (1.000)	0.021371 (0.000)	0.246192 (0.036)	47	0.000926 (0.041)	-0.000122 (0.981)	0.001048 (0.023)	0.017032 (1.000)	0.019568 (0.001)	0.419341 (0.018)	49	
1,200,1	0.000572 (0.114)	-0.000044 (0.939)	0.000615 (0.070)	0.013453 (1.000)	0.022076 (0.000)	0.017398 (0.062)	67	0.000809 (0.108)	0.000172 (0.921)	0.000638 (0.090)	0.017068 (1.000)	0.018891 (0.092)	-0.840859 (0.088)	83	
2,200,1	0.000573 (0.114)	-0.000045 (0.943)	0.000618 (0.070)	0.013527 (1.000)	0.021966 (0.000)	0.044968 (0.057)	55	0.000598 (0.452)	0.000521 (0.614)	0.000076 (0.407)	0.015201 (1.000)	0.020484 (0.000)	-2.566407 (0.509)	59	
5,200,1	0.000605 (0.084)	-0.000107 (0.961)	0.000712 (0.048)	0.013660 (1.000)	0.021842 (0.000)	0.306519 (0.042)	41	0.000577 (0.491)	0.000546 (0.584)	0.000030 (0.446)	0.015364 (1.000)	0.020358 (0.000)	-2.649029 (0.555)	47	

Table A.6 Continued

	Hong Kong Lag 1							India Lag 1						
50,0	0.000691 (0.050)	-0.000142 (0.978)	0.000833 (0.033)	0.013660 (1.000)	0.020699 (0.000)	0.142991 (0.025)	246.33	0.000996 (0.034)	0.000078 (0.953)	0.000917 (0.041)	0.017176 (0.976)	0.019421 (0.017)	-0.812283 (0.043)	205.67
150,0	0.000591 (0.104)	-0.000049 (0.948)	0.000640 (0.067)	0.013504 (1.000)	0.021431 (0.000)	-0.016563 (0.051)	119.00	0.000977 (0.026)	-0.000217 (0.995)	0.001195 (0.010)	0.016911 (1.000)	0.019701 (0.003)	0.661269 (0.006)	108.33
200,0	0.000628 (0.073)	-0.000154 (0.978)	0.000782 (0.039)	0.013679 (1.000)	0.021828 (0.000)	0.399124 (0.027)	87.67	0.000554 (0.526)	0.000587 (0.531)	-0.000033 (0.491)	0.015209 (1.000)	0.020491 (0.000)	-2.913519 (0.594)	91.00
50,1	0.000657 (0.070)	-0.000128 (0.977)	0.000785 (0.041)	0.013601 (1.000)	0.021043 (0.000)	0.259918 (0.027)	143.67	0.001012 (0.020)	0.000048 (0.973)	0.000964 (0.022)	0.017493 (0.930)	0.019065 (0.047)	-0.512058 (0.026)	132.33
150,1	0.000583 (0.114)	-0.000030 (0.942)	0.000612 (0.074)	0.013609 (1.000)	0.021275 (0.000)	0.013986 (0.054)	64.33	0.000918 (0.036)	-0.000127 (0.993)	0.001045 (0.013)	0.017035 (1.000)	0.019542 (0.005)	0.358655 (0.007)	69.00
200,1	0.000625 (0.070)	-0.000147 (0.978)	0.000772 (0.034)	0.013702 (1.000)	0.021778 (0.000)	0.439534 (0.029)	54.33	0.000625 (0.362)	0.000485 (0.685)	0.000140 (0.332)	0.015932 (1.000)	0.019838 (0.042)	-2.298087 (0.415)	63.00

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.7 Test results for TRB rules for Hong Kong, India, Indonesia and Malaysia

