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# African Journal of **Business Management**

January 2020  
ISSN: 1993-8233  
DOI: 10.5897/AJBM  
[www.academicjournals.org](http://www.academicjournals.org)

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*Full Length Research Paper*

# **Elucidative motives of social and environmental reporting in Ethiopian companies**

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Received 28 October, 2019; Accepted 14 January, 2020

**Stakeholders' conscious follow-up on companies' operation pressured business organizations to be responsible for the society and environment. Companies social and environmental reporting is essential to ease this pressure. Despite its importance, there is no clear consensus on the motivation of companies for their reporting. Therefore, the aim of this study was to examine the motivational factors influencing social and environmental reporting from large tax payers in Ethiopia. An explanatory research design through quantitative research approach was employed by using both primary and secondary data source which was collected from 262 sampled firms in 2018. The regression result revealed that firm age, size, profitability, board size and industry sensitivity had a positive and significant influence on social and environmental reporting, whereas, leverage had a negative and significant impact on social and environmental reporting. This result implied that beyond the voluntary nature of Ethiopian companies' social and environmental reporting, they have been using their reporting to legitimize their position in the society.**

**Key words:** Agency theory, legitimacy theory, social and environmental reporting, stakeholder theory.

## **INTRODUCTION**

The prevailing world's environment and impact of mankind on the ecology of the world at large have led to the increased public concern and scrutiny of operations and performances of companies (Agbiogwu et al., 2016). Businesses have bilateral impact on the environment: in one way it contributes to economic and technological advancement and in the other it causes different social and environmental problems such as pollution, resource depletion, etc. Nowadays, companies are under pressure to become accountable and expected to demonstrate that they are aware and addressing the impact of their operations on the environment and society in general

(Ding et al., 2014).

The rapid growth in business activities and increasing concern of societies for their environment has brought the need for companies to disclose their environmental and social activities in annual report (Agbiogwu et al., 2016). Theoretically, firms are expected to deal with environmental reporting in order to be successful and acceptable by different stakeholders around the business. Accounting scholars have used legitimacy theory, stakeholder theory and agency theory to articulate company's relationship with the environment using social and environmental accounting (Reverte, 2009; Deegan,

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2002). The theoretical frameworks were intended to explain the existence of social contract between the company and different stakeholders; and breaching these social contracts will threaten the sustainability of the organization. This posits social and environmental accounting as a key to companies' competitiveness and survival (Deegan, 2002).

However, currently there is no universally accepted theoretical framework for why companies disclose social and environmental information (Suttipun and Stanton, 2012; Nguyen et al., 2017). Scholars argue that companies reporting on social and environmental information should comply with the existing regulation; nevertheless, there is no stringent regulation compatible with general financial reporting. Moreover, an increasing number of companies are disclosing social responsibility activities within a voluntary framework. Existing empirical studies have evolved the nature of social and environmental reporting (SER) and captured meaningful substances in explaining motivational factors of SER (Reverte, 2009; Gray, 2006; Parker, 2005; Deegan, 2002).

One fact to be noted is that, most of the literatures were concentrated on developed nations where stakeholders and different regulatory bodies can exert high pressure on the organization for its impact on the environment and societies, its standard also originated and implemented. Cumming (2006) also suggested a new research area of social and environmental reporting by which studies should stress on creating broader geographical evidence across nations for the purpose of fully depicting its status and underlying determinants.

In Ethiopia, the reporting system is at its infant stage and undergoing thorough tremendous changes. The financial reporting regulatory body has been focused on implementing International Financial Reporting Standard without considering sustainability reporting. On the other hand, the issues of environmental protection, sustainable development and environmental rights have been explicitly covered by the country's constitution without handing over the monitoring responsibility to a specific authoritative body. Within these perplex issues containing non-mandatory regulation, the motivational factors for social and environmental reporting in Ethiopian companies should be investigated to influence its degree of improvement. Therefore, this study has identified factors that influenced social and environmental reporting among Ethiopian companies; more importantly, it has provided an insightful explanation for the factors by using different theoretical perspectives.

## LITERATURE REVIEW

### Theoretical review

Previous studies produced diverse body of academic

literature which explains the underlying motivational factors of company's social and environmental reporting; however, a comprehensive theoretical framework is still elusive. The most dominant theories that have been used were legitimacy, stakeholder and agency theories (Nguyen et al., 2017; Suttipun and Stanton, 2012; Ali and Rizwan, 2013; De Burgwal and Vieira, 2014).

Legitimacy theory provides a comprehensive perspective of social and environmental reporting as it explicitly recognizes that companies are bound by social contract. The theory explains this social contract as an arrangement in which the firms agree to perform various socially desired actions in return for approval of their objectives and other rewards which will ultimately guarantee their continued existence and legitimation (Deegan, 2002). According to Nguyen et al. (2017), an entity can exist when its value system is consistent with the value system of the larger social system in which it is located. Additionally, Ali and Rizwan (2013) argue that only legitimate company has the right to utilize society's natural and human resources. This implies that organizations are required to respond to the changing expectations of the society to maintain their legitimacy (Woodward et al., 2001). The theory suggested that larger companies have to act more in response to reporting in order to have a greater influence on social expectations since they have more stakeholders than small companies (Ohidoa et al., 2016).

The other theoretical perspective is stakeholder theory, which divides the whole society into groups called stakeholders. It is more oriented to managerial tool for managing the informational needs of the various powerful stakeholder groups (shareholders, suppliers, customers, employees, general public, government and others) (Nguyen et al., 2017). This makes it in some way different from legitimacy theory in which, legitimacy theory discusses the expectations of society in general (Ali and Rezwan, 2013). Stakeholder theory states that all stakeholders are concerned with the environmental performance of the company but different stakeholders will have different views on how an organization should conduct its operations. Therefore, reporting is considered as a dialogue between the company and its stakeholders for negotiating this different social contract with each group of stakeholders (De Burgwal and Vieira, 2014).

Finally, agency theory deals with the relationship of firms with various economic agents who act opportunistically within efficient markets. In agency relationships, management is required to provide periodic reporting on the performance of the company to its principal and then, performance of management is assessed by the principal based on the report that has been submitted. Through this assessment, reporting can serve as a means of accountability and transparency of management performance to the principal in determining debt contractual obligations, managerial compensation contracts or implicit political costs (Reverte, 2009). In the

corporate annual financial statement, there is additional information on corporate responsibility in environmental aspect. However, company's environmental reporting and its accountability are based on fulfilling the principal's desire (Wahyuni and Mahmud, 2017). The contract between principal and agent is under the assumptions of short-termism, utter selfishness and utility maximization (Gray et al., 2014). This assumption limits the scope of relevant social and environmental reporting as well as its intended purpose; so far, principals mainly creditors might sit uncomfortably with more investment on the area which they believe will return evasive market advantage. On the other hand, there is a belief that social and environmental reporting helps organizations to attract new investors and obtain financing at a lower cost (Jizi et al., 2014).

### Empirical review and hypotheses development

The discussed theories have different perspectives on the same issue and viewed as complementary in explaining social and environmental reporting. Previous studies have also used different theoretical approaches to explain the factors that influence social and environmental reporting of firm's indifferent part of the world (Hussainey et al., 2011; Nguyen et al., 2017; Esa and Anum Mohd Ghazali, 2012). Therefore, based on the reviewed literatures and the stated theoretical frameworks, the current study has formulated hypotheses to explain the factors that influence social and environmental reporting practice of companies as the following.

Legitimacy theory is concerned with the whole public and consequently companies that are deemed to be more highly exposed to public scrutiny are subject to high pressure on their social and environmental activities from the public, consumer, employees, and government regulatory bodies. Larger companies and older firms are more likely dominant in the society and thus these companies are expected to have larger and diversified stakeholders in their product market and across diversified geographical area (Knox et al., 2006; Aerts et al., 2006). Consequently, they will be highly visible for social activists or regulators and thus they will use social and environmental reporting as a way to enhance their legitimacy through establishing their social responsibility credentials which will reduce the pressure of public scrutiny (Wachira, 2017; Ohidoa et al., 2016).

Moreover, older firms are more likely to be bigger firms and for them the cost and ease of gathering information is less than the small and young companies, their accounting system is relatively effective; so participating and reporting social and environmental practices will be less costly than that of small firms (Nguyen et al., 2017). From an empirical perspective, various studies have found both firm age and size have a positive influence on social and environmental reporting (Welbeck et al., 2017;

Kansal et al., 2014; Dyduch and Krasodomska, 2017; De Burgwal and Vieira, 2014; Reverte, 2009). Hence, the first two hypotheses are developed as follows:

*H1: There is a positive and significant relationship between firm size and social and environmental reporting.*

*H2: There is a positive and significant relationship between firm age and social and environmental reporting.*

According to stakeholder theory, profitable firms are more motivated to satisfy the information needs of the stakeholders (Ismail and Chandler, 2004). There can be several underlying explanations for this positive relationship. According to Pirsch et al. (2007), profitable firms have the necessary economic means to practice in social and environmental reporting, since companies with less economic resources are expected by their owners to focus on activities that have more direct return for the company. The other explanation was a management that has the knowledge to make a company profitable will also have the knowledge and understanding of social responsibility (Adda et al., 2016). Moreover, managers in more profitable companies disclose social and environmental information in order to support their own position and compensation (Fernandez, 2016).

However, previous empirical studies revealed a mixed result in regard to the relationship between social and environmental reporting with profitability (De Burgwal and Vieira, 2014; Hussainey et al., 2011; Welbeck, 2017; Dyduch and Krasodomska, 2017). Based on reviewed literatures, the study presumed that more profitable firms want to keep their social contract to maintain their place in the eye of their immediate stakeholders (that is, supplier and customers), the public as a whole and then, they will focus more on social and environmental reporting. Accordingly, to test this argument the following hypothesis was formulated:

*H3: There is a positive and significant relationship between firm profitability and social and environmental reporting.*

Leverage is another factor used in the literature to explain social and environmental reporting. The agency argument stated that, highly leveraged firms are more likely to voluntarily disclose more information (Jensen and Meckling, 1976). In line with this theory, Naser and Hassan (2013) evidenced that a company with higher debt to equity ratio disclose more detailed information than company with low leverage in order to satisfy the need and requirements of lenders. However, according to Wahyuni and Mahmud (2017), the disclosed information is based on the desire of the principal which positioned reports of social and environmental information on the willingness of creditors and shareholders. In line with this, there is also an argument which states that highly levered



firms face financial difficulties; thus, it is difficult for them to invest in social and environmental reporting which has no short-term financial return (Chiu and Wang, 2015). On top of these arguments, most research findings inclined to the negative relationship of leverage and social and environmental reporting (Purushothaman et al., 2000; Brammer and Pavelin, 2008; Chiu and Wang, 2015). Therefore, this study has developed the following hypothesis:

*H4: There is a negative and significant relationship between firm leverage and social and environmental reporting.*

Board size is another attribute which was frequently used as explaining factor of social and environmental reporting studies. Larger board size can help boards to overcome skill insufficiencies in making more flexible disclosure related to future earnings (Dyduch and Karasodomska, 2017). Studies by Siregar and Bachtiar (2010) and Esa and Anum Mohd Ghazali (2012) confirmed that as the number of board member increases, the extent of social and environmental reporting also increases simultaneously. In the current study, the assumption was when the board size is larger, then the members will more likely be versatile than a smaller one because they have expertise from various disciplines that optimally mobilize resources from the social contract. Based on the mentioned reasoning the following hypothesis was developed:

*H5: There is a positive and significant relationship between firm board size and social and environmental reporting.*

Both legitimacy and stakeholder theory stated that sensitive industries are considered to feel a great pressure from society or certain stakeholders to provide environmental information and thus, they are more likely to disclose this information to avoid a legitimacy gap between society and corporate operations (De Burgwal and Vieira, 2014). Environmentally sensitive industries are referred to industries whose activities affect the environment directly (like: mining, chemical, and manufacturing) (Reverte, 2009). Since, firms in sensitive industries have a direct and visible effect on the environment and will face a great pressure to comply with strict environmental regulations. Otherwise, stakeholders (NGOs, government and the general public) and especially investors may assume that the social contract is breached (Clarkson et al., 2008; Brammer and Pavelin, 2006). Most results of previous studies (Reverte, 2009; Bayoud and Kavanagh, 2012; Naser and Hassan, 2013; Dyduch and Karasodomska, 2017) support the aforementioned argument. Thus, the current study has also developed the following hypothesis:

*H6: There is a positive and significant relationship*

*between industry sensitivity and social and environmental reporting.*

## METHODOLOGY

### Study design

This research has adopted explanatory research design with quantitative research approach to identify the causal relationship between environmental reporting and factors that can influence social and environmental reporting of large tax payer companies in Ethiopia. The study has utilized both primary and secondary data. The primary data has been collected through structured questionnaire which included both closed and open-ended questions. The closed ended questions were used to collect categorical data, whereas the open-ended questions have been utilized for enabling the respondents to provide a detail of self-expression that deals with environmental disclosure. On the other hand, audited financial statement of the sampled companies was used as secondary data.

The target populations of this study were large tax payer's companies in Ethiopia. According to Ethiopian Revenue and Custom Authority (ERCA), there were 1050 large tax payer companies<sup>1</sup> during the study period (2018). Out of the total population, 290 sample size was determined using Yamane (1967) formula. However, as the response rate was 90.3%, only 262 companies were considered as subject for the analysis.

### Model specification and variable measurement

In order to investigate factors that affect social and environmental reporting, the study used binary logistic regression model. The binary logistic regression model was selected due to the nature of the dependent variable (categorical variable) with having only two categories (disclosing companies and non-disclosing). To capture the phenomena in a mathematical form:

$$Y_i = \beta X_i + U_i \quad (1)$$

where  $Y_i$  is the observed response for the  $i_{th}$  firm which had SER or not.  $X_i$  is a set of independent variables such as age, size, profitability, leverage, board size and industry's environmental sensitivity.

$Y_i$  will be equal to one when a company employs SER and zero otherwise. This means that:  $Y_i=1$  if  $X_i$  is greater than or equal to critical value,  $X^*$  and  $Y_i=0$  if  $X_i$  is  $\leq$  critical value,  $X^*$ . It is important to note that  $X^*$  represents the combined effects of the exogenous variables  $X_i$  at the threshold level. Equation 1 represents a binary choice model involving the estimation of probability of a company reporting social and environmental information (Y) given a set of factors (X) which are exogenous to the companies. In mathematical notation, this is shown as:

$$P(Y_i=1) = F(\beta' X_i) \quad (2)$$

$$P(Y_i=0) = 1 - F(\beta' X_i) \quad (3)$$

The logit model used a logistic cumulative distributive function to estimate P as follows:

<sup>1</sup>According to ERCA companies are classified as large taxpayers when they have annual turnover (revenue) more than 37 million Ethiopian birr.

**Table 1.** Measurement of variables.

No.	Variable	Measurement
1	Social and environmental reporting	Dummy variable (1 if firm is reporting social and environmental information, 0 if not)
2	Size	Log of total asset
3	Profitability	Return on asset (Net income/Total asset)
4	Financial leverage	Debt ratio (Total debt to total asset)
5	Industry environmental sensitivity	Dummy variable (1 if firm is exposed to environmental problem, 0 if it is not)
6	Board size	Number of board member
7	Firm Age	Number of years until study data were collected

**Table 2.** Descriptive statistics for both dependent and independent variables.

Variable	AGE	SIZE	LEV	PROF	BS	SER	IS
Mean	20.927	6.155	0.597	0.063	6.778	-	-
Maximum	63	9.953	1.764	0.290	9	-	-
Minimum	6	1.500	0.031	-0.027	3	-	-
Std. Dev.	7.073	2.315	0.358	0.074	1.326	-	-
Frequency for score=1	-	-	-	-	-	186	167
Percentage	-	-	-	-	-	70.99	63.74
Observation	262	262	262	262	262	262	262

$$p(Y_i = 1) = \frac{e^{\beta'x}}{1 + e^{\beta'x}} \quad (4)$$

$$p(Y_i = 0) = 1 - \frac{e^{\beta'x}}{1 + e^{\beta'x}} = \frac{1}{1 + e^{\beta'x}} \quad (5)$$

The probability model is a regression of the conditional expectation of Y on X which results in:

$$E(Y | X) = 1(F(\beta'X_i)) + 0(1 - F(\beta'X_i)) = F(\beta'X_i) \quad (6)$$

Assuming that, when the model is nonlinear, the parameters could not necessarily be the marginal effects of the various independent variables. The relative effect of each of the independent variables on the probability of reporting social and environmental information is obtained by differentiating Equation 6 with respect to  $X_{ij}$  which results in:

$$\frac{\delta P_i}{\delta X_{ij}} = F(\beta'X_i) (1 - F(\beta'X_i)) \beta \quad (7)$$

Then, the model was estimated by using the maximum likelihood method. To analyze the relationship between SER and motivational factors, the estimated empirical model is:

$$P(\text{SER}=1/X) = \beta_0 + \beta_1 \text{AGE}_i + \beta_2 \text{SIZE}_i + \beta_3 \text{PROF}_i - \beta_4 \text{LEV}_i + \beta_5 \text{BS}_i + \beta_6 \text{IS}_i + U_i \quad (8)$$

where  $\text{SER}_i$  = social and environmental reporting of company i,  $\text{AGE}_i$  = age of company i,  $\text{SIZE}_i$  = size of company i,  $\text{PROF}_i$  = profitability of company i,  $\text{LEV}_i$  = leverage of company i,  $\text{BS}_i$  = board size of company i,  $\text{IS}_i$  = industry environmental sensitivity of company i,  $\beta_0$  = Constant (intercept),  $\beta_1, \beta_2, \dots, \beta_6$  = slope coefficients of independent variables, and  $U_i$  = the discrepancy term.

## RESULTS AND DISCUSSION

### Descriptive statistics

From the sampled companies, 70.99% were reporting their social and environmental practice (Table 1). Moreover, out of the sampled companies, 63.74% were engaged in either in mining or agriculture or manufacturing industry and thus, they were considered as sensitive industry for the environment. The mean value of age, size, leverage, profitability and board size were 20.93, 6.155, 0.597, 0.063 and 6.78, respectively. The minimum and maximum value of age was 6 and 63, respectively. Then, these results had shown a bigger variability among the sampled companies (Table 2).

### Correlation analysis among variables

To observe SER association with the motivational factors and ascertain whether the independent variables were not highly correlated with each other, Pearson correlation matrix was employed. As it was illustrated in Table 3, social and environmental reporting had a positive linear relationship with all explanatory variables except leverage, which had a negative relationship. The values of correlation coefficient for independent variables were all below the recommended threshold (0.8) by Gujarati and Porter (2003). Furthermore, the VIF (Table 4) also confirms that there is no evidence of multi-collinearity.

**Table 3.** Pearson correlation matrix.

Variable	SER	AGE	SIZE	PROF	LEV	BS	IS
SER	1						
AGE	0.70	1					
SIZE	0.54	0.39	1				
PROF	0.29	0.22	-0.14	1			
LEV	-0.46	-0.32	-0.40	0.11	1		
BS	0.60	0.40	0.54	-0.02	-0.33	1	
IS	0.53	0.40	0.16	0.17	-0.12	0.30	1

**Table 4.** VIF statistics.

Variable	VIF
Size	1.651
Prof	1.164
levge	1.278
Bords	1.585
Insest	1.253
Age	1.582

### Regression results

The study had employed a logit regression model. Heteroscedasticity problem was expected since the collected data were cross-sectional. To test heteroscedasticity problem, the study used the following hypothesis:

Ho:  $\lambda LR=2[\text{Log Lu}-\text{LogLr}] > \text{critical value at 5 \% significance level, Heteroscedasticity}$

Ha:  $\lambda LR=2[\text{Log Lu}-\text{LogLr}] < \text{critical value at 5 \% significance level, no Heteroscedasticity}$

where log Lu is the value of unrestricted log-likelihood function and Lr is the value of restricted log –likelihood function.  $\lambda LR$  had a distribution with n degrees of freedom where n is the number of independent restrictions. The LR statistics of testing the null hypothesis of homoscedasticity assumption is given by:

$$LR = 2[\text{Log Lu} - \text{Log Lr}]$$

where Log Lu is the maximized value of unrestricted log-likelihood function and Log Lr or the maximized value of restricted log-likelihood function estimated only with constant term. In this model, the value of the log-likelihood with only constant term (restricted log-likelihood) was -157.78164 and the maximized log-likelihood value of full model (Unrestricted log like hood) was -20.117624. Therefore, the result of the test for the model is shown as:

$$LR = 2[-20.117624 - (-157.78164)] = 275.328032$$

The critical value of Equation 6 is 12.5916 at 5% significance level. Thus, the LR exceeds the critical value, which implies that the model has heteroscedasticity problem. Thus, in order to correct such problem, robust standard errors estimation was employed.

The model was statistically acceptable as 87.25 of the variation explained in the logit model (Table 5). The Chi-square test showed that the model was significant at 1%, which in turn declared the overall model was a good fit with p-value of 0.0000. The regression result showed age, size, profitability, board size and industry's sensitivity had a significant positive impact on social and environmental reporting of companies, whereas leverage had a negative effect.

A positive impact of age, size and industry's sensitivity on Ethiopian companies' engagement in reporting of their social and environmental information were as expected, which then indicated that when a company gets older or bigger or environmentally sensitive, they were more likely to report their social and environmental practice. Given that these explanatory variables were more related with social visibility; firms wanted to be perceived as a good company for the society and gained a public confidence by disclosing their social and environmental information which in turn maintains their social contract; keeping their dominancy and enabled them to minimize evil eye on the company (Reverte, 2009; Knox et al., 2006; Aerts et al., 2006; Wachira, 2017; Ohidoa et al., 2016; De Burgwal and Vieira, 2014; Naser and Hassan, 2013). According to these results, legitimacy theory was relevant for Ethiopian companies, because they have reported to sustain their legitimacy or to avoid a legitimacy gap between the society and firm's operation.

The impact of profitability on companies social and environmental reporting was significantly positive, which implied that when Ethiopian companies were more profitable, they would be more ambitious for satisfying the information needed of their stakeholders; especially stakeholders who were in control of the important resources of the firm. This result is in line with stakeholder theory and previous studies (Adda et al., 2016; Pirsch et al., 2007), which confirmed that profitable firms have more economic resource to invest in building their

reputability and maintain their position in addition to investing on activities which had direct return like those with a less profitable companies do.

On the other hand, this study revealed that leverage had a negative significant effect on Ethiopian companies' social and environmental reporting which then implied that unlevered firms reported more environmental-related information than levered firms. This finding also suggested that, when companies in Ethiopia were more levered, their creditors can exert much pressure on them to participate in investment activity which has more direct financial return. Therefore, even if agency theory stated that levered firms have more disclosure than less levered one for minimizing the agency cost, the reporting of levered firms was not inclined to social and environmental information, which was similar to the findings of Wahyuni and Mahmud (2017), Reverte (2009) and Dyduch and Kasodomska (2017).

Finally, board size had a significant positive impact on social and environmental reporting. This result indicated that when board size became larger in Ethiopian companies, they were more likely to have expertise who were capable of observing the bilateral nature of companies' relationship with its environment from various angle. The result was in line with finding of Siregar and Bachtiar (2010) and Esa and Anum Mohd Ghazali (2012) which reported that, as the number of board member increased, the social and environmental reporting could also have moved in the same direction.

## Conclusion

In Ethiopia, there was no regulatory body for social and environmental reporting and thus, around 71% of sampled companies were reporting their social and environmental information during the study period but such figure was obtained due to companies were engaged through voluntary framework. Hence, the study was aimed to investigate the motivational factors influencing reporting of social and environmental information voluntarily among large tax payer companies in Ethiopia. Accordingly, the result of the study would be helpful for different stakeholders to design any policies or regulation to sustain the companies reporting practice and increase quality and quantity of social and environmental information provided for the public.

The result of the study also evidenced that size, age and industry's sensitivity were positively affected by the social and environmental reporting practices of Ethiopian large tax payer companies. This indicates socially visible companies were more involved in reporting their social and environmental practice. Ethiopian companies voluntarily reported their social and environmental reporting for enhancing their position and image in the society, legitimizing their activity and mitigating the negative impact of their operation to the environment.

Profitability of companies also positively affected their

social and environmental reporting. This indicated that profitability can relax companies' investment decision, even if that investment enhances companies' evasive advantage. Then, it implied that profitable companies could use their reporting to sustain their profitability and maintain their social contract. Moreover, it is obvious that engaging in social and environmental reporting has its own cost and as a result of this cost, a decision to report social and environmental practices could be hard for any manager without a direct observable return. Therefore, profitable companies have futuristic manager who has knowledge of its social responsibility in addition to making the company profitable.

Moreover, the result of the study has indicated that board size positively affected social and environmental reporting. This is an indication of board member's expertise is important for organizations involvement in social and environmental reporting. It is also known that board members are among the top supervisor of the organization and when larger member of expertise combined together it can result in a greater social responsibility. The other finding of this study evidenced that leverage impacted negatively the social and environmental reporting. This in turn implied that companies' indebtedness caused inflexibility to engage in social and environmental reporting as a result of creditors orientation towards companies' short-term return.

Finally, this study majorly depends on firm characteristics that lead to social and environmental reporting; however, it believed that there are also other external factors which might contribute for their voluntary reporting. Future study on the problem area can go through both firm characteristics and other external factors (such as local and international level regulation, accounting standard, and others). Furthermore, the absence of common accepted standard for social and environmental reporting makes it difficult to go through the content of companies reporting. Therefore, dummy variable was used to measure the social and environmental reporting of Ethiopian companies. With this respect, further study is recommended to use content analysis in order to draw better conclusion.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge Wolkite University for financial and material support for this study.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# **Did index trader and swap dealer activity produce a bubble in the agricultural commodity market?**

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Received 29 August, 2019; Accepted 16 January, 2020

**This paper investigates the role of speculative activity in the agricultural commodity futures market in the period 2006-2017. Specifically, the study tests the causal relationship between the prices of fourteen agricultural commodities listed on the US commodity market Chicago Mercantile Exchange (CME) and Chicago Board of Trade (CBT) and the trading activity of commodity index traders (CITs) and swap dealers. The analysis uses the Granger Causality test based on a seemingly unrelated regression (SUR) system. The results show that CIT and swap dealer positions did not significantly influence prices of agricultural commodities, but might explain the increase in their price volatility. The findings disprove Masters' hypothesis that speculators produced a bubble in the commodity market. In this context, any attempt (such as taxes) by lawmakers to limit speculation should be carefully evaluated.**

**Key words:** Commodity index traders, swap dealers, agricultural futures market, Masters' hypothesis, Granger causality.

## **INTRODUCTION**

In recent years, prices of agricultural commodities have undergone abrupt variations, which have threatened food security of countries, which are more dependent on food imports and characterized by poverty. The phenomenon has attracted the attention of food policy makers and academics, who investigate both causes and possible solutions. The rising level and volatility of food prices was particularly evident in 2007-2008. FAO (2009) states that in fact there was a real "surge" in both spot and future prices in that period, and it generated an increase of about 100 million undernourished individuals worldwide. These fluctuations continued in the following years: in 2009 there was a collapse in prices, but prices rose again

in 2011. From 2011 to 2014, agricultural commodity prices were stable, but later they declined again and in 2016 the FAO food price index reached the same level as 2007 (FAO, 2017).

There are many possible economic reasons for these anomalous price movements, including the progressively extreme weather conditions, the development of emerging economies (particularly China), and the increasing use of land for the production of biofuels instead of food.

However, according to Gheit (2008), Masters and White (2008), Petzel (2009), Hamilton (2009), Einloth (2009), Robles et al. (2009), Wahl (2009), Gilbert (2010),

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JEL classification: C12; G12; Q14.

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and Tang and Xiong (2012), factors related to changes in supply and demand fundamentals cannot fully explain the high volatility of agricultural commodity prices since 2007. The other factor that could have increased volatility since 2007 is excessive speculation. On this point, Masters (2008), Masters and White (2008), and Gilbert (2010) find that speculators and, among others, commodity index traders (CITs), could have caused a bubble that burst in 2009, generating a sudden and unexpected drop in commodity prices.

There are in fact several explanations for the "special" role of CITs in increasing commodity price volatility. First, they mainly take long positions and renew them through the rollover technique, without disinvesting before the expiration date. Moreover, unlike "traditional" speculators, CITs invest in different commodity indices rather than focusing on a specific one. This makes their participation in different commodity markets very wide. Finally, CITs cannot only buy long-term derivatives directly on futures market, but can also invest in commodity indices "sold" by swap dealers, and thus be involved in numerous contracts.

The idea that excessive speculation in the commodity futures market could have pushed future and spot prices up above levels justified by supply and demand fundamentals thus creating a 'bubble', was first put forward by Masters (2008) and is thus known in the literature as "Masters' hypothesis". Michael Masters, the director of the hedge fund Master Capital Management L.L.C., in fact put forward his theory to the permanent subcommittee of the United States Senate (2009), set up to investigate anomalies in wheat prices by the Chicago Board of Trade. Specifically, Masters accused CITs of being responsible for commodity price fluctuations recorded in 2007-2008 and called for the Senate to establish stringent limits to speculation (FAO, 2009).

Masters' hypothesis was supported with data published in the SCOT reports by the Commodity Futures Trading Commission (CFTC). These showed a significant increase in the open interest held by CITs in 2007, 2008, 2010 (when the threshold of 500,000 contracts on corn was exceeded) and 2014. The data also proved the rapid and significant growth in volumes of contracts. In the case of corn, for example, the number of future contracts rose from 273,000 in December 2008 to almost 405,000 in December 2009.

Masters' hypothesis led to heated debate about the role of CITs in the commodity futures market.

Some authors share Masters' point of view (Gheit, 2008; Masters and White, 2008; Petzel, 2009; Hamilton, 2009; Einloth, 2009; Robles et al., 2009; Wahl, 2009; Gilbert, 2010; Tang and Xiong, 2012; Van Huellen, 2019).

Other authors, "skeptics" (Headey and Fan, 2008; Brunetti and Büyüksahin, 2009; Irwin et al., 2009; Till, 2009; Aulerich et al., 2009; Sanders et al., 2010; Stoll and Whaley, 2010; Buyuksahin and Harris, 2011; Capelle-Blancard and Coulibaly, 2011; Irwin et al., 2011;

Rouwenhorst and Tang, 2012), find that Masters' bubble hypothesis shows weaknesses and is not consistent with typical market mechanisms.

Moreover, studies by the World Bank (2008) and Childs and Kiawu (2009) follow a weaker version of Masters' hypothesis, finding that the absence of a statistically significant impact of the speculator activity on commodity futures prices does not imply that this activity had no effect at all.

Overall, previous literature finds conflicting evidence that Masters' hypothesis provides a valid explanation of agricultural future market functioning, and further studies on the real impact of speculator positions are needed. In this context, this paper aims to test the possible Causality relation between the trading activity of CITs and swap dealers and the prices and price volatility of the main agricultural commodities in the period 2006-2017. Specifically, our paper tries to answer the following research questions: (i) did CITs and swap dealers' trading activity influence agricultural commodities prices in the period 2006-2017? and (ii) did CITs and swap dealers' trading activity influence agricultural commodities price volatility in the same period?

The study enriches previous literature from different points of view. First, to our knowledge, our dataset is the first to include not only the 12 agricultural commodity markets of the SCOT report, but also the soybean meal and the oats markets. A second innovation is the extension of the time horizon, as our data are collected from 13 June 2006 to 26 December 2017, for a total of 603 observations. We also improve previous literature from a methodological point of view as we calculate the Granger Causality by using a SUR system. Finally, we use two different proxies for speculation: the working T index (long-term speculation) and the volume of open interest ratio (short-term speculation).

## LITERATURE REVIEW

The rapid increase in agricultural commodity prices recorded in mid-2008, their rapid subsequent decrease and their further fluctuations in the following years stimulated a debate on the role of speculation in financial markets.

In this context, in 2008 Michael Masters put forward his hypothesis. The large amount of speculative funds invested in different types of agricultural commodity derivatives in recent years and the significant and unwarranted upward pressure on their prices support the validity of Masters' hypothesis in the agricultural commodity market.

The first strand of literature shares Masters' point of view (Gheit, 2008; Masters and White, 2008; Petzel, 2009; Hamilton, 2009; Einloth, 2009; Robles et al., 2009; Wahl, 2009; Gilbert, 2010; Tang and Xiong, 2012; Van Huellen, 2019).

Gilbert (2010) examines commodity price trends in different futures markets: crude oil, aluminium, nickel, copper, corn, soybeans, and wheat. He finds evidence that in the period under investigation (2006-2008 for crude oil and grains and 2000-2008 for three non-ferrous metals), commodity index funds influenced commodity futures prices in two of the seven markets. Specifically, the author identifies three bubbles for copper (in 2004, 2006 and 2008) and a bubble for soybeans (at the beginning of 2008).

Tang and Xiong (2012) demonstrate that, together with the rapid growth of investments in commodity indices, non-energy commodity prices became increasingly correlated with oil prices in the period 1998-2011. They interpret this result as evidence that the price of agricultural commodities was influenced not only by fundamentals, but also by the trading activity of speculative funds, and the process of "market financialization" led to a growing correlation between commodities.

Petzel (2009) supports Masters' hypothesis, finding that unleveraged futures positions of index funds represented new demand and the amount of these investments was "too big" for the size of the commodity futures market.

According to Wahl (2009), the sudden rise in commodity prices recorded in the period 2006-2008, proved by an increase in the FAO index of 71%, could not be explained by long-term factors such as the demand of emerging countries or stagnation of production. It could only be explained by food speculation. Moreover, Einloth (2009) supports Masters' hypothesis using the basic theory of storage. This theory, which states that low inventories lead to the rise of commodity prices and the increase of marginal convenience yield, was not however completely verified by the author for the oil market. Einloth (2009) interprets his result as evidence that the oil price peaks recorded in 2008 were due to the effects of speculation, although he does not focus specifically on index trader activities. These ideas were shared by Gheit (2008) and Hamilton (2009).

Robles et al. (2009) also support this view. Their analysis, based on 49 Granger Causality tests and developed using different speculation proxies, shows in fact that index trader speculative activity positively influenced the prices of four agricultural commodities (maize, rice, soybeans and wheat) in the period 2006-2008. The same conclusion is reached by Van Huellen (2019) in his study of three agricultural commodities (wheat, corn and soybeans) in the period 2006-2015.

Sharing the bubble hypothesis, Masters and White (2008) recommended three specific regulatory steps to establish more stringent limits on speculation. The first step was re-establishing speculative position limits for all products and all markets, to be applied every month by the CFTC instead of on a spot basis. Second, they called for an amendment to the Commodity Exchange Act, in

order to define excess speculation numerically in terms of open interest. The third step was legislation aiming to eliminate or, at least, drastically reduce, index speculation.

Masters' hypothesis was also supported by the U.S. Senate Permanent Subcommittee on Investigations (2009), which was established to examine the performance of the Chicago Board of Trade's (CBOT) wheat futures contract. The subcommittee, in its report dated 24 June 2009, concluded in fact that: "*there is significant and persuasive evidence to conclude that these commodity index traders, on the whole, were one of the main causes of unjustified changes in the price of futures contracts on wheat compared to the price of wheat in the spot market*".

However, Masters' hypothesis shows some weaknesses. The "skeptics", including Headey and Fan (2008), Brunetti and Büyüksahin (2009), Irwin et al. (2009), Till (2009), Aulerich et al. (2009), Sanders et al. (2010), Stoll and Whaley (2010), Buyuksahin and Harris (2011), Capelle-Blancard and Coulibaly (2011), Irwin et al. (2011), Hamilton and Wu (2012), Rouwenhorst and Tang (2012), Sanders and Irwin (2013), Sanders and Irwin (2016), and Etienne et al. (2017), argue in fact that the bubble hypothesis has several critical aspects and is not consistent with typical market mechanisms.

Specifically, Irwin et al. (2009) identify three logical inconsistencies. The first is equating money flows into derivatives markets with demand for physical commodities. Combined with the evidence that commodity future markets are zero-sum, this suggests that money flows in themselves did not necessarily impact prices. Moreover, Irwin et al. (2009) find that, as CITs are rarely involved in the delivery process of physical commodities or the cash market in general, their trading could have not influenced the equilibrium cash prices. The third inconsistency is identifying index funds as pure risk-seeking speculators and hedgers as pure risk avoiding, because on the market speculators sometimes hedge and hedgers sometimes speculate.

In addition to these "errors", there are other ways in which the bubble hypothesis is not convincing, as suggested by Irwin et al. (2009). First, if the hypothesis held, many investments made by index traders should have been linked to an increase in stocks while, in reality, in the period 2006-2008 stocks declined in most commodity markets. Second, in the same period, the relationship between prices and inventories for storable commodities was convex. Moreover, markets with the highest concentration of index fund positions showed the smallest price increases (Irwin et al., 2009), which is the opposite of what the bubble hypothesis predicts. Furthermore, the buying positions of index funds were very predictable, and this conflicts with theoretical models based on the assumption of unpredictable trading patterns of these traders to make arbitrage risky. Fifth, price increase in 2006-2008 was also recorded in



markets without index fund participation and for commodities without futures markets (Headey and Fan, 2008; Stoll and Whaley, 2010). Again, in the same period, speculation was not excessive if properly compared to the demand for hedging. Speculation in fact should not be considered excessive only in terms of capital flows speculated; the needs of hedgers also need to be taken into account. On this point, the absence of excessive speculation was tested by Buyuksahin and Harris (2011) in the crude oil futures market in 2004-2009, by Till (2009) in the crude oil, heating oil, and gasoline futures markets in 2006-2009 and by Sanders et al. (2010) in nine agricultural futures markets in 2006-2008. The role of CITs in creating a bubble in the commodity futures market is also minimized by Stoll and Whaley (2010). They show that commodities outside an index are correlated with those within an index to the same extent that they are correlated each other. In their opinion, this means that fundamentals, rather than CIT investments, explain the correlation.

In this context many studies, using the Granger Causality test, find very little evidence of a causal relationship between index fund positions and movements in different agricultural commodity futures prices. This supports the idea that index funds did not cause a bubble (Brunetti and Büyüksahin, 2009; Aulerich et al., 2009; Capelle-Blancard and Coulibaly, 2011; Irwin et al., 2011; Rouwenhorst and Tang, 2012; Gilbert and Pfuderer, 2014; Garcia et al., 2015; Donati et al., 2016; Etienne et al., 2017).

Specifically, Irwin et al. (2011) find evidence that Masters' hypothesis could be verified in the period January 2004-September 2009 only for the corn market (and not for corn, soybeans and wheat considered jointly), and only when the percentage of open interest was used as proxy of speculation. They also find a negative relation between the two variables rather than a positive one, as one would expect if index traders had actually been responsible for the bubble.