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Hong Kong Lag 0							India Lag 0						
25	0.000675 (0.055)	-0.000104 (0.965)	0.000778 (0.044)	0.013532 (1.000)	0.020708 (0.000)	0.2073 (0.037)	125	0.001194 (0.003)	-0.000124 (0.992)	0.001318 (0.007)	0.017452 (0.987)	0.019051 (0.014)	0.3540 (0.008)	123
50	0.000579 (0.107)	0.000039 (0.907)	0.000540 (0.094)	0.013679 (1.000)	0.020539 (0.000)	-0.3124 (0.092)	67	0.001096 (0.010)	-0.000033 (0.984)	0.001130 (0.014)	0.017778 (0.880)	0.018711 (0.131)	0.0462 (0.016)	57
100	0.000388 (0.372)	0.000292 (0.659)	0.000096 (0.357)	0.014134 (1.000)	0.020220 (0.000)	-1.3991 (0.345)	32	0.000851 (0.070)	0.000184 (0.917)	0.000667 (0.074)	0.018178 (0.501)	0.018280 (0.397)	-0.8190 (0.086)	29
150	0.000429 (0.290)	0.000195 (0.760)	0.000234 (0.254)	0.014547 (1.000)	0.020565 (0.000)	-0.8177 (0.221)	18	0.000495 (0.657)	0.000515 (0.669)	-0.000020 (0.426)	0.018147 (0.547)	0.018044 (0.575)	-2.2209 (0.443)	23
200	0.000507 (0.164)	0.000061 (0.884)	0.000446 (0.126)	0.014460 (1.000)	0.021064 (0.000)	-0.2588 (0.114)	12	0.000632 (0.333)	0.000478 (0.686)	0.000154 (0.308)	0.017469 (0.996)	0.018192 (0.484)	-2.2505 (0.508)	15

Table A.7 Continued

	Hong Kong Lag 1							India Lag 1						
25	0.000619	-0.000032	0.000652	0.013646	0.020600	-0.1216	125	0.001045	0.000063	0.000981	0.017768	0.018677	-0.5614	123
	(0.108)	(0.929)	(0.087)	(1.000)	(0.000)	(0.076)		(0.020)	(0.965)	(0.024)	(0.866)	(0.127)	(0.036)	
50	0.000464	0.000199	0.000265	0.013803	0.020427	-1.0589	67	0.000954	0.000144	0.000809	0.017836	0.018645	-0.8059	57
	(0.271)	(0.751)	(0.255)	(1.000)	(0.000)	(0.231)		(0.033)	(0.943)	(0.044)	(0.842)	(0.157)	(0.066)	
100	0.000472	0.000168	0.000304	0.014308	0.020049	-0.8468	32	0.000798	0.000260	0.000538	0.018294	0.018096	-1.1358	29
	(0.235)	(0.801)	(0.215)	(1.000)	(0.000)	(0.200)		(0.128)	(0.841)	(0.147)	(0.354)	(0.528)	(0.171)	
150	0.000418	0.000224	0.000194	0.014701	0.020370	-0.9003	18	0.000433	0.000589	-0.000156	0.018196	0.017952	-2.5742	23
	(0.325)	(0.734)	(0.286)	(1.000)	(0.000)	(0.235)		(0.769)	(0.545)	(0.577)	(0.469)	(0.629)	(0.614)	
200	0.000466	0.000139	0.000327	0.014587	0.020895	-0.5352	12	0.000576	0.000559	0.000017	0.017486	0.018165	-2.6167	15
	(0.209)	(0.832)	(0.192)	(1.000)	(0.000)	(0.150)		(0.479)	(0.589)	(0.429)	(0.987)	(0.462)	(0.656)	
	Indonesia Lag 0							Malaysia Lag 0						
25	0.001547	-0.001043	0.002590	0.013641	0.017519	4.8739	109	0.000766	-0.000570	0.001336	0.010908	0.016900	2.5812	114
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
50	0.001029	-0.000497	0.001525	0.013557	0.017596	2.2860	61	0.000693	-0.000414	0.001108	0.010200	0.017212	2.0022	62
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.000)	(0.999)	(0.000)	(1.000)	(0.000)	(0.000)	
100	0.000796	-0.000282	0.001078	0.013344	0.018002	1.2236	29	0.000455	-0.000276	0.000731	0.010241	0.018654	1.0468	31
	(0.008)	(0.998)	(0.003)	(1.000)	(0.000)	(0.002)		(0.039)	(0.990)	(0.018)	(1.000)	(0.000)	(0.018)	
150	0.000747	-0.000273	0.001019	0.013252	0.018722	1.0651	17	0.000465	-0.000322	0.000787	0.010102	0.019392	1.1806	13
	(0.014)	(0.999)	(0.003)	(1.000)	(0.000)	(0.001)		(0.045)	(0.994)	(0.015)	(1.000)	(0.000)	(0.017)	
200	0.000561	0.000169	0.000392	0.013300	0.018754	-0.7243	15	0.000351	-0.000037	0.000388	0.009974	0.019058	0.1162	13
	(0.143)	(0.866)	(0.135)	(1.000)	(0.000)	(0.154)		(0.135)	(0.861)	(0.132)	(1.000)	(0.000)	(0.144)	
	Indonesia Lag 1							Malaysia Lag 1						
25	0.001404	-0.000863	0.002266	0.013675	0.017513	3.9934	109	0.000782	-0.000587	0.001369	0.010273	0.017398	2.6707	114
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)	
50	0.000894	-0.000322	0.001216	0.013863	0.017303	1.4366	61	0.000586	-0.000291	0.000876	0.010277	0.017169	1.3649	62
	(0.005)	(1.000)	(0.002)	(1.000)	(0.000)	(0.000)		(0.012)	(0.989)	(0.013)	(1.000)	(0.000)	(0.011)	
100	0.000738	-0.000199	0.000937	0.013413	0.017937	0.8460	29	0.000428	-0.000231	0.000659	0.010250	0.018648	0.8621	31
	(0.030)	(0.992)	(0.016)	(1.000)	(0.000)	(0.008)		(0.062)	(0.981)	(0.034)	(1.000)	(0.000)	(0.030)	
150	0.000714	-0.000216	0.000930	0.013270	0.018706	0.8418	17	0.000449	-0.000296	0.000745	0.010122	0.019372	1.0484	13
	(0.038)	(0.990)	(0.015)	(1.000)	(0.000)	(0.009)		(0.054)	(0.993)	(0.019)	(1.000)	(0.000)	(0.023)	
200	0.000567	0.000183	0.000384	0.013442	0.018543	-0.6961	15	0.000344	-0.000012	0.000355	0.009978	0.019047	0.0420	13
	(0.146)	(0.831)	(0.159)	(1.000)	(0.000)	(0.171)		(0.153)	(0.845)	(0.152)	(1.000)	(0.000)	(0.149)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.8 Test results for TRB rules for Korea, Pakistan, Sri Lanka and Taiwan