Capelle-Blancard and Coulibaly (2011) also find very little evidence of a causal relationship between index fund positions and movements in the futures prices of the twelve commodities examined in the SCOT reports in the period 2006-2010.

Moreover, Brunetti and Büyüksahin (2009), using not-publicly available data provided by the CFTC large trader reporting system, test the Granger Causality between the daily rate of returns of futures contracts on corn and other non-agricultural commodities and the daily positions of the five most important categories of traders in two different periods (2005-2009 for non-agricultural commodities and 2006-2009 for corn). They find that corn prices were not affected by trader positions. The same not-publicly available data, referring to the twelve agricultural commodities analyzed in the SCOT reports, are used by Aulerich et al. (2009), who find no evidence of the validity of Masters' hypothesis.

Rouwenhorst and Tang (2012) also find very weak evidence of a causal relationship between index trader positions and movements in the futures prices of the twelve commodities examined in the SCOT reports. Their results show in fact that in the period 2006-2010, only one commodity of twelve passed the Granger Causality test, and with a negative coefficient. Also Gilbert and Pfuderer (2014) use the same test in order to verify the role of CIT positions in explaining weekly returns of four commodities (corn, soybeans, CBOT wheat and KCBT wheat) in the period January 2006-December 2011. Their evidence shows no Causality at the 5% significance level and a weak negative Causality at the 10% significance level, only in the corn market. This appears to confirm that index traders bore no responsibility for the rise in agricultural commodities weekly returns.

Moreover, Donati et al. (2016) consider the twelve agricultural commodities of the SCOT reports in order to test the causal relationship between CIT positions and commodities returns and both realized and implied volatility between 2006 and 2015. They also investigate the inverse relationship between these variables and, in order to use daily as well as weekly data, choose the volume to open interest ratio (VOIR) as proxy of trading activity. Their results find no significant relationships except for a negative link between trading activity (measured by VOIR) and realized volatility. Finally, Etienne et al. (2017) find mixed results in their study of the causal relationship between CIT net long positions and the weekly returns of four agricultural commodities (corn, soybeans, CBOT wheat and KCBT wheat) in the period January 2004-June 2015 using the Granger test. Specifically, they find a weak and negative relationship between the variables investigated only on the corn market.

In order to overcome possible limits of the Granger Causality test, Sanders and Irwin (2016) test the same relationship investigated by Etienne et al. (2017) using a Fama-MacBeath regression, considering the 19 markets appearing in the IDD reports. Their estimations, conducted from 2008 to 2015 on annual, quarterly and monthly data, show no positive relationship between CIT positions and commodities market returns. In fact, they even find slight evidence of a reduction in returns due to index traders' purchases.

However, the absence of a statistically significant causal relationship between commodity futures prices and index fund positions does not imply that trading activity of CITs had no effect at all. A weaker version of Masters' hypothesis may in fact be useful. This is the idea of the World Bank (2008), Robles et al. (2009), and studies by Childs and Kiawu (2009), which identify the massive amount of investments by non-commercial traders in the agricultural commodity market as one of the different elements leading to the agricultural commodity price rise in 2008.

Overall, the literature finds conflicting evidence that CIT

speculative activity in the futures market has been a source of agricultural commodity price rises in recent years. Most papers seem not to support Masters' hypothesis, and agree that there is no direct impact of commodity index funds on commodity futures prices. However, these studies are based on different samples and time horizons, which means their results are not comparable. Further research on the market impact of agricultural commodity index funds is needed.

This paper attempts to fill this gap by testing the possible Causality relation between the trading activity of CITs and swap dealers and prices and price volatility of the main agricultural commodities in the period 2006-2017.

### SAMPLE AND METHODOLOGY

Data on trading activity was collected on the commodity US futures markets Chicago Mercantile Exchange (CME) and Chicago Board of Trade (CBT) provided by the Commodity Futures Trading Commission (CFTC) in the following reports: Commitments of Traders (COT), Supplemental Commitment of Traders (SCOT) and Disaggregated Commitment of Traders (DCOT). The COT reports, published since 1985, provide a weekly breakdown of open

$$[(NCL - CITL) + (NCS - CITS) + 2*(NCSP)] + [(CL - CITL) + (CS - CITS)] + [CITL + CITS] + [NRL + NRS] = 2*(TOI) \quad (2)$$

where in addition to the COT reports, CITL and CITS represent the long and short positions held by commodity index traders.

$$[SDL + SDS + 2*(SDSP)] + [MML + MMS + 2*(MMSP)] + [PML + PMS] + [ORL + ORS + 2*(ORSP)] + [NRL + NRS] = 2*(TOI) \quad (3)$$

In the DCOT reports, reporting traders are classified into four categories: swap dealers (SD), money managers (MM), processors and merchants (PM) and other reporting (OR).

The sample consists of 14 agricultural commodities: SRW wheat, HRW wheat, Corn, Soybeans, Soybean Oil, Cotton No. 2, Feeder Cattle, Live Cattle, Lean Hogs, Cocoa, Sugar No. 11, Coffee C, Soybean Meal and Oats. Data on the first 12 markets are extracted from the SCOT reports and data on the Soybean Meal and Oats from the DCOT reports.

Data are collected from June 13, 2006 to December 26, 2017, for a total of 603 observations. Following previous literature (Sanders and Irwin, 2010), the initial date was chosen in order to make CIT data (published since 3 January 2006) and data contained in the DCOT reports (published since 13 June 2006) comparable. The last date is the most recent date of publication by CFTC.

Data on CITs and swap dealers were extracted from the SCOT and DCOT reports, respectively. This made it possible to calculate the net position (long minus short position), the percentage of net long position (net position divided by total positions) and the percentage of long position (long position divided by total long positions in the market) for each category of traders.

The CFTC report published in September 2008 shows that about 95% of operations carried out by CITs on the agricultural commodity market had swap dealers as counterparties. Thus we consider, only with reference to soybean meal and oats, the positions of swap dealers as the best variable to proxy the position of index traders, as suggested by previous literature (Sanders and Irwin, 2010).

Market returns were calculated using continuous series of nearby futures adjusting for contract rollovers. In order to "correct" the

interest for futures and options on futures markets in which 20 or more traders hold positions equal to or above the reporting levels established by the CFTC. The total open interest is divided among different categories of traders as follows:

$$[NCL + NCS + 2*(NCSP)] + [CL + CS] + [NRL + NRS] = 2*(TOI)(1)$$

where NCL, NCS, and NCSP are the long, short and spreading positions of non-commercials, respectively and defined as all speculators active in the futures market; CL and CS are the long and short positions of commercials, classified as traders looking for coverage related to the goods they produce (hedgers); NRL and NRS are the long and short positions of non-reportables, that is, all small traders under the minimum threshold set by the CFTC.

Moreover, since 2007 the CFTC has also made SCOT reports available in response to criticism about the COT on the impact of CITs on price volatility. The COT reports, in fact, reveal two main critical issues. First, the "commercial" category includes data from swap dealers, which take long positions to cover the short ones related to the "sale" of commodity indices to the index funds. These operations can be classified as "hedging", but are completely different from pure "hedge positions". Second, the "non-commercial" category is very broad and includes the activity of commodity index traders in the COT reports, which are separated from non-commercials and presented as a separate trader category in the SCOT. In the SCOT reports, the open interest is calculated as follows:

Furthermore, in order to constantly improve the classification of traders, since 2009 the CFTC has published Disaggregated Commitment of Traders (DCOT) reports, in which the open interest is calculated as follows:

nearby prices to take into account the practice of rollover, the natural logarithm of nominal prices are estimated as follows:

$$R_t = \ln \frac{P_t}{P_{t-1}} 100 \quad (4)$$

where  $p_t$  is the future price of the nearest-to-expiration contract on each Tuesday (the day on which CFTC data are published). In order to avoid possible bias related to rollover,  $p_{t-1}$  is also calculated using futures prices for the same nearest-to-expiration contract. Data on future nearby prices is taken from Data stream. The rollover is considered to take place on or before the first day of the delivery month. Realized volatility is calculated using the estimator suggested by Parkinson (1980):

$$\sigma_t = \sqrt{\frac{Z}{n4\ln 2} \sum_{i=1}^n \left( \ln \frac{H_i}{L_i} \right)^2} \quad (5)$$

where Z is equal to 52 in order to annualize the estimate of volatility, n is equal to 1 (week) and  $H_i$  and  $L_i$  are the high and low prices of the nearest-to-expiration futures contract recorded from Wednesday to Tuesday (included).

The second volatility measure, that is, implied volatility, is calculated by including the option premiums in the Black and Scholes pricing model. Specifically, we consider the average values of the two nearest-the-money call and the two nearest the money put options, that is, the options whose strike prices are closer to the prices of the underlying assets.

Two proxies were used for speculation: the working T index (long-term speculation) and the volume to open interest ratio (short-term speculation). The working T index measures the excess of speculation with respect to coverage needs and is calculated as follows:

$$\begin{cases} 1 + \frac{NCS}{CL+CS}, se\ CS \geq CL \\ 1 + \frac{NCL}{CL+CS}, se\ CL > CS \end{cases} \quad (6)$$

A one-way Granger Causality test was run to examine whether the trading activity of CITs and swap dealers affect commodity prices and their volatility, as suggested by previous literature (Robles et al., 2009; Sanders and Irwin, 2010; Donati et al., 2016). The bivariate Granger test determines whether one time-series is useful in forecasting another time-series by estimating the following regression model:

$$y_{t,k} = \alpha_k + \sum_{i=1}^m \gamma_{i,k} y_{t-i,k} + \sum_{i=1}^n \beta_{i,k} x_{t-i,k} + \varepsilon_t \quad (7)$$

In this general formula,  $y_{t,k}$  represents the market factors for market  $k$  in year  $t$  and is explained by a constant  $\alpha_k$ , an autoregressive component  $\sum_{i=1}^m \gamma_{i,k} y_{t-i,k}$ , a casual component  $\sum_{i=1}^n \beta_{i,k} x_{t-i,k}$  and a residual term  $\varepsilon_t$ . The autoregressive component is composed of a coefficient  $\gamma_{i,k}$  (where  $i$  identifies the lag) and the lagged market factor  $y_{t-i,k}$ . The casual component is formed by a coefficient  $\beta_{i,k}$  and the lagged casual component  $x_{t-i,k}$ . The lag structure ( $m, n$ ) is determined by a procedure over  $m=4$  and  $n=4$  using an OLS method, choosing the model that minimizes the Schwartz criteria to avoid over-parameterization (Enders, 2008). The null hypotheses underlying the Granger Causality test is that the explanatory variable  $x$  does not Granger cause the independent variable  $y$ .

The independent variables of our model are the following market factors: market returns (R), realized volatility (RV) and implied volatility (IV). Our explanatory variables are: the change in the net positions ( $\Delta NET$ ), the change in the percent of long positions ( $\Delta LONG$ ) of index traders and swap dealers, the working T index (T-index) and the volume to open interest ratio (VOIR). For example, Equation 8 shows our model where market returns are the independent variable and the change in the net positions is the explanatory variable:

$$R_{t,k} = \alpha_k + \sum_{i=1}^m \gamma_{i,k} R_{t-i,k} + \sum_{j=1}^n \beta_{j,k} \Delta NET_{t-j,k} + \varepsilon_{t,k} \quad (8)$$

where  $R_t$  is the log-relative nearby futures returns for a given market  $k$  in period  $t$  and  $\Delta NET$  is the change in the net positions held by the trader group.

In order to overcome limitations of the Granger test, we improve the methodology by implementing a SUR system, where all the markets are modeled as unique system of equations. As suggested by the SUR approach, the common component for each market is the residual term  $\varepsilon_t$ . This methodology allows us to test the hypothesis  $H_0: \beta_{j,k} = 0 \quad \forall j,k$  and also the impact at the system level related to all the examined markets  $\sum_{k=1}^k \sum_{j=1}^n \beta_{j,k} = 0$ .

The software Eviews was used for the econometric analysis. As

regards our sample, data provided by the CFTC enable us to estimate the net long position of index traders and swap dealers in the period 2006-2017. The net position was calculated by subtracting short positions from long positions (in number of contracts): a positive value indicates a net long position, while a negative value indicates a net short position. Summary statistics are shown in Table 1.

Table 1 shows the net positions held by CITs (Panel A) and swap dealers (Panel B) from June 2006 to December 2017. Data are extracted from the CFTC website.

CITs show a positive minimum net position for all commodities except soybean meal and oats (Table 1, Panel A). Consequently, for these two markets, as suggested by Sanders and Irwin (2010), we consider swap dealer data as proxy for index trader data. Swap dealers show a negative minimum net position in two markets (cocoa and sugar No. 11), as shown in Table 1, Panel B. This indicates that the correspondence between positions of swap dealers and index traders was not perfect in the period 2006-2017. This evidence is consistent with results of Sanders and Irwin (2010), who found a negative net long position for the same two markets in the period 2006-2010. Table 1 also shows that CITs always have longer positions than swap dealers.

Moreover, we estimate the net long position of index traders and swap dealers by means of an alternative measure. Table 2 shows in fact the percentage of net long position held by SCOT categories (Panel A) and DCOT categories of traders (Panel B) from June 2006 to December 2017. The percentage of net long position is calculated by dividing the net position by the total positions held by each category of trader. This indicator reveals whether traders are focused on the long or short side of the market.

Table 2 shows the percentage of net long positions held by SCOT categories (Panel A) and DCOT categories (Panel B) from June 2006 to December 2017. Data were extracted from the CFTC website.

Index traders show a positive percentage of net long position in each market, with a range varying from 73% (sugar No. 11) to 94% (live cattle), as shown in Table 2, Panel A. This indicates that these traders concentrated on the long side of the market in the period 2006-2017. The percentage of net long position of commercials is however always negative. This is not surprising given that this category of traders includes hedgers, who focus on the short side of the market in order to cover the risk related to the production of agricultural commodities. Moreover, the net positions of non-commercial are always positive, except for SRW wheat.

Despite the different classification of traders, Table 2, Panel B shows that the net position of producers and merchants (which roughly corresponds to the category "commercials" in Table 2, Panel A) is negative in every market, while the net position of managed money and other reporting is always positive, except for SRW wheat. Swap dealers concentrate on the long side of the market and report very high percentages.

The net positions and the percentage of net long position reveal whether traders operate mainly on the long or the short side of the market. In order to identify the importance of each category, it is however necessary to quantify speculation. The percentage of open interest (short-term speculation) held by each trading category is shown in Table 3.

Table 3 shows the percentage of total open interest held by SCOT categories (Panel A) and DCOT categories of traders (Panel B) from June 2006 to December 2017. Data are extracted from the CFTC website.

Table 3, Panel A shows that the highest percentage of open interest is held by non-commercials and commercials traders, while index traders hold a lower percentage ranging from 9 to 21%. This demonstrates that overall the participation of index traders in the market in the period 2006-2017 was not higher than that of other traders, although index traders tended to hold high net positions (Table 1, Panel A) and to be focused on long positions (Table 2,

**Table 1.** Net positions.

<b>Market</b>	<b>Mean</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Standard deviation</b>
<b>Panel A: Commodity index traders</b>				
SRW WHEAT	162,210	229,565	96,185	35,512
HRW WHEAT	39,544	66,592	16,293	9,624
CORN	367,235	503,937	223,985	54,688
SOYBEANS	141,146	201,251	77,857	24,394
SOYBEAN OIL	82,160	113,563	36,630	14,514
SOYBEAN MEAL	29,534	87,867	-7,239	24,983
OATS	1,475	5,217	-1,266	1,263
COTTON NO.2	70,617	122,555	42,681	14,470
FEEDER CATTLE	7,720	14,225	3,663	2,385
LIVE CATTLE	107,555	156,752	60,615	23,484
LEAN HOGS	80,814	127,379	46,004	14,121
COCOA	24,154	40,226	5,117	7,812
SUGAR NO.11	228,094	392,740	131,074	59,133
COFFEE C	42,106	67,021	22,473	9,874
<b>Panel B: Swap dealers</b>				
SRW WHEAT	128,050	197,713	62,929	34,621
HRW WHEAT	28,398	49,385	9,952	7,659
CORN	282,753	442,696	163,606	64,131
SOYBEANS	106,789	193,888	36,284	29,601
SOYBEAN OIL	71,820	105,225	27,442	14,940
FEEDER CATTLE	4,581	9,180	1,364	1,654
LIVE CATTLE	84,100	128,967	49,300	17,675
LEAN HOGS	65,936	114,377	36,326	12,460
COTTON NO. 2	56,871	118,380	21,184	17,016
COCOA	9,392	26,695	-5,103	4,553
SUGAR NO. 11	117,603	271,255	-119,434	72,307
COFFEE C	31,030	56,959	10,008	9,544

**Table 2.** Percentage of net long position.

<b>Market</b>	<b>Non-commercial (%)</b>	<b>Commercial (%)</b>	<b>Index traders (%)</b>	<b>Non-reporting (%)</b>
<b>Panel A: SCOT categories</b>				
SRW WHEAT	-25	-36	75	-16
HRW WHEAT	18	-32	87	-13
CORN	19%	-28	78	-21
SOYBEANS	28	-30	76	-23
SOYBEAN OIL	10	-32	83	11
SOYBEAN MEAL	39	-30	74	22
OATS	35	-31	82	22
COTTON NO. 2	38	-48	86	17
FEEDER CATTLE	21	-11	84	-38
LIVE CATTLE	35	-56	94	-32
LEAN HOGS	22	-63	91	-20
COCOA	22	-24	74	23
SUGAR NO. 11	28	-34	73%	10
COFFEE C	9	-30	83	14

Table 2. Cont'd

<b>Panel B: DCOT categories</b>	<b>Producers &amp; Merchants (%)</b>	<b>Swap dealers (%)</b>	<b>Managed money (%)</b>	<b>Other reporting (%)</b>	<b>Non-reporting (%)</b>
SRW WHEAT	-40	84	-5	-8	-16
HRW WHEAT	-34	90	37	23	-13
CORN	-31	89	35	29	-21
SOYBEANS	-32	84	50	10	-23
SOYBEAN OIL	-35	92	24	7	11
FEEDER CATTLE	-14	86	45	10	-38
LIVE CATTLE	-58	91	52	21	-32
LEAN HOGS	-67	93	39	19	-20
COTTON NO. 2	-53	75	46	45	17
COCOA	-24	35	33	19	23
SUGAR NO. 11	-32	48	39	54	10
COFFEE C	-31	71	19	29	14

Table 3. Percent of total open interest.

<b>Market</b>	<b>Non-commercial (%)</b>	<b>Commercial (%)</b>	<b>Index trader (%)</b>	<b>Non-reporting (%)</b>	
<b>Panel A: SCOT categories</b>					
SRW WHEAT	46	25	21	9	
HRW WHEAT	36	37	13	14	
CORN	41	33	13	13	
SOYBEANS	43	35	12	10	
SOYBEAN OIL	38	40	13	8	
SOYBEAN MEAL	36	43	9	12	
OATS	25	50	8	17	
COTTON NO. 2	39	40	15	6	
FEEDER CATTLE	42	18	10	29	
LIVE CATTLE	42	30	16	12	
LEAN HOGS	44	27	17	12	
COCOA	38	48	9	5	
SUGAR NO. 11	33	43	16	8	
COFFEE C	43	40	13	5	
<b>Panel B: DCOT categories</b>					
<b>Managed money (%)</b>	<b>Producers &amp; merchants (%)</b>	<b>Swap dealers (%)</b>	<b>Other reporting (%)</b>	<b>Non-reporting (%)</b>	
SRW WHEAT	26	22	19	24	9
HRW WHEAT	25	36	11	15	14
CORN	19	30	13	24	13
SOYBEANS	20	32	12	26	10
SOYBEAN OIL	20	38	13	20	8
FEEDER CATTLE	22	17	7	24	29
LIVE CATTLE	25	29	14	21	12
LEAN HOGS	23	25	15	24	12
COTTON NO. 2	19	36	17	23	6
COCOA	28	44	11	13	5
SUGAR NO. 11	20	37	19	16	8
COFFEE C	23	36	14	23	5

**Table 4.** Summary statistics on the working T index.

Market	Mean	Maximum	Minimum	Standard deviation
<b>Panel A: COT categories</b>				
SRW WHEAT	1.25	1.48	1.13	0.08
HRW WHEAT	1.23	1.48	1.08	0.09
CORN	1.18	1.32	1.09	0.06
SOYBEANS	1.15	1.32	1.07	0.05
SOYBEAN OIL	1.15	1.33	1.04	0.07
SOYBEAN MEAL	1.13	1.26	1.04	0.05
OATS	1.12	1.40	1.03	0.08
FEEDER CATTLE	1.43	1.76	1.28	0.08
LIVE CATTLE	1.19	1.36	1.09	0.06
LEAN HOGS	1.21	1.46	1.08	0.07
COTTON NO. 2	1.11	1.35	1.02	0.07
COCOA	1.13	1.28	1.05	0.04
SUGAR NO. 11	1.11	1.28	1.02	0.07
COFFEE C	1.14	1.30	1.03	0.07
<b>Panel B: SCOT categories</b>				
SRW WHEAT	1.57	2.16	1.21	0.19
HRW WHEAT	1.32	1.66	1.10	0.14
CORN	1.28	1.53	1.12	0.10
SOYBEANS	1.24	1.51	1.12	0.08
SOYBEAN OIL	1.23	1.59	1.05	0.11
SOYBEAN MEAL *	1.18	1.59	1.05	0.11
OATS *	1.16	1.46	1.03	0.10
FEEDER CATTLE	1.57	2.22	1.35	0.15
LIVE CATTLE	1.27	1.47	1.12	0.08
LEAN HOGS	1.34	1.81	1.11	0.14
COTTON NO. 2	1.17	1.59	1.03	0.10
COCOA	1.18	1.42	1.06	0.08
SUGAR NO. 11	1.19	1.43	1.05	0.08
COFFEE C	1.23	1.57	1.05	0.13

Panel A). This is confirmed in the case of swap dealers (Table 3, Panel B), which held even lower percentages of total open interest than index traders. These data are consistent with the evidence found by Sanders and Irwin (2010) and Irwin (2013).

These data show that, in the period 2006-2017, commodity index traders and swap dealers hold globally high and mainly long net positions that, in term of open interest, were lower than those of commercial and non-commercial traders.

The working T index was also used to proxy long-term speculation. Data on this variable, which expresses in percentages the excess of speculation compared to coverage needs, are reported in Table 4, Panel A shows low values of the working T index, which means that speculation was barely sufficient to meet hedgers' coverage needs. The highest values are found in the markets for SRW wheat (1.25) and feeder cattle (1.43). These results are confirmed in Panel B, which shows data calculated using information extracted from the SCOT reports, and supports the evidence found by Sanders et al. (2010).

Table 4 shows summary statistics of the working T index for COT (Panel A) and SCOT categories (Panel B) from June 2006 to December 2017. Following Equation 6, in Panel B, the working T index is calculated by re-categorizing index traders into a non-commercial category. Results for the two markets, indicated with \*,

are obtained from DCOT data on the assumption that commercial and non-commercial traders of SCOT reports correspond, respectively to producers and merchants and to swap dealers + managed money + other reportable of DCOT reports. Non-reportable traders are considered 50% non-commercial (speculators) and 50% commercial (hedgers).

## RESULTS AND DISCUSSION

This paper aims to study the impact of CITs and swap dealers' trading activity on agricultural commodities prices and volatility in the period 2006-2017. Data provided by the CFTC was first collected in order to estimate the explanatory variables to insert into Model 8. Granger Causality tests describe the results of which the robustness is verified in robustness check.

### Granger Causality tests

In order to verify the existence of a possible Causality

**Table 5.** The impact of CIT percentage of long positions on agricultural commodities returns.

Market, k	m, n	p-value $\beta_j=0, \forall j$	Estimate $\sum \beta_j$	p-value $\sum \beta_j=0$
SRW WHEAT	1,1	0.005	35.192	-
HRW WHEAT	1,1	0.095	24.556	-
CORN	1,2	0.963	0.383	0.988
SOYBEANS	1,2	0.213	-5.791	0.752
SOYBEAN OIL	1,3	0.278	-0.865	0.968
SOYBEAN MEAL	1,1	0.669	-9.982	-
OATS	1,1	0.789	-5.213	-
FEEDER CATTLE	1,1	0.046	-14.148	-
LIVE CATTLE	1,1	0.687	3.493	-
LEAN HOGS	1,1	0.633	-6.782	-
COTTON NO. 2	1,1	0.035	-23.512	-
COCOA	1,1	0.181	26.848	-
SUGAR NO. 11	1,1	0.245	22.710	-
COFFEE C	1,1	0.667	-5.821	-
		<b>p-value <math>\beta_{j,k}=0, \forall j,k</math></b>	<b>Estimate <math>\sum \sum \beta_{j,k}</math></b>	<b>p-value <math>\sum \sum \beta_{j,k}=0</math></b>
System		0.293	41.068	0.953

relationship between speculative traders' activity and agricultural commodity prices and volatility, Granger Causality tests were conducted. Here, we consider three proxies of speculation, that is, percentage of long position, the working T index and VOIR, as explanatory variables, and market returns and realized volatility as independent variables. The robustness check tests the robustness of our results considering net positions as explanatory variable and implied volatility as independent variable.

The first analysis tests whether the CIT percentage of long positions positively influenced agricultural commodities returns in the period 2006-2017. Results are shown in Table 5, where the (m, n) lag structure minimizing the Schwartz criteria is 1 for every market except for corn, soybeans and soybean oil. In the SUR system, parameters are pooled for the constant term ( $\alpha_k$ ) and the estimated  $\beta_{2,k}$  of the long position variable.

Table 5 shows the results of the Granger Causality test. The null hypothesis is that CITs percentage of long positions did not influence agricultural commodities returns from June 2006 to December 2017. Models are estimated across the K markets using a SUR system. In the model, the Wald tests do not reject the following cross-market coefficient restrictions:  $\alpha_1 = \alpha_2 = \dots = \alpha_K$ ;  $\beta_{2,1} = \beta_{2,2} = \dots = \beta_{2,K}$ . The common coefficients are estimated as a single pooled parameter across all K markets.

Results reported in Table 5 show that, market-by-market, for 11 of the 14 examined markets, the CIT percentage of long positions does not influence agricultural commodities returns at all, as p-values are higher than 5%. P-values lower than this threshold are found however in the case of SRW wheat, feeder cattle

and cotton No. 2. However, only for the SRW wheat market the relationship is positive (the estimated coefficient is 35.192), and moreover, the SUR system shows a global p-value equal to 0.293. This means that, considering the 14 markets together, the CIT percentage of long positions did not lead to an increase in agricultural commodities returns in the period 2006-2017. These conclusions, based on weekly data, confirm previous findings by Sanders and Irwin (2010), Stoll and Whaley (2010), Aulerich et al. (2009), Irwin (2013), and Donati et al. (2016).

The second analysis tests whether the swap dealer percentage of long positions positively influenced agricultural commodities returns in the period 2006-2017. Results are shown in Table 6, where the (m, n) lag structure minimizing the Schwartz criteria is 1 for every market except for corn, soybeans and soybean oil. In the SUR system, parameters are pooled for the constant term ( $\alpha_k$ ) and the estimated  $\beta_{2,k}$  of the long position variable.

Table 6 shows the results of the Granger Causality test. The null hypothesis is that swap dealer percentage of long positions did not influence agricultural commodities returns from June 2006 to December 2017. Models are estimated across the K markets using a SUR system. In the model, the Wald tests do not reject the following cross-market coefficient restrictions:  $\alpha_1 = \alpha_2 = \dots = \alpha_K$ ;  $\beta_{2,1} = \beta_{2,2} = \dots = \beta_{2,K}$ . The common coefficients are estimated as a single pooled parameter across all K markets.

Results reported in Table 6 show that, market-by-market, for 10 of the 12 examined markets, the swap dealer percentage of long positions does not influence agricultural commodities returns at all, as p-values are

**Table 6.** The impact of swap dealer percentage of long positions on agricultural commodities returns.

Market, k	m,n	p-value $\beta_j=0, \forall j$	Estimate $\sum \beta_j$	p-value $\sum \beta_j=0$
SRW WHEAT	1,1	0.008	41.366	-
HRW WHEAT	1,1	0.126	27.058	-
CORN	1,2	0.786	13.200	0.694
SOYBEANS	1,2	0.155	-7.913	0.728
SOYBEAN OIL	1,3	0.392	3.101	0.896
FEEDER CATTLE	1,1	0.125	-14.929	-
LIVE CATTLE	1,1	0.430	8.446	-
LEAN HOGS	1,1	0.610	-8.290	-
COTTON NO. 2	1,1	0.032	-29.660	-
COCOA	1,1	0.118	29.703	-
SUGAR NO. 11	1,1	0.264	27.363	-
COFFEE C	1,1	0.617	-8.324	-
		<b>p-value <math>\beta_j, k=0, \forall j, k</math></b>	<b>Estimate <math>\sum \sum \beta_j, k</math></b>	<b>p-value <math>\sum \sum \beta_j, k=0</math></b>
System		0.053	81.122	0.352

higher than 5%. P-values lower than this threshold are however found in the case of SRW wheat and cotton No. 2. However, only for the SRW wheat market is the relationship positive (the estimated coefficient is 41.366), and moreover, the SUR system shows a global p-value equal to 0.053. This result suggests that, considering the 12 markets together, the swap dealer percentage of long positions did not lead to an increase in agricultural commodities returns in the period 2006-2017.

The impact of traders' positions on agricultural commodities price volatility was also investigated<sup>1</sup>. First, we conduct a Granger Causality analysis aiming to test whether the CIT percentage of long positions impacted agricultural commodities realized volatility in the period 2006-2017.

The results show that, market-by-market, for 9 of the 14 examined markets, the CIT percentage of long positions does not influence agricultural commodities realized volatility at all. P-values lower than 5% are found only in the case of SRW wheat, corn, soybeans, cotton No. 2 and sugar No. 11, for which all estimated coefficients are positive. This means that, in the case of these commodities, in the period 2006-2017 a rise in the percentage of long position held by CITs caused an increase in realized volatility. The results obtained in the market-by-market analysis are confirmed at the SUR system level, as the system shows a global p-value equal to 0.015. However, the directional impact (positive) is not statistically different from zero (p-value is equal to 0.820). This evidence is partially consistent with previous studies identifying a causal relationship between CIT positions and some commodity price volatility (Aulerich et al., 2009; Tang and Xiong, 2012; Algieri, 2016).

Second, we conduct a Granger Causality analysis aiming to test whether the swap dealer percentage of long positions influenced agricultural commodities realized volatility in the period 2006-2017.

The results show that, market-by-market, for 7 of the 12 examined markets, the swap dealer percentage of long positions does not influence at all agricultural commodities realized volatility, as p-values are higher than 5%. P-values lower than this threshold are however found in the case of SRW wheat, corn, soybeans, soybean oil and cotton no.2, and for all these, except for soybean oil, estimated coefficients are positive. This means that for these commodities a rise in the percentage of long position held by swap dealers caused an increase in realized volatility in the period 2006-2017. The results obtained in the market-by-market analysis are confirmed at the SUR system level, as the system shows a global p-value equal to 0.001. In this case, as in Table 6, the significance of the result is weakened by the fact that the cumulative impact (positive) is not statistically different from zero. These results are broadly in line with the findings of Borin and Di Nino (2012) who verify a positive relationship between swap dealer activity and volatility in a few markets using a different estimation methodology.

Third, we conduct a Granger Causality analysis to investigate the relationship between the working T index and agricultural commodities realized volatility in the period 2006-2017. Results are shown in Table 7.

Table 7 shows the results of the Granger Causality test. The null hypothesis is that the working T index did not influence agricultural commodities realized volatility from June 2006 to December 2017. Models are estimated across the K markets using a SUR system. In the model, the Wald tests do not reject the following cross-market coefficient restrictions:  $\gamma_{2,1} = \gamma_{2,2} = \dots = \gamma_{2,K}$ . The common

<sup>1</sup>Results on realized volatility are available on request.



**Table 7.** The impact of the working T index on agricultural commodities realized volatility.

Market, k	m,n	p-value $\beta_j=0, \forall j$	Estimate $\sum \beta_j$	p-value $\sum \beta_j=0$
SRW WHEAT	3,2	0.002	-0.101	0.000
HRW WHEAT	3,2	0.019	-0.097	0.005
CORN	1,2	0.000	-0.288	0.000
SOYBEANS	4,3	0.643	-0.058	0.247
SOYBEAN OIL	4,2	0.063	-0.057	0.066
SOYBEAN MEAL	2,2	0.027	-0.118	0.008
OATS	4,2	0.472	0.064	0.292
FEEDER CATTLE	4,2	0.217	0.019	0.276
LIVE CATTLE	4,2	0.334	0.978	0.754
LEAN HOGS	1,2	0.000	14.835	0.000
COTTON NO. 2	2,3	0.290	-0.079	0.114
COCOA	4,2	0.167	0.099	0.071
SUGAR NO. 11	3,2	0.018	-0.115	0.074
COFFEE C	2,3	0.013	-0.080	0.028
		<b>p-value <math>\beta_{j,k}=0, \forall j,k</math></b>	<b>Estimate <math>\sum \beta_{j,k}</math></b>	<b>p-value <math>\sum \beta_{j,k}=0</math></b>
System		0.000	15.002	0.016

coefficients are estimated as a single pooled parameter across all K markets.

Results reported in Table 7 show that, market-by-market, for 7 of the 14 examined markets, the working T index does not influence at all agricultural commodities realized volatility. P-values lower than the 5% threshold are found in the case of SRW wheat, HRW wheat, corn, soybean meal, lean hogs, sugar No. 11, and coffee C. All their coefficients are negative, except in the case of lean hogs. This means that, in the period 2006-2017, a rise in the long-term speculation contributed to reduce the realized volatility in the SRW wheat, HRW wheat, corn, soybean meal, lean hogs, sugar No. 11, and coffee C markets. In the same period however, an excess of long-term speculation in the lean hog market contributed to increasing the realized volatility. The results obtained in the market-by-market analysis are confirmed at the SUR system level, as the system shows a global p-value equal to 0.000, but with a positive and statistically significant cumulative impact. These results strengthen those on realized volatility, showing a positive relationship between CITs and swap dealers percentage of long positions and realized volatility, and are consistent with previous studies by Sanders and Irwin (2010), Du et al. (2011), and Algieri (2016).

Finally, we test whether short-term speculation influenced agricultural commodities realized volatility in the period 2006-2017. Short-term speculation is proxied by the ratio between volume and open interest (VOIR), as suggested by Peck (1981), Streeter and Tomek (1992), and Du et al. (2011). Results are shown in Table 8.

Table 8 shows the results of the Granger Causality test. The null hypothesis is that VOIR did not influence agricultural commodities realized volatility from June 2006

to December 2017. Models are estimated across the K markets using a SUR system. In the model, the Wald tests do not accept the following cross-market coefficient restrictions:  $\gamma_{2,1} = \gamma_{2,2} = \dots = \gamma_{2,K}$ ;  $\gamma_{3,1} = \gamma_{3,2} = \dots = \gamma_{3,K}$ . For this reason, it is not possible to impose any restrictions on the system and all parameters are estimated market-by-market.

Results reported in Table 8 show that, market-by-market, for 10 of the 14 examined markets, VOIR does not influence agricultural commodities realized volatility at all, as p-values are higher than 5%. P-values lower than this threshold are found only in the case of HRW wheat, soybean oil, oats and live cattle. All these coefficients are positive, except in the case of soybean oil. This means that, in the period 2006-2017, a rise in the short-term speculation contributed to increasing the realized volatility in the HRW wheat, oats and live cattle markets. In the same period, however, an excess of short-term speculation in the soybean oil market contributed to decreasing the realized volatility. The results obtained in the market-by-market analysis are confirmed at the SUR system level, as the system shows a global p-value equal to 0.002. These findings are consistent with previous studies by Streeter and Tomek (1992), Luu and Martens (2003), Robles et al. (2009), and Du et al. (2011).

### Robustness checks

The robustness of our results was test<sup>2</sup>. First, we focus on the impact of speculative traders' positions on agricultural commodities returns using net positions

<sup>2</sup>Results in robustness check are available on request.

**Table 8.** The impact of VOIR on agricultural commodities realized volatility.

Market, k	m,n	p-value $\beta_j=0, \forall j$	Estimate $\sum \beta_j$	p-value $\sum \beta_j=0$
SRW WHEAT	4,1	0.150	0.076	-
HRW WHEAT	4,1	0.005	0.200	-
CORN	4,2	0.187	0.019	0.796
SOYBEANS	4,2	0.982	0.008	0.849
SOYBEAN OIL	4,2	0.013	-0.038	0.277
SOYBEAN MEAL	2,2	0.205	-0.005	0.921
OATS	4,1	0.028	0.213	-
FEEDER CATTLE	4,2	0.362	0.033	0.492
LIVE CATTLE	4,1	0.013	12.488	-
LEAN HOGS	4,1	0.569	5.308	-
COTTON NO. 2	2,1	0.053	0.163	-
COCOA	4,1	0.737	-0.023	-
SUGAR NO. 11	3,1	0.271	0.106	-
COFFEE C	2,1	0.926	0.006	-
		<b>p-value <math>\beta_{j,k}=0, \forall j,k</math></b>	<b>Estimate <math>\sum \sum \beta_{j,k}</math></b>	<b>p-value <math>\sum \sum \beta_{j,k}=0</math></b>
System		0.002	18.626	0.101

instead of the percentage of long positions. Our analysis on CITs demonstrates that their net positions do not lead to an increase in returns, but rather to a decrease, thus confirming our previous findings. Specifically, our results show that, market-by-market, for 12 of the 14 examined markets, CIT net positions do not influence at all agricultural commodities returns. P-values lower than 5% are found only in the case of corn and feeder cattle. However, in both markets the relationship is negative (the estimated coefficients are -0.419 and -5.79, respectively) and moreover, the SUR system shows a global p-value equal to 0.008 with a negative cumulative directional impact. This suggests that, considering the 14 markets together, CIT net positions did not lead to an increase in agricultural commodities returns in the period 2006-2017, but rather to a reduction. The result is particularly significant because the cumulative directional impact is statistically different from zero (p-value equal to 0.047). These findings are partially consistent with those by Stoll and Whaley (2010) in the cotton market, Sanders and Irwin (2010) in the corn market and Etienne et al. (2017) in the corn market.

Our robustness analysis on swap dealers also shows that their net positions do not lead to an increase in returns but to a reduction, consistently with our results for CITs. The market-by-market analysis shows that for 11 of the 12 examined markets, swap dealer net positions do not influence agricultural commodities returns at all. The only p-value lower than the 5% threshold is found in the case of the lean hog market. However, in this market, the relationship is negative (the estimated coefficient is -22.900) and, moreover, the SUR system shows a global p-value equal to 0.019 with a negative cumulative

directional impact. This means that, consistently with the results shown in Table 6, considering the 12 markets together, swap dealer net positions did not lead to an increase in agricultural commodities returns in the period 2006-2017, but at most to a reduction.