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	
Korea Lag 0								Pakistan Lag 0							
25	0.000672	-0.000352	0.001024	0.016817	0.021786	1.6413	121	0.001663	-0.000704	0.002367	0.014396	0.017476	3.0872	109	
	(0.025)	(0.975)	(0.028)	(1.000)	(0.000)	(0.025)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		
50	0.000606	-0.000310	0.000915	0.016575	0.022291	1.4287	61	0.001175	-0.000158	0.001333	0.014863	0.017235	0.5717	63	
	(0.031)	(0.966)	(0.033)	(1.000)	(0.000)	(0.033)		(0.001)	(0.999)	(0.001)	(1.000)	(0.000)	(0.001)		
100	0.000662	-0.000326	0.000988	0.016026	0.022594	1.5985	26	0.001115	-0.000201	0.001316	0.015100	0.017287	0.7422	23	
	(0.009)	(0.980)	(0.014)	(1.000)	(0.000)	(0.022)		(0.004)	(0.993)	(0.004)	(1.000)	(0.000)	(0.005)		
150	0.000335	0.000130	0.000205	0.016580	0.022240	-0.6980	21	0.001019	-0.000300	0.001318	0.015040	0.018173	0.8766	15	
	(0.201)	(0.618)	(0.313)	(1.000)	(0.000)	(0.387)		(0.003)	(0.998)	(0.002)	(1.000)	(0.000)	(0.002)		
200	0.000473	-0.000043	0.000517	0.016153	0.022215	0.2194	12	0.001021	-0.000340	0.001361	0.014857	0.018829	0.9743	11	
	(0.078)	(0.830)	(0.112)	(1.000)	(0.000)	(0.163)		(0.005)	(0.997)	(0.002)	(1.000)	(0.000)	(0.002)		
Korea Lag 1								Pakistan Lag 1							
25	0.000498	-0.000163	0.000661	0.016874	0.021747	0.6264	121	0.001601	-0.000628	0.002230	0.014413	0.017471	2.7318	109	
	(0.108)	(0.885)	(0.108)	(1.000)	(0.000)	(0.113)		(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		
50	0.000527	-0.000214	0.000742	0.016542	0.022326	0.9605	61	0.001074	-0.000014	0.001088	0.014946	0.017147	-0.0620	63	
	(0.060)	(0.933)	(0.063)	(1.000)	(0.000)	(0.071)		(0.007)	(0.988)	(0.008)	(1.000)	(0.001)	(0.011)		
100	0.000636	-0.000299	0.000935	0.016128	0.022515	1.4597	26	0.001111	-0.000192	0.001303	0.015113	0.017271	0.7106	23	
	(0.018)	(0.963)	(0.028)	(1.000)	(0.000)	(0.034)		(0.002)	(0.999)	(0.001)	(0.999)	(0.000)	(0.001)		
150	0.000344	0.000113	0.000231	0.016640	0.022189	-0.6260	21	0.001010	-0.000280	0.001290	0.015064	0.018129	0.8175	15	
	(0.195)	(0.644)	(0.288)	(1.000)	(0.000)	(0.368)		(0.002)	(0.998)	(0.002)	(1.000)	(0.000)	(0.003)		
200	0.000462	-0.000026	0.000488	0.016157	0.022214	0.1265	12	0.000988	-0.000259	0.001247	0.014872	0.018808	0.7351	11	
	(0.088)	(0.794)	(0.137)	(1.000)	(0.000)	(0.202)		(0.002)	(0.996)	(0.001)	(1.000)	(0.000)	(0.001)		
Sri Lanka Lag 0								Taiwan Lag 0							
25	0.001830	-0.000837	0.002667	0.012179	0.011241	3.8738	101	0.000592	-0.000729	0.001321	0.015817	0.020024	3.9069	123	
	(0.000)	(1.000)	(0.000)	(0.142)	(0.850)	(0.000)		(0.006)	(0.994)	(0.006)	(1.000)	(0.000)	(0.005)		
50	0.001574	-0.000719	0.002293	0.012557	0.010684	3.1657	49	0.000552	-0.000685	0.001237	0.015996	0.019883	3.7122	63	
	(0.000)	(1.000)	(0.000)	(0.006)	(0.984)	(0.000)		(0.009)	(0.998)	(0.002)	(1.000)	(0.000)	(0.002)		
100	0.001103	-0.000130	0.001232	0.012505	0.010264	0.5483	31	0.000108	-0.000128	0.000236	0.015017	0.020599	0.5267	37	
	(0.000)	(0.998)	(0.001)	(0.000)	(0.999)	(0.001)		(0.239)	(0.688)	(0.277)	(1.000)	(0.000)	(0.346)		
150	0.001035	-0.000198	0.001233	0.012663	0.009623	0.8660	17	0.000124	0.000103	0.000022	0.014545	0.020044	-0.5459	22	
	(0.000)	(1.000)	(0.000)	(0.000)	(1.000)	(0.000)		(0.226)	(0.302)	(0.451)	(1.000)	(0.000)	(0.674)		
200	0.000958	-0.000204	0.001162	0.012483	0.009521	0.8085	12	-0.000039	0.000468	-0.000508	0.014692	0.019853	-1.9629	18	
	(0.001)	(1.000)	(0.000)	(0.001)	(1.000)	(0.000)		(0.443)	(0.035)	(0.817)	(1.000)	(0.000)	(0.920)		