Second, we use net positions instead of percentage of long positions to test the robustness of our previous results related to the influence of speculative traders' positions on agricultural commodities realized volatility (Tables 7 and 8). Our robustness analysis on CITs shows that their net positions did not drive realized volatility in the period 2006-2017. These findings are consistent with those of Aulerich et al. (2009), who find no Causality relationship between CIT net positions and volatility in the period 2004-2005, and poor evidence of Causality in the period 2006-2008.

Our robustness analysis on swap dealers also shows that their net positions did not impact realized volatility in the period 2006-2017. As in previous cases, all markets for which  $n=1$  have in fact the same Causality test result ( $\beta_1=0.854$ ). Overall, there is therefore no evidence that the net positions held by swap dealers impacted agricultural commodities realized volatility in the period 2006-2017.

Third, we use implied volatility instead of realized volatility to test the robustness of our previous results. The analysis on CITs shows that their net positions do not drive implied volatility either market-by-market or at a SUR system level. Specifically, all markets have p-values higher than 5% and the SUR system has a global p-value equal to 0.789. These results confirm previous findings by Aulerich et al. (2009), who detect no Causality either market-by-market or at system level.

The robustness analysis on swap dealers also shows that their net positions do not drive implied volatility because market-by-market all p-values are higher than 5% and the global p-value of the SUR system is equal to 0.516. This means that net positions of the two categories of traders did not impact implied volatility in the period examined.

Percentage of long positions was also used instead of net positions to test the influence of speculative traders' positions on agricultural commodities implied volatility. Our analysis on CITs shows that their percentage of long positions did not impact implied volatility either market-by-market or at a system level in the period 2006-2017. The global p-value is in fact equal to 0.230. As regards swap dealers, our analysis demonstrates that a high percentage of long positions leads to a reduction in implied volatility. Our results show that, market-by-market, for 10 of the 11 examined markets, the swap dealer percentage of long positions does not influence agricultural commodities implied volatility at all, as p-values are higher than 5%. P-values lower than this threshold are found only in the case of soybean oil market. However, in this case, the relationship is negative (the estimated coefficient is -0.476) and, moreover, the SUR system shows a global p-value equal to 0.039 with a negative cumulative directional impact (not statistically different from zero). This means that, considering the 11 markets together, the swap dealer percentage of long positions did lead to a reduction in soybean oil implied volatility in the period 2006-2017, but the direction of the impact across markets is simply not consistent with a systematic effect. This evidence confirms previous findings by Sanders and Irwin (2010), who detect a negative relationship in four of fourteen analyzed markets and also at a SUR system level.

Moreover, we test the robustness of our previous results concerning the influence of the two speculation proxies on agricultural commodities implied volatility. Our analysis shows that the working T index does not drive implied volatility. The result is that all markets for which  $n=1$  have the same Causality test result, where  $\beta_1=0.222$ . Overall, there is no evidence that the T index impacted agricultural commodities implied volatility in the period 2006-2017, as suggested by Sanders and Irwin (2010).

Furthermore, the analysis on VOIR shows our short-term speculation measure does not drive implied volatility either. The results demonstrate in fact that, market-by-market, for 12 of the 13 examined markets, VOIR does not influence agricultural commodities implied volatility at all. The only p-value lower than 5% is found for the cocoa market. The estimated coefficient of this market is negative and indicates that, in the period 2006-2017, a rise in short-term speculation contributed to reducing implied volatility. Despite these market-by-market results, the SUR system shows a global p-value equal to 0.036, but the positive cumulative directional impact is not statistically different from zero. This means that, considering the 13 markets together, VOIR leads to a

decrease of the cocoa market, and the direction of the impact across markets is not consistent with a systematic effect, so our previous results are confirmed.

Finally, we conclude that neither CITs nor swap dealers can be considered responsible for the increase in agricultural commodities prices in the period 2006-2017. As regards price volatility, however, our results appear to depend on the measure of volatility used. Long-term speculation appears to have led to an increase in realized volatility, but not in implied volatility. Short-term speculation, on the other hand, appears to have caused mixed effects in both types of volatility, but results are not clear at system level.

## Conclusions

This study investigates the role of speculative activity in the agricultural commodity futures market in the period 2006-2017. It tests the causal relationship between the prices of fourteen agricultural commodities and the trading activity of commodity index traders and swap dealers. The analysis tests the relationships, at a weekly frequency, by means of bivariate Granger Causality tests and using an SUR system approach, which improves the power of statistical tests. We proxy trading activity through net long position and percentage of long position held by CITs and swap dealers, and speculation through the working T index (long-term speculation measure) and VOIR (short term speculation measure). We measure price volatility by means of realized volatility and implied volatility.

Our results do not show any Causality between CIT and swap dealer trading activity and weekly returns, thus confirming previous findings by Sanders and Irwin (2010). Unlike that study, however, we identify a positive relationship between the percentage of traders holding long positions and realized volatility. This is also confirmed by the long-term speculation proxy and, in some markets, also by the short-term one.

Overall, our study suggests that CITs and swap dealers cannot be accused of having generated a bubble in the agricultural commodity market, but they may have increased price volatility. Criticism of Masters' theory in current literature therefore appears to be grounded. However, speculation does appear to impact on price volatility, and because agricultural commodities are used for essential purposes of food, feed and fuel, increasing volatility has negative effects at global level. We do not disprove previous evidence that speculation is necessary to meet the needs of hedgers for coverage, but it is the case that if it were to become the main activity of the market, the futures markets would fall into disuse.

On the other hand, however, it would also be risky to impose stricter limits on speculation, because there is no convincing evidence that speculators have "driven" prices to take advantage of them. On the basis of previous

literature and our results, restrictive measures would be not only unjustified, but also potentially harmful. If speculation were too stringently discouraged, hedgers would no longer find counterparties to "cover" their positions and would be forced to search for alternative instruments, such as insurance products, instead of those offered by the futures market. Insurance companies, however, apply very high premiums to protect farmers, as the climate risk is both incisive and unpredictable. In the end, these higher costs would inevitably be borne by final consumers and no positive effect would be had on prices or volatility. These conclusions do not suggest that the futures market has worked well in recent years, or that it should be left unregulated, but only that before adopting restrictions on speculation, further research is needed on the role of speculation in agricultural commodity markets. Any attempt by lawmakers to limit speculation should be carefully evaluated in order to avoid depriving the market of a precious source of liquidity and producers of an irreplaceable hedging instrument.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# **Leader–member exchange, organizational citizenship behaviours and performance of Ghanaian Technical University Lecturers**

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Received 12 September, 2019; Accepted 5 December, 2019

**This study investigates the mediating role of organizational citizenship behaviours (OCBs) on the leader-member exchange (LMX) and employee performance relation and the degree to which work experience moderates the relation between leader-member exchange and OCBs. Lecturers from six technical universities in Ghana, making up three hundred and thirty-six lecturers, were selected using convenience sampling. The participants completed self-administered surveys. OCBs fully mediated the association between LMX and employee performance. Furthermore, the findings indicate that the interplay between LMX and work experience on OCBs is compensatory in nature such that as work experience increases, the positive association between LMX and OCBs decrease. Managers of higher education institutions should create enabling work environments that encourage high-quality LMX and citizenship behaviours. Moreover, as work experience tends to attenuate the positive influence of LMX on OCBs, managers in higher education should focus their attention on employees with low rather than high work experience. This research adds to the employee performance literature through examining a novel link among leader-member exchange, organizational citizenship behaviours and performance.**

**Key words:** Leader-member exchange, organizational citizenship behaviours, Ghana, Technical University.

## **INTRODUCTION**

Ghana's transition to a knowledge economy, coupled with accelerating complexities regarding the demands for

lecturers and managers in higher education institutions (HEI), is pressuring HEIs, especially academic staff

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members and institutions transitioning to university status to holistically support teaching, learning and the development of a research culture to enhance university performance (Ho et al., 2013; Jones et al., 2017;

Technical University ACT, 2016). Such changes require leadership interactions in HEIs and actions that promote higher-education goals that ultimately lead to effective performance. Hogg et al. (2005) assert that leadership is a social influence process that shapes the cognitive experience established on social relations, ultimately influencing group life and the team engagement of group members. Social exchange theory (SET) explains social and interpersonal behaviour as social exchanges of valuable resources (for instance, social support) and has the potential to explain a wide range of interpersonal interactions in organizational settings (Cropanzano and Mitchell, 2005). In line with the SET, if organizational members receive support through the interpersonal interactions they engage in, they tend to reciprocate and offer support in return. Following these basic tenets of SET the Leader-Member-Exchange (LMX) shows that employees tend to increase their task engagement when they experience high rather than low quality exchanges (LMX) with their leaders. A leader's relational approach and personal attention toward a subordinate's social and work life are thus paramount to understanding such behaviours (Khan and Malik, 2017). LMX emphasizes the value of harmonious relationships between leaders and subordinates as well as argues that team and organizational performance is fostered when leaders and subordinates develop mature and rewarding relationships (Graen and Uhl-Bien, 1995; Haspari et al., 2019; Lo et al., 2006). Empirical research suggests that LMX predicts organizational citizenship behaviours (OCBs) because employees engaged in high-quality relations with their supervisors also tend to engage in behaviours that support others in their work environment and ultimately increase performance (Organ, 1998; Martin et al., 2016). OCBs constitute informal modes of cooperation and contributions (that is, job behaviours) in which individuals engage to achieve job satisfaction and perceived fairness at work (Organ, 2018). Empirical research to date shows that OCBs are essential to performance, and such behaviours are often triggered by the support and effort of leaders (Khan and Malik, 2017; Organ, 2018).

Although LMX promotes OCBs in higher education (Alabi, 2012; Power, 2013), the complex relationship between LMX, OCBs, and performance of lecturers as contributors to knowledge and national development, especially in Ghana, remain under examined and thus should be further explored (Atatsi et al., 2019). Research on OCBs in Ghana focuses on workforce in general organizational contexts (Asiedu et al., 2014; Gyekye and Haybatollabi, 2015; Mensah and Bawole, 2018), and the studies on lecturers' OCBs in higher education have not received much attention (Alabi, 2012; Inelmen et al., 2017).

Epitropaki and Martin (1999) show that demographics such as work tenure/experience affect the quality of leader-member exchanges in HEI. The accumulation of individual qualitative and quantitative work experiences during the years impacts on employees' cognitive and affective responses at work (Forteza and Prieto, 1994; Tesluk and Jacobs, 1998) and ultimately impact on their engagement in interpersonal relationships at work as well. However, only few empirical studies explored the way in which tenure and work experience play out in the relational landscape at work (Ng and Feldman, 2010), especially because work tenure/experience are commonly used as control variables (Cogliser et al., 2009; Ng and Feldman, 2013). It was argued that work tenure and work experience are contingencies of the way in which LMX affects individual behaviours and OCB. A moderation argument for work tenure was built, based on previous research showing that individual and contextual factors related to work experience bring valuable work-related skills, knowledge and incentives fostering individual and organizational outcomes (Lance et al., 1989; Ng and Feldman, 2010; Tesluk and Jacobs, 1988). In the current study, work experiences as number of years a person has been in a workforce or has been working was evaluated (Kegans et al., 2012; McDaniel et al., 1988) and intend to examine the degree to which work experience moderates the influence of LMX on OCB among higher-education lecturers.

In this paper, we set out to investigate LMX, OCBs, work experience, and performance of lecturers in Ghanaian technical universities. This study is among the first to explore in an integrated model, the mediating role of OCB in the relationship between LMX and performance as well as the moderating role of work experience on the relationship between LMX and OCB. The study has two important contributions. First, it contributes to the studies on teacher performance in higher education setting by exploring the mechanisms and contingencies that explain the association between LMX and individual performance. Secondly, it contributes to the scarce empirical evidence from the African higher education by testing this model in Ghanaian context, in which higher education is expected to make major contributions to economic and social development (Coker-Kolo and Darley, 2013; Morley et al., 2009).

### **Employee performance defined**

Central to any organization's growth is employee performance, a multi-dimensional concept (that is, task performance, citizenship behaviour, counter-productive behaviour), with each dimension referring to specific dimensions of performance, from individual standalone performance to the quality of interpersonal relations with other employees that ultimately impact overall performance of groups and organizations (Atatsi et al.,

2019; Bergeron et al., 2014; Huei et al., 2014; Martin et al., 2016; Viswesvaran and Ones, 2002). Despite the significance of individual performance in organizations, little consensus exists regarding a definition for employee performance. Employee performance instruments evaluate either behaviours employees engaged in or outcomes of their actions (Campbell and Wiernik, 2015). Borman and Motowidlo (1993 p.71) argue that employee performance represents "the proficiency with which incumbents perform activities that are formally recognized as part of their jobs; activities that contribute to the organization's technical core either directly by implementing a part of its technical process, or indirectly by providing it with needed materials or services". Janssen and Van Yperen (2004) suggest that employee performance results from the realization of specific actions required through an employee's job description that the employer subsequently appraises and rewards.

Building on these characterizations, Viswesvaran and Ones (2000) describe job performance as a notional concept because: a) one cannot point to something physical and concrete and state that it is job performance and one can only point out the manifestations of the construct, and b) there are many manifestations that indicate job performance. This characterization is unsurprising since as Schmidt (1993) suggests, and corroborated by Pulakos et al. (2000), Masa'deh et al. (2017), Viswesvaran (2001) and Harari et al. (2014) that job performance (especially in knowledge intensive jobs) can be attributed to work dynamism, innovations, emergence of the knowledge management, knowledge-sharing, and transfer in contemporary work environments, and dimensions of employee performance will continue to adapt to explain current situations. This study examines employee performance as task-related performance, a stand-alone construct introduced by Viswesvaran and Ones (2000) that measures how well employees perform his/her job as prescribed in their job descriptions. We use Viswesvaran and Ones's (2000) characterization and refer to employee or job performance as "scalable actions, behaviour, and outcomes that employees engage in or bring about that are linked with and can contribute to organizational goals" (Viswesvaran and One 2000, p. 216).

### **LMX, OCB, and Employee performance**

As prompts of enhanced performance, leader-member relationships have attracted researchers' attention for several decades. To date, mediators like role clarity, job satisfaction, trust, motivation empowerment and organizational commitment were used to explain the positive association between LMX and job performance (Martin et al., 2016). These findings were extended by arguing that relational factors may play a mediating role as well. Grounded in SET (Blau, 1964), LMX suggests that reciprocal relationships between supervisors and

subordinates shape individual well-being and performance. According to SET, employees engaged in harmonious social interactions from which they derive personal rewards (or resources) tend to reciprocate and share resources or social support with other employees. The tenets of the SET were built on to test an integrative model in which we argue that the positive association between LMX and employee performance is explained by relational mechanisms rooted in social exchange. Uhl-Bien (2006) identifies LMX as a prime leadership approach that emphasises and exemplifies the positive role of social relationships for performance outcomes. It describes a distinct quality of relationship (that is, high or low) between a leader/supervisor and a subordinate over time, and the extent of emotional aid and interchange of valued job-related resources (Graen and Uhl-Bien, 1995; Gerstner and Day, 1997; Han et al., 2018; Pellegrini and Scandura, 2006; Wayne and Green, 1993). Quality LMX relationships are thus indicators of robust relationships based on former positive interactions with leaders that concur with employees' expectations. Such employees experiencing high quality LMX are thus able to access resources that they value and experience better relationships than those in a low quality LMX groups do (Sue-Chan et al., 2011). Besides employment contracts, high-quality associations are established on trust, loyalty, obligation, mutual liking, respect and loyalty, coupled with formal monetary exchanges, while low-quality relations are built solely on employment contracts and pure economic exchanges (Khan and Malik, 2017; Khorakian and Sharifirad, 2019). Consequently, employees in high-quality relationships ultimately experience improved work performance (Stoffers et al., 2014) and commitment toward leaders and the organization (Graen and Uhl-Bien, 1995; Martin et al., 2016; Sue-Chan et al., 2011). Chan and Mak (2012), Law et al. (2010), Kim et al. (2015), shows a positive influence of LMX on employee performance in research conducted in profit and non-profit organizations in Hong Kong and China, while Alabi (2012) explores the same relationships in HEIs in the Ghana.

In line with SET, it was argued that if members experience high quality LMX they will tend to reciprocate and share resources, time and effort with their colleagues (Anand, Vidyarthi and Rolnicki, 2018). In other words, the quality of LMX in leader-employee dyads influence employee attitudes, capabilities and their tendency of reciprocating by engaging in performance-related behaviours that will support their organization (Breevaart et al., 2015; Stoffers et al., 2014). Among these reciprocation behaviours are OCBs, which Organ (1988, p.4) define as "individual behaviour that is discretionary, not directly or explicitly recognized by the formal reward system, and that in the aggregate promotes the effective functioning of the organization". OCB behaviours refer to voluntary activities undertaken by employees beyond prescribed job requirements that benefit individuals, groups, and the organization and Organ's 5-factor model



of OCBs consists of altruism, sportsmanship, courtesy, civic virtue, and conscientiousness (Organ, 1988; Podsakoff et al., 2000; Podsakoff et al., 2009). Creating a workplace that promotes such OCB is crucial to the organization as a whole, and dispositional factors, such as relational leader exchanges, predispose employees to engage in OCBs (Graen and Scandura, 1987; Organ and Ryan, 1995; Podsakoff et al., 2000). According to Bolino (1999), employees who seek to promote their image and performance, and who realise the limitations in their in-role work performance, inevitably focuses on OCBs to achieve their performance goals. When leaders pioneer social exchanges by showing commendatory treatment on some employees, those employees tend to reciprocate by working harder in the interest of leader and organization (Loi et al., 2011; Qi et al., 2019). Thus, employees' work-related behaviours depend on treatment from supervisors, with research highlighting positive outcomes of LMX and citizenship behaviours (Ilies et al., 2007; Loi et al., 2011; Rockstuhl et al., 2012).

Citizenship behaviours are conducive for performance in organizations as they enable good quality social interactions, help reciprocation and social support that will eventually facilitate coordination reduce conflicts and foster task engagement (Naqshbandi et al., 2016; Smith et al., 1983; Podsakoff and Mackenzie, 1997; Rose, 2016). Since LMX represents the quality of exchanges, high LMX creates a context conducive to employees engaging in OCBs and performing better consequently. Therefore the hypothesis is that:

H1: Organizational citizenship behaviours mediate the relationship between LMX and employee performance.