Table A.8 Continued

	Sri Lanka Lag 1							Taiwan Lag 1						
25	0.001649	-0.000620	0.002269	0.012282	0.011155	2.8204	101	0.000576	-0.000708	0.001284	0.015861	0.019992	3.8118	123
	(0.000)	(1.000)	(0.000)	(0.063)	(0.889)	(0.000)		(0.003)	(0.999)	(0.001)	(1.000)	(0.000)	(0.000)	
50	0.001481	-0.000592	0.002073	0.012551	0.010723	2.5900	49	0.000591	-0.000715	0.001306	0.016060	0.019826	3.8862	63
	(0.000)	(1.000)	(0.000)	(0.003)	(0.981)	(0.000)		(0.005)	(0.998)	(0.003)	(1.000)	(0.000)	(0.003)	
100	0.001038	-0.000063	0.001101	0.012521	0.010248	0.2386	31	0.000049	-0.000044	0.000093	0.015099	0.020514	0.1891	37
	(0.000)	(0.998)	(0.000)	(0.002)	(0.999)	(0.001)		(0.299)	(0.561)	(0.359)	(1.000)	(0.000)	(0.437)	
150	0.000997	-0.000160	0.001157	0.012648	0.009644	0.6824	17	0.000116	0.000132	-0.000015	0.014584	0.019991	-0.6769	22
	(0.000)	(0.999)	(0.000)	(0.000)	(1.000)	(0.000)		(0.223)	(0.282)	(0.464)	(1.000)	(0.000)	(0.698)	
200	0.000918	-0.000136	0.001053	0.012505	0.009484	0.5262	12	-0.000070	0.000516	-0.000586	0.014720	0.019824	-2.1643	18
	(0.004)	(0.996)	(0.002)	(0.000)	(1.000)	(0.002)		(0.477)	(0.018)	(0.843)	(1.000)	(0.000)	(0.945)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.

Table A.9 Test results for TRB rules for Thailand and Japan

Rule	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig	\bar{r}_B	\bar{r}_S	$\bar{r}_B - \bar{r}_S$	σ_B	σ_S	AER	Sig
	Thailand Lag 0							Japan Lag 0						
25	0.001050	-0.000993	0.002043	0.015189	0.019006	5.0021	113	0.000057	-0.000487	0.000543	0.010965	0.015568	2.6750	130
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.061)	(0.934)	(0.066)	(1.000)	(0.000)	(0.063)	
50	0.000624	-0.000486	0.001110	0.015436	0.018767	2.4691	59	0.000149	-0.000512	0.000661	0.010796	0.015575	3.0251	56
	(0.004)	(0.992)	(0.004)	(1.000)	(0.000)	(0.007)		(0.017)	(0.966)	(0.023)	(1.000)	(0.000)	(0.031)	
100	0.000151	-0.000082	0.000233	0.015573	0.019100	0.2957	39	-0.000028	-0.000379	0.000351	0.011109	0.015330	2.1937	32
	(0.299)	(0.775)	(0.252)	(1.000)	(0.000)	(0.235)		(0.129)	(0.849)	(0.141)	(1.000)	(0.000)	(0.187)	
150	0.000104	0.000022	0.000081	0.015028	0.019353	-0.0961	23	-0.000116	-0.000238	0.000122	0.011203	0.014929	1.5519	22
	(0.362)	(0.644)	(0.357)	(1.000)	(0.000)	(0.337)		(0.245)	(0.517)	(0.335)	(1.000)	(0.000)	(0.464)	
200	0.000352	-0.000153	0.000505	0.014428	0.019351	0.6954	13	0.000203	-0.000442	0.000645	0.011050	0.014910	2.7338	10
	(0.078)	(0.855)	(0.109)	(1.000)	(0.000)	(0.157)		(0.021)	(0.927)	(0.032)	(1.000)	(0.000)	(0.094)	
	Thailand Lag 1							Japan Lag 1						
25	0.000895	-0.000809	0.001703	0.015518	0.018718	4.0511	113	0.000018	-0.000453	0.000471	0.011225	0.015413	2.4725	130
	(0.000)	(1.000)	(0.000)	(1.000)	(0.000)	(0.000)		(0.088)	(0.898)	(0.098)	(1.000)	(0.000)	(0.102)	
50	0.000499	-0.000347	0.000846	0.015543	0.018679	1.7265	59	0.000083	-0.000445	0.000528	0.011032	0.015428	2.6512	56
	(0.030)	(0.955)	(0.033)	(1.000)	(0.000)	(0.046)		(0.051)	(0.905)	(0.064)	(1.000)	(0.000)	(0.082)	
100	0.000112	-0.000036	0.000148	0.015789	0.018864	0.0792	39	-0.000050	-0.000358	0.000308	0.011208	0.015272	2.0842	32
	(0.373)	(0.710)	(0.331)	(1.000)	(0.000)	(0.304)		(0.137)	(0.812)	(0.148)	(1.000)	(0.000)	(0.229)	
150	0.000109	0.000008	0.000100	0.015060	0.019320	-0.1050	23	-0.000093	-0.000252	0.000159	0.011329	0.014869	1.6303	22
	(0.379)	(0.630)	(0.373)	(1.000)	(0.000)	(0.374)		(0.194)	(0.592)	(0.251)	(1.000)	(0.000)	(0.392)	
200	0.000364	-0.000188	0.000553	0.014451	0.019308	0.8207	13	0.000200	-0.000441	0.000641	0.011060	0.014907	2.7467	10
	(0.075)	(0.883)	(0.087)	(1.000)	(0.000)	(0.141)		(0.017)	(0.925)	(0.030)	(1.000)	(0.000)	(0.095)	

Note: $\bar{r}_i, i = B, S$ is the mean return per trading period classified as Buy/ Sell. $\sigma_i, i = B, S$ is the standard deviation of the Buy/ Sell returns. AER is the adjusted excess return, i.e. the return in excess of the buy-and-hold strategy after transaction costs. Sig denotes the number of trading signals.