### **Work experience as moderator in the LMX-OCB relationship**

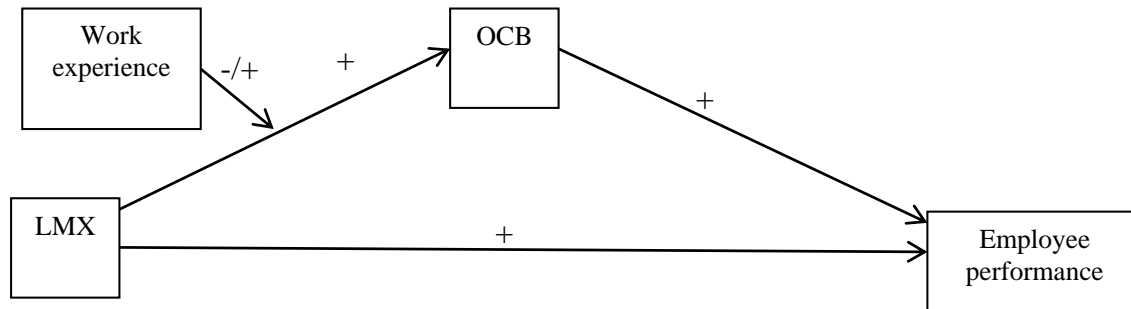
Research to date showed that the likely association between LMX and OCB is contingent on a factors related to the leader (Anand et al., 2018); while variables related to the employees, like their work experience received little to no attention so far. In this study, work experience was operationalized as the number of years an employee has been working. Such a conceptualization links experience to the total exposure time one has to task and organizational factors that ultimately form the context in which one's expertise is created (Lance et al., 1989; Ng and Feldman, 2010; Tesluk and Jacobs, 1988). Work experience is associated with OCB through work-value balance (Kegans et al., 2012), and work experience may lead to accumulation of both human and social capital that foster OCBs (Ng and Feldman, 2010, 2011). However, engagement in OCBs may vary for employees with different work experiences (Dirican and Erdil, 2016; Ng and Feldman 2011; Sethi, 2019).

Research suggests that LMX relates positively to

OCBs, but little is known about the effects of moderators, such as work experience, on the relationship (Cogliser et al., 2009; Martin et al., 2016). Research shows a positive relationships between work tenure and job behaviours, but little theoretical and empirical research assesses work tenure's and experience's effect on employee outcomes (Ng and Feldman, 2010; Sturman, 2003; Wright and Bonett, 2002). The quality of social relationship is vital to shaping employee work experiences (Brower et al., 2000), and employers and employees enjoy beneficial work outcomes of such relationships (Cogliser et al., 2009; Ishak, 2005). Understanding the effects of work experience on the LMX-OCB relationship is essential to enabling practitioners to make functional changes and thus improve individual work performance (Kim et al., 2015; Ucanok, 2008).

Two contrary theoretical reasons explain the outcomes of work experience in relationship to employee OCBs. Some proponents argue that inexperienced workers, aiming to accumulate as fast as possible new perspectives on work performance, experiment with novel strategies that have the potential to improve the work context as well; while more experienced employees who already possess a range of work strategies through years of experience may lack such engagement (Kim et al., 2015). This explanation might link to the honeymoon effect, described by Bonett and Wright (2002) and Huang et al. (2006). It argues that new employees' have a high degree of enthusiasm toward work that promotes OCB, especially when the LMX is high. LMX is expected to be more beneficial to OCB when it triggers the reciprocation motives (employees are ready to help others outside of their work task when they were helped themselves). As such employees with little work experience working in contexts with high quality LMX are most likely to feel supported by their supervisors and in exchange be ready to help others as well. As a consequence, in this conceptual perspective the interplay between LMX and work experience is compensatory in nature.

Other research suggest that employees with greater work experience value their work more and have accumulated during the years relationship-specific knowledge, skills and expertise that encourage OCBs (Kegans et al., 2012; Ng and Feldman, 2010; Sturman, 2003). This argument is based on the premise that as individuals spend more years working, they acquire greater human (that is, expertise and knowledge about business processes and strategies; Becker, 1964) and social capital (that is, social network of relationships in and outside of work environments, Burt, 1992). As a consequence the accumulation of human and social capital promotes OCBs (Ng and Feldman, 2011; Slaughter et al., 2007). According to these arguments, LMX will facilitate the engagement in OCB especially for employees with high work experience that already have accumulated substantial human and social capital. This



**Figure 1.** Overall conceptual model.

second perspective focuses on a capital accumulation perspective, assuming lecturers' OCBs increase with work experience and the LMX adds to this effect a multiplicative fashion. Therefore LMX influences OCBs (Li et al., 2012; Martin et al., 2016) and work experience represents a contingency that accentuates the positive association between LMX and OCBs. Given these two opposing views on the moderating role of work experience, we formulate an exploratory hypothesis (phrased as two competing hypotheses) on the moderating role of work experience in the relationship between LMX and OCBs:

H2: The positive effect of leader-member exchange on organizational citizenship behaviours is moderated by work experience such that: (a) the effect increases with work experience VS (b) the effect decreases with greater work experience.

The overall theoretical model is presented in Figure 1.

## METHODOLOGY

The respondents for this study were Ghanaian technical university lecturers. a quantitative design was used to collect data using a cross-sectional survey. Self-administered questionnaires were used to collect data from faculty members through convenience sampling due to time and cost limits. Responses were elicited from 498 lecturers across six technical universities in six regions of Ghana. Of these, 162 returned incomplete responses and were removed from analysis, leaving 336 usable surveys (67.5% response rate).

### Measures

#### *Employee performance*

Employee performance was evaluated using a validated scale from Rodwell et al. (1998). The construct comprises 9 items scored on a Likert-type scale that ranged from strongly disagree (1) to strongly agree (5). Sample items included "I am currently working at my best performance level", "I set very high standards for my work", "I am one of the best at the work I do", "My work is always of high quality," and "I am proud of my work performance." Cronbach's alpha coefficient for the scale was .72. Given the fact that the individual performance scale is multi-dimensional, we have used the

dominant factor score as indicator of the underlying dominant factor (namely individual performance). In computing the dominant factor score, the Bartlett's approach was used, as this approach makes it possible to obtain the "true dominant factor score of the variable" (DiStefano et al., 2009).

#### *Leader-member exchange*

Developed by Graen and Uhl-Bien (1995), LMX 7 was used to assess respondents' perceptions of LMX quality. The scale consisted of seven items that were scored on a 5-point Likert-type scale and characterised the overall effectiveness of dyads between leaders and subordinates. Sample items included, "Do you know where you stand with your leader (follower)... [and] do you usually know how satisfied your leader (follower) is with what you do?" (1=rarely, 5=very often), "I have enough confidence in my leader (follower) that I would defend and justify his or her decision if he or she were not present to do so" (1 =strongly disagree, 5= strongly agree). Cronbach's alpha for the scale was .85. The overall LMX score was also computed using the Bartlett's approach, by saving the dominant factor score as the scale score for further analyses (DiStefano et al., 2009)

#### *Organizational citizenship behaviour*

OCBs were measured using Podsakoff et al.'s (1990) 24-item scale and scored on a 7-point Likert-scale. Sample items included "I help others who have heavy workloads"(altruism), "My attendance at work is above the norm"(conscientiousness), "I am a classic' squeaky wheel' that needs greasing" (sportsmanship), "I take steps to try to prevent problems with other employees" (courtesy), and "I attend functions that are not required, but help the company image"(civic virtue). The general score for OCBs was obtained using the Bartlett dominant factor score and Cronbach's alpha coefficient for the scale was 0.86.

#### *Work tenure/experience*

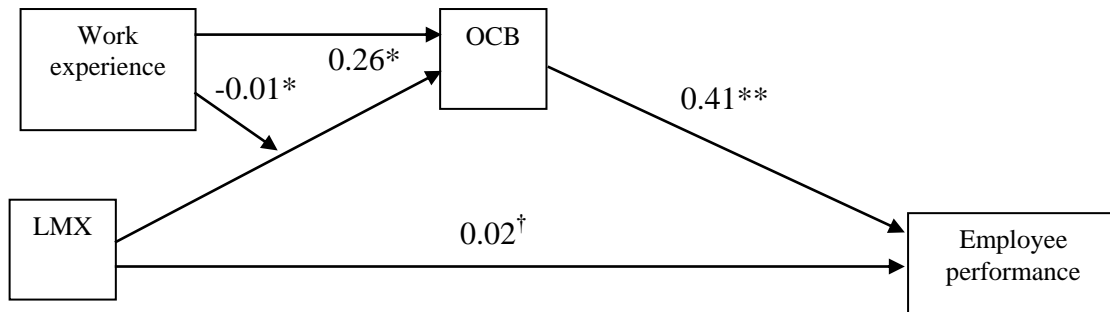
Respondents were asked to report the number of years they have been working and we have used this as a continuous variable to reflect work tenure in our analyses.

## RESULTS

PROCESS macros was used to analyse data (Hayes,

**Table 1.** Conditional effects of work experience.

Work experience	LMX to OCB Effect Size (SE)	95% confidence Interval
Low	0.14 (.04)	[0.08, 0.25]
Average	0.10 (.03)	[0.06, .17]
High	0.07 (.03)	[0.02, 0.14]



\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ; †n/s

**Figure 2.** Results of the mediation analysis.

2017) as this statistical procedure allows the simultaneous estimation of mediation and moderation effect and it can handle asymmetric distributions when the normal distribution assumptions are not tenable. Based on a resampling procedure, the indirect effect of LMX on performance was estimated using OCB as a mediator (PROCESS Model 4). To account for potential confounding effects of the moderator that was entered during subsequent analyses, work experience was also included as a control variable. Results suggest that the indirect effect was significant (effect size=.10, SE=.03,  $CI_{low} = .056$ ;  $CI_{high} = .165$ ), supporting H1. The influence of LMX on OCBs was positive and significant ( $B = .24$ ,  $SE = .05$ ,  $p < .0001$ ), and the influence on OCBs on performance was also positive ( $B = .40$ ,  $SE = .05$ ,  $p < .0001$ ). Since the remaining influence of LMX on performance was non-significant when OCB was entered in the model as a mediator ( $B = .01$ ,  $SE = .05$ ,  $p = .73$ ), it can be concluded that the mediation was full rather than partial. To test H2, PROCESS Model 7, which estimates conditional mediation on work experience was used. Results suggest that moderation by work experience in the relationship between LMX and OCB is significant ( $B = -.01$ ,  $SE = .006$ ,  $p = .04$ ), supporting H2. The conditional effects are presented in Table 1, and results of the overall mediation model are shown in Figure 2. The magnitude of the positive effect of LMX on OCB decreased with work experience, supporting H2 (b). Thus, it was argued that work experience seems to substitute the beneficial relational effects of LMX on OCB, and work experience therefore motivates OCBs. This argument is also

supported by a significant association between work experience and OCBs ( $B = .023$ ,  $SE = .006$ ,  $p = .0005$ ), suggesting that as work experience increases, employees engage in more or rather than less OCBs.

## DISCUSSION

Given the importance of individual performance in enhancing the value and goals of an organization, this study tested an LMX, OCB, and employee performance mediation model, exploring moderation by work tenure on the LMX–OCB relationship of lecturers in Ghanaian technical universities. These results support a positive relationship between LMX and OCBs, and between OCBs and employee performance. This study contributes to employee performance literature by showing that the beneficial effects of LMX on individual performance can be explained by the engagement in OCBs. In other words, employees that work in contexts in which the quality of their relationships with the supervisors is high tend to perform better because they engage in OCBs. In line with the SET OCBs represent a relational mechanism; possible related to reciprocation and reciprocity norms, that explains the relationship between LMX and performance outcomes.

The context of this study offers cultural insights from Ghana regarding the effects of LMX, OCBs, and performance relationships. Results concur with extant research that suggests that quality LMX is an antecedent of OCBs (Duong, 2011; Han et al., 2018; Khan and Malik,

2017; Martin et al., 2016). The results are in line with the social exchange theory (Blau, 1964) explaining that high-quality relationships between leaders and subordinates that create a sense of reciprocity and thus compel employees to exert extra effort through OCBs and result in performance. Although our results show that the remaining direct relationship between LMX and employee performance is not significant, other factors may be at play in explaining the relationship. This full mediation was rather surprising in light of previous research that documented a positive association between LMX and individual performance. One explanation is the Ghanaian culture, characterised by collectivism and high power distance, high-quality exchanges offer opportunities for employees to be in a leader's in-group, hence the need for reciprocity through OCBs.

This study also speaks to the importance of OCBs in higher education and their significance in the growth and maturation of institutions/organizations in a global-knowledge, competitive business context (Khan and Malik, 2017). Results for H2 suggest that the interplay between work experience and LMX is compensatory in nature namely the positive effects of LMX on OCB decrease as work experience increases. This finding is in line with the honeymoon effect among low-experienced employees since they come to an organization with needs, desires, skills, and abilities, and expect that their skills and abilities can be used to meet their needs. Consequently, when they experience high LMX they engage in OCBs and expend effort to achieve organizational goals (Chan and Mak, 2014; Harris et al., 2014; Huang et al., 2006; Ibrahim and Amin, 2014; Wright and Bonnet, 2002).

Experienced employees might indirectly respond to challenging work by withdrawing commitment to work, becoming burned out, less motivated, or apathetic (Wright and Bonnet 1997). Although such employees demonstrate loyalty to the organization, they may approach work activities more mechanically as they approach retirement (Huang et al., 2006; Chan and Mak, 2014; Rosen and Jerdee, 1976; Wright and Bonett, 1997). If this explanation is accurate, the effect of LMX on OCB and ultimately their performance tends to be lower. Wright and Bonett (2002) support this argument; committed employees with short tenures perform better than workers with long tenures do. Another explanation is based on the importance of reciprocity and social interaction perceptions. Highly experienced, tenured workers build strong, durable interpersonal relationships with spouses, family, and friends due to a need for status and affection for status and affection (Steuerink and Lindenberg, 2006), but younger employees focus on work-life balance, opportunities to develop skills, and pay associated with performance (Finegold et al., 2002). For employees with less work experience, it becomes more important to reciprocate at work rather than in the family domain; therefore for this group of employees, the

positive effect of LMX on OCBs tends to be higher than for those with high work experience.

### **Limitations and directions for future research**

Further exploration of mediation and moderation of OCB in relation to other variables related to reciprocation in social interactions (such as social support and learning in team contexts), would extend understanding of OCBs and performance in HEIs. Moreover, comparative, cross-cultural studies of lecturers that examine disparities of mechanisms through which OCBs influence LMX, performance, tenure, and other variables should be conducted to assess these concepts from various cultural perspectives. With exchanges of faculty members among HEIs globally, research should examine LMX, power distance, and OCBs to align empirical results with associated cultures and help managers, practitioners, and stakeholders of HEIs deal with cultural challenges. A limitation of the study is that it used a cross-sectional approach that evaluated globally the OCBs and more fine-grained investigations are required to further understand the intricate relationship between LMX and OCBs. For example, focus groups could also be used to elicit multiple responses from lecturers on divergent perspectives related to LMX, OCBs, tenure, and performance to assess Ghanaian technical university lecturers' perceptions regarding these concepts and their relevance to higher education in Ghana. Being a cross-sectional study, our results do not warrant causal claims and future research could try to use instrumental variables in field research or experimental designs to further explore the causal association between LMX and OCB. Finally, another limitation of the study is the fact that all data were collected from the same source; therefore common-method bias is likely to have impacted the results (Podsakoff et al., 2011). However, common method bias is less likely to lead to overestimation of interaction effects (Siemsen et al., 2010); therefore it can be concluded that the results for the interaction effect are less likely to be affected by common method bias. The scales have good internal consistency, yet the Cronbach's alpha for the employee performance scale was rather low. Future research could rely on data collected from multiple sources and performance data for example could be based on supervisor ratings or on some established metrics of academic impact instead of using self-reports as did in this research.

### **Practical implications**

This study highlights to stakeholders, managers, and practitioners in Ghanaian HEIs, the importance of LMX when promoting core mandates of faculty and facilitating an enabling work environment. The study provides

insights and contributes to literature on LMX, OCBs, work experience, and performance of lecturers in Ghana's public education sector. Teachers (especially the ones with less work experience) tend to engage in OCB when they experience good relationships with their supervisors. The most important managerial insight refers therefore to providing good supervisory support, especially to those with little work experience. High quality LMX is conducive for OCBs that are ultimately reflected in employee performance. Given how critical work experience is in influencing employees' cognitive and affective reactions to OCBs (Forteza and Prieto, 1994) and in development of knowledge and skills in higher education, practitioners must pay attention to both qualitative and quantitative components of high-work-experience employees. Attention should also be paid to LMX and extra-role behaviours to identify expertise during learning and development of abilities and skills necessary for the performance in tertiary education (Lance et al., 1989; Morrison and Branter, 1992; Tesluk and Jacobs, 1998). Such attention shapes the quality of leadership, performance, and socioeconomic growth of Ghana in the long-term.

## Conclusion

Given the importance of lecturers' performance in higher education, it is essential for stakeholders, practitioners, and managers of HEIs to understand the interactions of variables that influence performance. Results from the current study suggest OCBs mediate the effect of LMX on performance, and the positive association between OCB and LMS is moderated by work experience. From a stakeholder viewpoint, this study represents a reference for leaders and supervisors, especially those in African and Ghanaian HEIs, who want to enhance the performance of faculty members.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# **Determinants of business companies' economic performance in Burkina Faso**

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Received 31 December, 2018 ; Accepted 11 April, 2019

**This study examines the determinants of enterprises economic performance in trade, industry and services sectors in Burkina Faso. Based on data from a sample of 179 companies of 2013 financial statements, various analyzes highlight effects of economic, financial, environmental and managements variables on company performance. The results of econometric estimations using the logit model show the significance of investments, seniority or companies ages, debt ratio, employee salaries and geographical location on companies economic performance in the three sectors. In addition, manager gender and nationality are decisive in industrial sector while employee total wages and productivity are in services. It therefore appears the necessity to develop general economic policies that are appropriate for companies but also specific to the different sectors of activity in the country.**

**Key words:** Economic performance, sector of activities, logit model.

## **INTRODUCTION**

The economic performance of companies is a problem for both developed and developing countries. Indeed, efficient companies participate in the development of a nation by achieving growth goals which generally deal with employability, collection of tax revenues, promotion of innovation, etc. (Lazare, 2016). Thus, they can be considered as levers of economic growth necessary for development and combating poverty.

Burkina Faso, along with other developing countries, in its ongoing pursuit of development, is continuously implementing structural policies to support growth and address the social and economic shortcomings that cause long-term problems.

In this sense, it has drawn up a economic policy reference document for achieving growth objectives, named National Plan for Economic and Social Development (Pndes). One of its main focuses is: private sector is an important lever for growth through promotion of trade sector and development of industrial sector, putting the company at the heart of social and economic development system. Thus, many reforms have been undertaken in the promotion of entrepreneurship and have helped to accelerate creation of businesses. On an annual average, more than 5000 companies were created over the period 2011 to 2015.

The mobilization of domestic resources, mostly done by

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JEL Classification: C25, D21, H32.

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formal enterprises, is essential to achieve economic development goals. The more effective they are, the more they will participate in the overall economic growth effort. This raises the question of economic performance of companies given their prominent place in the economic development system.

What are the business performance criteria at the national level? Are they the same for all sectors of activity? Do they depend on specific characteristics of enterprises as mentioned by Nwachukwu et al. (2010)? For example, Jibao and Kai (2010) showed that economic performance in some industrial sectors in China depends on industrial factors, while for others, it depends on firms factors.

This raises the question of companies economic performance determinants regarding their prominent place in the economic development system.

This work highlights the factors of companies economic performance. It will lead to a better understanding of factors influencing performance in order to make appropriate recommendations for better business profitability.

## LITERATURE REVIEW

Theoretical aspects revolve essentially around the existential relationship between three (3) elements that are the structural behaviors of the market, the behavioral response of the company and its performance. This relationship is still called structure-behavior-performance paradigm or SCP paradigm.

SCP states that structural characteristics of the market orient the behavior of companies, which has an impact on their performance. It is described as the basic scheme of the American industrial economy. Bourke (1989), on a sample of 17 French banks in a comparative study of the profits of European banks use the SCP paradigm to explain the performance factors of these.

Looking empirical approaches, Nwachukwu and Oseghale (2010) found that the determinants of business performance could be divided into three (3) components. It would therefore depend on company individual characteristics, its economic characteristics and the environment in which it operates.

Concerning enterprise size, Vettori and Jarillo (2000) shows the existence of an optimal size and a decrease of company unit costs which could influence its profitability. Indeed, the size of the company allows practice of economies of scale by lowering costs and then increase profitability.

However Staikouras and Wood (2004) find, out of a sample of 690 banks (138 major banks and 547 small banks) that average profits decline with the size of the firm.

This support thesis of a negative relationship between firm size and its growth as stipulated by Davidsson et al. (2002), Almus and Nelinger (1999), Denis (1954)

Woywode and Lessat (2001).

About employee productivity, Steindl (1947) considered twenty-one (21) American industries in which the amount of electrical energy consumed per hour of human labor increases considerably with the number of workers employed in each establishment. Enke (1950) in the Journal *Intermediate Economy Theory* explains that "too much productivity may not pay if it is bought too expensive and if the rate of interest is too high". "But for Osborn (1951) "the law of the reduction of the cost according to the increase of the volume of production can not be verified if the establishments concerned use to a very variable extent their production capacity".

Looking to investments, Chowdhury and Wolf (2003), in a study of small and medium-sized enterprises in East Africa (Kenya, Tanzania, Uganda) found a non-significant impact of Information and communication technologies (ICT) investments on business profitability.

Concerning company age, Davidsson et al. (2002) found that age was the most influential variable on firm growth rate among twenty-one (21) explanatory variables.

Indeed, there is a number of activity year at which owners' incentives to grow their business diminish. They are reluctant about new expenses like staff recruitment for example, Storey (2016).

Company location can have an impact on its activity. Steil and Wolf (1997) linked one of the causes of a firm's growth to its geographic location.

For example, if the enterprise is located in a rural place, it develops a proximity strategy by operating in a low uncertainty market. This would have less impact on innovation capabilities and best business practices (Julien, 2000).

Company activity can also have an impact on its performance. Samuelson et al. (1989) show that "business growth rates vary significantly across different industries".

This is confirmed by Harhoff et al. (1998) who showed, on a sample of ten thousand (10000) West German companies covering all sectors of the economy find that service sector firms are characterized by above average employment growth rates. Hinchey et al. (1997) determine a relationship between development dynamics within a branch and the growth rate of the firm. Almus and Nelinger (1999) show that there is a strong correlation between the firm's specificity and its growth rate. For Woywode and Lessat (2001), firms in the transportation, finance, insurance and services sectors are more likely to grow than firms in the processing industry.

Company manager's age could have an impact on its performance. For Hambrick and Mason (1984), the young owner-manager is more adapt to develop a growth strategy based on new ideas and a propensity to develop innovative behavior than an older one. The senior manager's age or the average age of the executive team have a negative effect on the growth according to

**Table 1.** Average profitability in each sector.

Sector	Average profitability (%)
Trade	28
Industry	27
Services	27

Source: Study construction.

Woywode and Lessat (2001). Otherwise, Mathieu et al. (2003) show that manufacturing firms with the highest growth and innovation rates are led by employers with technical training.

Concerning gender, Robert and Berhe (1999) showed on a sample of SME from southern New Jersey that women entrepreneurs who made up 16% of their sample were relatively young (70% of them were under 50 years old), worked for fewer hours and took fewer risks, which is characteristic of low performance as stipulated by Fasci and Valdez (1998).

However, one aspect of the study has been successful in showing that women who are highly motivated at work and strive to find a balance between their work and their family produce better financial outcomes, while for men, these same conditions reduce the financial performance of the institutions they run. This result was found by Ekpinda (2010) on a sample of about one hundred Beninese firms showing through a quantile regression model, that women-run businesses were achieving better economic performance. So human capital, has a positive correlation with enterprise economic performance. Bates (1990), Brüderl and Preisendöffer (2000).

In some lectures, companies' juridical forms has an effect on performance. Woywode and Lessat (2001) on a sample of 8436 companies shows that the effects of legal juridical form on probability of rapid growth are significant. Indeed, rapid growth is the affair of limited liability company (LLCs) and societies in general rather than individual companies.

Some studies have evoked the absence of a link between performance and capital. For Demsetz and Lehn (1985) and Charreaux (1991), capital performance is indifferent to organizational training, while other authors mentioned a non-neutrality (Shleifer et al., 1988; Djelassi, 1996).

Myers and Majluf (1984), through the pecking-order theory, establish a decreasing preference for the financing means of a company. Its respectively self-financing, debt and stocks issues.

Modigliani and Miller (1985) establish two periods in which the impact of financial debt on performance is different.

Wanda (2001), on a sample of 39 companies found over a period of 3 years that the long-term financial debt is neutral in explaining the performance of the company because shareholders prefer own funding financing.

## MATERIALS AND METHODS

### Data

2013 companies physical financial statements were collected by Chamber of commerce and industry of Burkina Faso and the study variables were extracted for the analysis. The database was build and the variables were subdivided into four categories. These are the economic, environment financial and managements variables. And then:

(1) Economic variables include number of employee, turnover, investments in 2013, productivity of business equal to ratio value added/number of employee;

(2) Environment variables include geographical location (Ouagadougou or others towns), sub-category of company activity. Thus, there are four sub-categories of activity for trade sector, seven for industry and also seven services<sup>3</sup>; the legal juridical form adopted by the company to conduct its business. A company is either of a legal form as a sole proprietorship or a limited liability company ;

(3) Management variables include age of the manager, nationality of the company, employees wages, companies age and sex of manager;

(4) Financial variables include company capital and its debt ratio.

### Descriptive analysis

#### *Average profitability in each sector*

Trade, industry and services are the three sectors considered for the analysis. Table 1 shows the average profitability on each sector.

### Principal component analysis ACP and multiple component analysis ACM approach

#### *ACP or Principal component analysis*

Principal component analysis is a technique for summarizing the information contained in a vast array of quantitative data from graphical representations. It provides a map of variables based on their linear correlation.

For the analysis, all the quantitative variables of the model are used namely the financial profitability of the company, its seniority (age), the realized turnover, the shareholders' equity, the number of employee, employee salaries, investments, age of manager, productivity<sup>4</sup>.

We will comment a factorial plan. Indeed, the first factorial axis gives nearly 42% of the information while the two axes combined alone give more than 60% information<sup>5</sup>. The quantitative variables such as turnover, capital, number of employee, employee wages and investments are shown on axis 1 with a fairly good correlation.

Financial profitability and debt ratios are best represented on the axis 2 with a pretty good correlation. To a lesser extent, we find company age or seniority.

According to Axis 1, we see that companies that generate significant turnover are those with largest capital. They are also ones who have a high number of employees and a high level of employee wages with strong investments made. Thus Axis

<sup>3</sup> See Annex 1 for the subcategories of the trade, industry and services sectors.

<sup>3</sup> The variables geographical location, productivity, nationality, sex of the manager as well as his age were put in illustrative in the ACP method, in order to increase the level of information of the chosen factorial plan.

<sup>5</sup> See annex 2

contrasts this business profile with companies that have the lowest values for these variables that we just mentioned.

Axis 2 shows that companies that are more profitable are those that are most heavily indebted. They are ones that are the least old too. On the other hand, the companies that are the oldest are those which are unprofitable with low debt ratios<sup>6</sup>.

### ACM or multiple correspondence analysis

The multiple correspondence analysis (ACM) is a factorial method adapted to tables in which a set of individuals is described by a set of qualitative variables (in columns). A typical example of this data issue on opinion surveys.

Variables were categorized according to modalities in order to search through an ACM, reconciliations between them<sup>7</sup>.

Thus, five distinct groups can be determined:

(1) There is a group of limited liability companies located in Bobo-Dioulasso. They have a workforce of less than 25 employees and a turnover less than 200 million. They seem to be run by women and are nationals companies as nationality. These are mainly semi-wholesale businesses, hotels and restaurants, study services that are best represented on axis 2.

(2) The second group, which is the opposite of the first group, represents limited companies. They are generally located in Ouagadougou. They realize more than one billion of turnover and have more than 200 employees. They are usually for foreign nationality. They work in the wholesale trade, chemical industries, extractive industries or mining, insurance, wood industries. Also, they realize the most important investments and have the highest productivities.

(3) A third relevant group represents firms with low investment and low productivity, who are Burkinabe in origin and generally run by men aged 40 to 59 years or less. A well-represented sector for this group is other commercial services.

(4) A fourth group consist of sole companies, making average investments with a turnover between 200 million and one billion CFA<sup>8</sup> francs and led by seniors. A well-represented sector could be the agro-food industries.

(5) A fifth group would be companies with between 25 and 200 employees located in the capital Ouagadougou and practicing in the sectors of Buildings and public works and Retail. It was noticed that, in addition to the ACP conclusions, the most profitable sectors of activity seem to be industries like wood metal and miscellaneous and mining<sup>9</sup>, and the least profitable sectors seem to be the buildings and public works and the agro-food industries as well as the retail trade.

Also the foreign companies of our sample seem to be the most profitable as well as those located in Ouagadougou which are essentially of limited companies.

The model used is logistic method. Logistic regression is used for modeling of binary variables. It is applied in various fields such as medicine (healing or not of a patient), marketing (purchase or not of products or services following an action), etc. In the present case, the dependant variable which is financial profitability of companies take only 2 values explained by other variables. Such suits the present analysis to a logistic modelling approach.

Let consider  $Y_i$  be our interest variable, the financial profitability of companies.  $Y_i$  takes two values (0, 1) depending to each sector. It takes 1 if the company is profitable (0.28 for trade and

respectively 0.27 for industry and services) and 0 otherwise (Table 2).  $X_i$  is the set of exogenous variables of the model such as size, productivity, geographical location, age of the company, manager gender, shareholders' capital, debt ratio, investments, sub-category of activity, company nationality, manager age or years, productivity and employee wages.

We consider  $Y_i = X_i * \beta + U_i$  with  $U_i$  estimation errors. Then have therefore the following equations:

$$Y_i = 1 \text{ si } Y_i^* = X_i * \beta + U_i > 0$$

$$Y_i = 0 \text{ si } Y_i^* = X_i * \beta + U_i < 0 \text{ with } Y_i^*$$

The probability that company is profitable means that  $Y_i = 1$  is:

$$P(Y_i = 1) = P(X_i * \beta + U_i > 0) = P(X_i * \beta > -U_i) = P(-X_i * \beta < U_i)$$

$$= 1 - F(-X_i * \beta) = F(X_i * \beta)$$

With F the distribution function of the logistic law. The model is then estimated by the maximum likelihood method.

## RESULTS

The estimation of the logit model by taking into consideration, all activity sector simultaneously gives non conclusive and insignificant results. This is the reason why the method has been applied in each sector of activity individually (trade, industry and services).

### Trade

#### Model validation

The hypothesis of nullity of the coefficients is tested through the interpretation of the ratio of log likelihood LR, the statistic follows under  $H_0$  a law of  $\chi^2$  with 15 degrees of freedom (dof). Thus, for a threshold of 5%, the LR statistic is 29.89, which is greater than the  $\chi^2$  value at 15 dof read in the table which is 24.996. Then we reject the hypothesis  $H_0$  of nullity of coefficients. The estimated model has at least one explanatory variable of significance. In addition, the pseudo  $R^2$  is 38.5%.

In addition, the analysis of the prediction table shows that the investments as well as the company's age have a significant impact at the 5% threshold on the financial profitability in the trade sector while the impact of the sub-category (semi-wholesale) is significant at 10%.

#### Quality of the regression

**LinkTest:** The linktest regression in this first case shows that the hat variable is significant at the 5% threshold while the  $_{-} \text{hat}^2$  variable is not significant. Our model is not badly specified (Annex 5).

**Hosmer Lemeshow:** In addition, the p-value associated

<sup>6</sup> See Annex 3

<sup>7</sup> See Annex 4

<sup>8</sup> The local money. 1 dollar US is around 500 F CFA

<sup>9</sup> Sectors having the best coordinates on the axis

**Table 2.** Logistic regression of financial profitability in the trade sector.

Independent variable	beta	SE	z	P	IC
Nationality	-2.797	2,175	-1.290	0.198	(-7.060008, 1.46485)
<b>Sub-category</b>					
<b>Retail trade (reference)</b>					
Semi-wholesale	2.94	1,571	1,870	0.061 *	(-1385761, 6.019377)
Wholesale	2,175	1,575	1,380	0.167	(-9121059, 5.263016)
Small business	3,071	2,696	1,140	0.255	(-2.213143, 8.356885)
<b>Legal form</b>					
<b>Sole proprietorship (reference)</b>					
limited company (LC)	-2.288	1,947	-1.180	0.240	(-6.105249, 1.527256)
limited liability company (LLC)	-0.62	1,329	-0.470	0.641	(-3.22449, 1.983764)
Geographical location	0.302	1,041	0.290	0.771	(-1.737327, 2.34254)
Sex	0.001	1,019	0.000	0.999	(-1.996553, 1.998493)
Manager's age	0.031	0.047	0.670	0,505	(-060625, 1230393)
Debt ratio	-0.323	0.293	-1.110	0.269	(-8979891, 2503731)
Shareholders capital	-0.102	0.121	-0.840	0.398	(-3392818, 1349454)
Investments	0.74	0.293	2,520	0.012 **	(0.165527, 1.315377)
Productivity	6.951	5,035	1,380	0.167	(-2.917112, 16.81979)
Employees wages	0.018	0.014	1,320	0.186	(-0089329, 0460206)
Compagny's age	-0.166	0.077	-2.150	0.032 **	(-0.318212, -0144972)
Constant	1,232	3,348	0.370	0.713	(-5.328519, 7.794204)
N				56	
$\chi^2$ (15)				29.89	
P				0.0123	
Nickname R <sup>2</sup>				0.385	

\*Significant at 10%; \*\*significant at 5%; P: Pvalue; IC: confidence interval; SE: standard error.

**Table 3.** Prediction table in the trade sector.

Classified	Predicted value		Total
	Profitable	Unprofitable	
Profitable	25	11	36
Unprofitable	3	17	20
Total	28	28	56

Source: Study construction/stata.

with the Hosmer-Lemeshow statistic is 0.20. Which suggests that there is no evidence of a poor representation of the model. In conclusion the model is well specified (Annex 6).

**Quality of the prediction:** In our modeling of the determinants of financial profitability in the retail sector, x is the average value of financial profitability in the sector, which is 27%. The prediction table (Table 3) shows that for profitable commercial firms, 25 out of 36 cases were well predicted while for unprofitable firms, 17 out of 20 cases were well predicted. The prediction rate of the

model is equal to the sum of the cases correctly predicted relative to the total number of observations, that is,  $[(25 + 17) / 56] \times 100 = 75\%$ .

This explains why the variables used in the model explain to a good extent the probability that a company will be profitable.

**ROC Curve<sup>10</sup>:** The calculation of the area under curve (AUC) under stata shows that the value of the area under the ROC curve is about 88%. This demonstrates

<sup>10</sup> The receiver operating characteristic (ROC) curve

**Table 4.** Marginal effects in the trade sector.

Independent variable	dy/dx	SE	Z	P	IC
Nationality	-0.389	0.285	-1.36	0.173	-0.9476528, 0.1702596
<b>Sub-category</b>					
<b>Retail trade (reference)</b>					
Semi-wholesale	0.402	0.159	2.53	0.011	0.0902257, 0.7130341
Wholesale	0.286	0.186	1.54	0.124	-0.0785448, 0.6498081
Small business	0.421	0.359	1.17	0.241	-0.2827409, 1.124204
<b>Legal form</b>					
<b>Sole proprietorship (reference)</b>					
limited company (LC)	-0.309	0.228	-1.36	0.175	-0.7553375, 0.1373981
limited liabilitycompany (LLC)	-0.084	0.173	-0.49	0.627	-0.4240836, 0.2556807
Geographical location	0.042	0.144	0.29	0.771	-0.2408871, 0.3249756
Sex	0.000	0.142	0	0.999	-0.277402, 0.2776716
Rate of endettement	-0.045	0.039	-1.15	0.249	-0.1214965, 0.0315165
Employees	0.003	0.002	1.42	0.156	-0.0009865, 0.0061395
Company's age	-0.023	0.009	-2.54	0.011	-0.0409289, -0.0052979
Productivity	0.966	0.656	1.47	0.141	-0.3206087, 2.252252
Equity	-0.014	0.016	-0.86	0.388	-0.0464024, 0.0180118
Manager's age	0.004	0.006	0.68	0.498	-0.0082089, 0.0168808
Investments	0.103	0.031	3.28	0.001	0.0413357, 0.1644216

Source: Study construction/stata.

excellent discrimination of the model in trade sector (Annex 7).

**Marginal effects in the trade sector:** The marginal effects make it possible to study the impact of each exogenous variable on the explained variable (Table 4). The analysis of marginal effects of the model at 5 and 10% of significance, in the trade sector gives the following comments.

- (1) The probability for a semi-wholesale company to be profitable increases by 40% compared to a company in retail trade;
- (2) Compared to a company operating in retail trade, the probability of a company in trade to be profitable increase by about 10% when investments made are up to 1%;
- (3) The probability of a trade company to be profitable decrease by around 2% when its age or seniority increase by one year.

### Industry sector

The estimation results for industry sector data are shown in Table 5.

### Validation of the model

The hypothesis of nullity of the coefficients is tested

through the interpretation of the ratio of log likelihood LR. The statistic follows under  $H_0$  a  $\chi^2$  law with 16 degrees of freedom. Thus for a threshold of 5%, the LR statistic is 35.28, which is greater than the value of  $\chi^2$  at 16 dof read in the  $\chi^2$  table which is 26.296. Then we reject the hypothesis  $H_0$  of nullity of the coefficients. The estimated model has at least one explanatory variable of significance. The pseudo  $R^2$  is about 56%.

In addition, the analysis of the prediction table shows that the *personnel expense*, *investment* and *debt ratio* variables are significant at the 5% threshold while *nationality*, *sex of the manager* and *geographical location* are significant at 10%.

### Quality of the regression

**LinkTest:** The linktest regression for the industry sector gives the results table (Table 6). As in the trade sector, we note that the variable *hat* is significant at the 5% threshold while the variable *\_ hatsq* is not significant. This shows that our model does not suffer from a bad specification and does not omit important explanatory variables (Annex 8).

**Hosmer Lemeshow:** The p-value associated with the Hosmer-Lemeshow statistic is 0.59. Which suggests that there is no evidence of a poor representation of the

**Table 5.** Logistic regression in the industry sector.

rf 1	beta	SE	z	P	IC
<b>Independent variable</b>					
Nationality	3,932	2,226	1.770	0.07*	(-0.4304825, 8.293968)
<b>Sub-category</b>					
Agrifoods industries	2,044	2,637	0.780	0.438	(-3.124744, 7.21277)
Chemical Industries	0.800	2,963	0.270	0.787	(-5.006811, 6.606706)
Textile Industries	1,551	2,405	0.650	0.519	(-3.162429, 6.265319)
Wood Industries	2,572	2,596	0.990	0.322	(-2.516055, 7.660595)
Extractive industries	-1.360	3,445	-0.390	0.693	(-8.112589, 5.392505)
Geographical location	3,403	1,761	1,930	0.053*	(-0.048857, 6.854688)
Sex of the manager (man)	4,135	2,408	1,720	0.086*	(-0.5845775, 8.854781)
Manager's age	-0.028	0.139	-0.210	0.837	(-0.3000892, 0.243092)
Debt ratio	1,351	0.659	2,050	0.040**	(0.0593693, 2.64268)
Shareholder's capital	-0.293	0.193	-1.510	0.130	(-0.6713025, 0.0860198)
Investments	-1.438	0.694	-2.070	0.038**	(-2.797817, -0.0772436)
Productivity	-0.091	0.999	-0.090	0.927	(-2.049407, 1.866856)
Number of employees	-1.324	1,183	-1.120	0.263	(-3.642261, 0.993925)
Company's age	-0.071	0.095	-0.740	0.457	(-0.2571611, 0.1157827)
Employees wages	1,834	0.882	2,080	0.038**	(0.1051549, 3.56209)
Constant	-9.064	5,590	-1.620	0.105	(-20.02027, 1.892588)
N				51	
$\chi^2$ (16)				35.28	
P				0.0036	
Nickname R <sup>2</sup>				0.5561	

\*Significant at 10% ; \*\*Significant at 5%; P: P value; IC: confidence interval; SE: standard error.

**Table 6.** Prediction table in the industry sector.

Classified	Predicted values		
	Profitable	Unprofitable	Total
Profitable	14	7	21
Unprofitable	2	28	30
Total	16	35	51

Source: Study construction/stata.

model. In conclusion the model is well specified (Annex 9).

**Quality of the prediction:** The analysis of the prediction quality of our model will be done through the prediction table (Table 6). It is question of comparing, like in the commercial sector, the predictions of the occurrence of the event, that is, the cases where the dependent variable is equal to 1 to the true values taken by the dependent variable at the 27% threshold corresponding to the average value of financial profitability in the industrial sector. Using the lstat command under stata, we obtain the following results:

The prediction table shows that 14 out of 16 profitable

industrial enterprises have been well predicted while 28 out of 35 unprofitable companies have been well predicted. The prediction rate of the model is equal to the sum of cases correctly predicted relative to the total number of observations that is,  $[(14 + 28) / 51] \times 100 = 82.35\%$ .

This explains that variables used in the model largely explain the probability of an industrial company profitability.

**ROC Curve:** The calculation of the AUC under stata shows that the value of the area under the ROC curve is about 88%. This demonstrates an exceptional discrimination of the model in the industrial sector

**Table 7.** Marginal effects in the industry sector.

Independent variable	dy / dx	SE	z	P	IC
Nationality	0.350	0.169	2.07	0.038	0.0190686, 0.6810087
<b>Sub categories</b>					
Agri-food industries	0.165	0.194	0.85	0.394	-0.2151284, 0.545959
Chemical Industries	0.056	0.206	0.27	0.784	-0.3481499, 0.4610835
Textile Industries	0.120	0.169	0.71	0.478	-0.2109484, 0.4502618
Wood Industries	0.216	0.204	1.06	0.289	-0.1833399, 0.6158377
Extractive industries	-0.073	0.179	-0.41	0.683	-0.4237223, 0.277682
Geographical location	0.303	0.124	2.44	0,015	0.0597503, 0.5461651
Sex of the manager (man)	0.368	0.180	2.05	0.041	0.0157312, 0.7205558
Manager's age	-0.003	0.012	-0.21	0.837	-0.0266426, 0.0215682
Rate of endettement	0.120	0.045	2.69	0.007	0.0325969, 0.2079635
Shareholders capital	-0.026	0.015	-1.72	0.085	-0.0556749, 0.0035678
Investments	-0.128	0.047	-2.7	0.007	-0.2207189, -0.0352445
Productivity	-0.008	0.089	-0.09	0.927	-0.1822681, 0.1660158
Numberof employees	-0.118	0.099	-1.19	0.234	-0.3119394, 0.076161
Comapny's age	-0.006	0.008	-0.75	0.451	-0.0226579, 0.0100712
Employee wages	0.163	0.060	2.71	0.007	0.0449644, 0.2815264

Source: Study construction/stata.

(Annex 10).

**Marginal effects in the industry sector:** Marginal effects estimation results are shown in Table 7. Thus the analysis of the marginal effects of the significant variables shows that:

- (1) Compared to foreign companies, the probability for an industrial company to be profitable increase by 35% if it's nationality is Burkinabe ;
- (2) Compared to a company located in Bobo Dioulasso, the probability for an industrial company to be profitable increase by more than 30% when it is located in Ouagadougou;
- (3) Compared to companies led by woman, the probability for an industrial company led by man to be profitable increase of nearly 37%;
- (4) The probability for an industrial company to be profitable decrease by almost 13% if its investments rise by one unit;
- (5) The probability for an industrial enterprise to be profitable increase by about 12% if its debt ratio increases by one unit;
- (6) The probability for an industrial company to be profitable increase by more than 16% if its employee global wages rise by one unit.

### Service sector

The estimation results for the services sector data are shown in Table 8.

### Validation of the model

The hypothesis of nullity of the coefficients is tested through the interpretation of the ratio of log likelihood LR. The statistic follows under H0 a law of Chi<sup>2</sup> with 15 degrees of freedom. Thus for a threshold of 5%, the LR statistic is 26.84. Which is greater than the value of the Chi<sup>2</sup> at 15 ddl read in the table which is 24,996. Then we reject the hypothesis H0 of nullity of the coefficients. The estimated model has at least one explanatory variable of significance. The pseudo R<sup>2</sup> is about 38%.

Also, the subcategories «*Computer and*» at the 5 and 10% thresholds, respectively.

The geographic location, equity, productivity and seniority of *the company* are all significant at the 5% level. As for *personnel expenses*, they are significant at the 10% level.

### Quality of the regression

**LinkTest:** The linktest regression for the service sector gives the results table (Table 9). As in the trade and industry sectors, we note the significance of the  $\hat{\beta}$  variable at the 5% threshold and the non-significance of the  $\hat{\beta}^2$  variable at the same threshold. This shows that our model does not suffer from a bad specification and does not omit important variables (Annex 11).

**Hosmer Lemeshow:** The p-value associated with the Hosmer-Lemeshow statistic is 0.66. Which suggests

**Table 8.** Logistic regression in the services sector.

rf 1	Beta	SE	z	P	IC
<b>Independent variable</b>					
Nationality	0.964	1,656	0.58	0.56	-2.281087, 4.209552
<b>Subcategories</b>					
Insurance	0.000				
Other market services	1,251	1,147	1.09	0.276	-0.9978956, 3.499287
Hotels and restaurants	0.944	1,799	0.52	0.6	-2.582394, 4.469636
IT and telecommunications	4,015	2,010	2	0.046 **	0.075635, 7.954566
Study services	2,428	1,433	1.69	0.09 *	-0.3817456, 5.237402
Transport, warehousing and communications (reference)	0.000	(omit)			
Manager's age	0.062	0.048	1.27	0.202	-0.0331504, 0.1565111
<b>Legal form</b>					
<b>Sole proprietorship (reference)</b>					
Limited company (LC)	1,001	1,467	0.68	0.495	-1.874853, 3.87615
Limited liability company (LLC)	-0.309	1,393	-0.22	0.824	-3.039566, 2.420796
Geographical location (Ouaga)	2,227	1,130	1.97	0.049 **	0.0132642, 4.441337
Debt ratio	0.319	0.165	1.93	0.053 *	-0.0045697, 0.6429621
Shareholders capital	-1.386	0.637	-2.18	0.030 **	-2.635398, -0.13735
Productivity	0.985	0.441	2.23	0.026 **	0.1202477, 1.849407
Number of employees	0.003	0.009	0.3	0.764	-0.0148052, 0.0201531
Sex of the manager	0.000	(omit)			
Company's age	0.113	0,056	2	0.046 **	0.0020775, 0.2235158
Employee wages	-0.191	0.112	-1.7	0.090 *	-0.4109689, 0.0297195
Constant	-7.617	3,450	-2.21	0.027 **	-14.37885, -0.8549538
N				64	
Wald $\chi^2$ (15)				26.84	
P				0.0301	
Nickname R2				0.3798	

\*Significant at 10% ; \*\*Significant at 5%; P: P value; IC: confidence interval; SE: standard error.  
Source: Study construction.

that there is no evidence of a poor representation of the model. In conclusion the model has a good fit (Annex 12).

**Quality of the prediction:** The analysis of the predictive quality of our model through the prediction table (Table 9) compares, as in the trade and industry sector, the predictions of the occurrence of the event. These are the cases where the dependent variable is equal to 1 to the true values taken by the dependent variable at the 27% threshold corresponding to the average value of financial profitability in the service sector. Using the lstat command under stata, we obtain the following results. The prediction table shows that for profitable service firms, 27 cases out of 30 have been well predicted while for companies that are not profitable, 18 out of 33 cases have been well predicted. The prediction rate of the model is equal to the sum of the cases correctly predicted relative to the total number of observations that is,  $[(27 + 18) / 64] \times 100 =$

70.31%.

This explains why the variables used in the model explain the probability that a company will be profitable.

**ROC Curve:** The calculation of the AUC under stata shows that the value of the area under the ROC curve is about 88%. This demonstrates excellent model discrimination in the service sector (Annex 13).

**Marginal effects in the service sector**

Marginal effects estimation results are shown in Table 10. Thus the analysis of the marginal effects of significant variables in the service sector shows that (Table 11):

- (1) The probability for a services company to be profitable increase by about 31% when the company is located in Ouaga rather than other place;
- (2) The probability for a services company to be profitable



**Table 9.** Prediction table in the service sector.

Classified	Predicted values		
	Profitable	Unprofitable	Total
Profitable	27	16	43
Unprofitable	3	18	21
Total	30	34	64

Source: Study construction/stata.

**Table 10.** Estimated marginal effects in the services sector.

Variable	dy / dx	SE	Z	P	IC
<b>Marginal effects</b>					
Nationality	0.136	0.233	0.58	0.561	-0.3218385, 0.5930117
Manager's age	0.009	0.006	1.34	0.179	-0.0039785, 0.021325
<b>Legal form</b>					
Sole proprietorship	(reference)				
Limited company (LC)	0.132	0.189	0.70	0.484	-0.2382829, 0.502526
Limited liability company (LLC)	-0.042	0.188	-0.22	0.823	-0.4107077, 0.3266142
<b>Geographical location (Ouaga)</b>					
Debt ratio	0.313	0.140	2.23	0,026	0.0379929, 0.5883955
Shareholders capital	0.045	0.021	2.12	0,034	0.0033474, 0.0864209
Productivity	-0.195	0.071	-2.76	0.006	-0.3333206, -0.0565722
Number of employee	0.138	0.064	2.18	0,029	0.0138907, 0.2630744
Manager sex	0.000	(omitted)	0.30	0.764	-0.0020798, 0.0028318
Company's age	0.000				
Employee wages	0.016	0.007	2.20	0,027	0.0017586, 0.0299635
	-0.027	0.016	-1.63	0,103	-0.0590432, 0.0054334

P: Pvalue; IC: confidence interval; SE: standard error.

**Table 11.** Resume of sign and significance of financial profitability and the explanatory variables.

Variable	Financial profitability		
	Trade	Industry	Services
Nationality	-	* +	+
Limited liability company (LLC)	-	<i>n.e.</i>	+
Limited company (LC)	-	<i>n.e.</i>	-
Geographical location (Ouaga)	+	* +	** +
Sex (Male)	+	* +	<i>n.e.</i>
Manager's age	+	-	+
Debt ratio	-	** +	* +
Shareholders capital	-	-	- **
Investments	** +	- **	<i>n.e.</i>
Productivity	+	-	** +
Number of employee	+	-	+
Company's age	- **	-	** +
Employee wages	<i>n.e.</i>	** +	- *

- = negative link; + = positive link; - \* = significant negative link at 10%; + \*\* = significant positive link at 5%; *n.e.* = not estimated.

Source: Study construction.

decrease by about 19% when its shareholders capital is increased by one unit;

(3) The probability for a services company to be profitable increase by about 14% when employee productivity increases by one unit;

(4) The probability for a services company to be profitable increase by only 1.5% if it's seniority increases by one unit;

(5) The probability for a services company to be profitable decreases by 2.6% if employee total wages increase by one unit.

## DISCUSSION

### Trade sector

Investments are an important part of the growth of an enterprise. It contributes to companies performance in the global market by making new acquisitions, improving production capacities and so on.

In the commercial sector, investments and company's age are significant to explain commercial units economic performance at the 5% level. The sub-sector semi wholesale trade is significant at 10% level.

However, the role of investments in the financial performance of companies has not always been elucidated and the expected impact is often variable as shown by Chowdhury and Wolf (2003). They found that this impact on ICT companies was not significant. Thus, in the trade sector in Burkina Faso, it appear the necessity for a company to invest because of its role in financial profitability.

In addition, the company's age of the company came out significant in the explanation of the economic performance of the company. Moreover, this impact is negative, as suggested by Davidsson et al. (2002) and Storey (2016) on the link between age and performance.

So the older a business is, the lower the profitability become over time. This could be explained by a decrease in motivation of promoters specially when, for a given level of growth, expenses become more and reach high proportion. These expenses are encouraging by the thoughts of managers / owners whom starting believing theirs business become "immortal" and will never die. So, it appear a let to go in the expenses of personal consumption, which contribute to increase vulnerability of the company, which generally evolves in an uncertain environment.

Also the sub-category of semi-wholesale trade activities is significant compared to other sectors in the explanation of the financial performance of the trading companies. As suggested by Samuelson et al. (1989), the growth rates of firms depend on their nature. Thus the sub- sector "semi-wholesale trade" has a comparative advantage that would allow it to make good financial performance. Moreover, the fact that the activity is between the wholesale and retail sub categories, this

subsector has the benefits of them.

### Industry sector

In the industry sector, investments, employees wages and debt ratio were significant in explaining the financial performance of companies at 5% level. While, manager's nationality and gender and geographical location of the industrial unit are significant at 10% level.

As in the commercial sector, investments play a major role in explaining company's financial performance. However, this impact is negative for industries. Some explanations could be give by the fact that, industries does all required and necessary acquisitions before starting their business. And then, any new investments (equipment changes, new acquisitions, etc.) generate costs and appear as expenses for hem without inducing a significant growth. So, the impact could be low and decrease the financial profitability of industries.

Another result is the positive significance impact of debt ratio on industries profitability, unlike commercial sector where it is not. This is mentioned by Wanda (2001) as being the process of long-term debt neutrality. Thus, in Burkina Faso, manufacturers prefer debt to self-financement instead of use of pecking order theory of Myers and Majluf (1984). However, indebtedness can allow companies, below a given threshold, to finance their expansion capacities and use their own funds to develop certain aspects of their companies, which create a positive effect on industry value, Modigliani and Miller (1985). So debt influence the probability of industries in the country.

As result, employees wages have positive and significant impact on industries for being financially profitable. In fact, better wages have the effect of boosting the productivity of workers by making them more efficient and more innovative, which is known to lead positive results for the company even if Enke (1950) thinks that «too much productivity may not pay if it is bought too expensive and if the rate of interest is too high».

Moreover, as the literature shows, the location of the company could give it a significant comparative advantage that would influence its growth and profitability. Thus, in the explanatory model of the financial profitability of industries, the location is significant at 10% level. The fact that the industrial units are located in Ouagadougou, the economic capital of the country, significantly impact their financial profitability. They not only benefit from economies of scale and agglomeration, but also from the availability of support infrastructure and administrative services essential for their activities (Steil and Wolf, 1997). These factors prove to be important to achieve good financial results for the industrial sector. However, units located elsewhere operate in a market with low uncertainty, which is a limitation of their capacity for innovation and a source of

less impact on profitability (Julien, 2000).

One more result in the industrial sector founded is the nationality of the industry also has a significant positive impact on the probability at 10% of level. Indeed, the fact that the company operates on its territory confers it benefits related to this status, which is different for a foreign company. These can be related to tax reduction, to the knowledge of economic environment, etc. Thus, the knowledge of national market, the establishment of long-lasting and solid distribution networks, constitute major elements of influence on the financial profitability.

Another result is gender which is the subject of more attention of countries decision-makers. Increasingly, women's entrepreneurship is an integral part of development pillar use by governments to attain national objectives. Particularly, in Africa countries and many others of the world, the important role of women in society is critical to achieving sustained and inclusive growth.

From the explanatory model in the industry sector, it appears that gender has an impact on financial performance of industrial companies. Thus, the fact that the entrepreneur is male increase the probability that an industrial enterprise will become profitable compared to the fact that the entrepreneur is female. This can be explained by the nature and specificities of industrial activity base on time-consuming management, and exposition of various risks to ensure performance of the unit. However, this is not always close to the role gives to women in our society, a role in which they are frowned upon if they are not socially involved, Fasci and Valdez (1998) and Robert and Berhe (1999).

### Service sector

In the services sector, the econometric analysis shows the significance of geographical location, shareholders capital, productivity and seniority to determine financial performance of companies in Burkina at the 5% threshold. In addition, debt ratio and employees wages have a significant impact at the 10% level.

The geographical location of services in the economic capital Ouagadougou give them comparative advantages. Indeed, country capital contains the most opportunities for services such as transport activity, other market services, hotels and restaurants, research services, etc. This is mainly due to the proximity with a large population, so an available costumers, better infrastructure compared to elsewhere in the country (Steil and Wolf, 1997).

Shareholders capital has a significant and negative impact on the probability for a business service to be financially efficient as Tarek (2001) points it. There is a relationship of non-neutrality between these two quantities as denote by Shleifer et al. (1988). This negative effect can be explained by "lower financial income that does not cover workloads".

Productivity is a variable that plays a significant and

positive role in the business services profitability. Unlike other sectors where this finding does not emerge as Steindl (1947) states, there is an important role between productivity level and business performance.

The service companies ages have a significant and positive impact on their probability. The fact that a service enterprise is older allows it to build a strong network of partnerships and maintain it. This gives it comparative advantages related to its reputation, its experience gained in the field, etc. The seniority of the firm is therefore an influential variable in the explanatory model of Davidsson et al. (2002), in the service sector.

The debt ratio has an impact on the probability that a service company will perform financially as shown in the industry sector. Indeed, indebtedness is often used for capital expenditures related to the installation and operation of the service unit. This is often the case of research and training firms. Also some service activities such as transport, sells services require significant investments that can be made by the debt. This reduces the pressure on the company cash flow and rentabilize the money invested.

In addition, employees wages have a significant impact on the probability for a service activity to be profitable.

However, this impact is negative. Thus, the fact that personnel costs are much higher can lead to a decrease in performance.

### Conclusion

Thus the study reveals the existence of relevant explanatory factors on the financial profitability of companies in Burkina. However, from one sector to another, these elements differ and provide a better understanding of the strategic choices made by these entities in their growth process.

As recommendations, it is essential for Burkina Faso government to encourage initiatives that support businesses with high growth potential through appropriate policies. This could allow them to have more flexibility in the investments they make and greater flexibility in the restructuring of companies if they begin to face some difficulties related to significance factors showned.

### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

### ACKNOWLEDGEMENTS

The extend his thank his institution, Chamber of Commerce and Industry of Burkina Faso and the General Manager, Mr. Issaka Kargougou for their support in allowing access data for the paper.

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**ANNEX**

**Annex 1.** List of categories and sub-categories of activities

**Trade**

- Semi-wholesale
- Retail business
- Wholesale
- Small business

**Industry**

- Buildings and public works
- Agrofoods industries
- Chemical Industries
- Mineral Products Industries and Basic Metallurgical Industries
- Textile and paper industries
- Wood, Metal and Miscellaneous Industries
- Extractive industries

**Services**

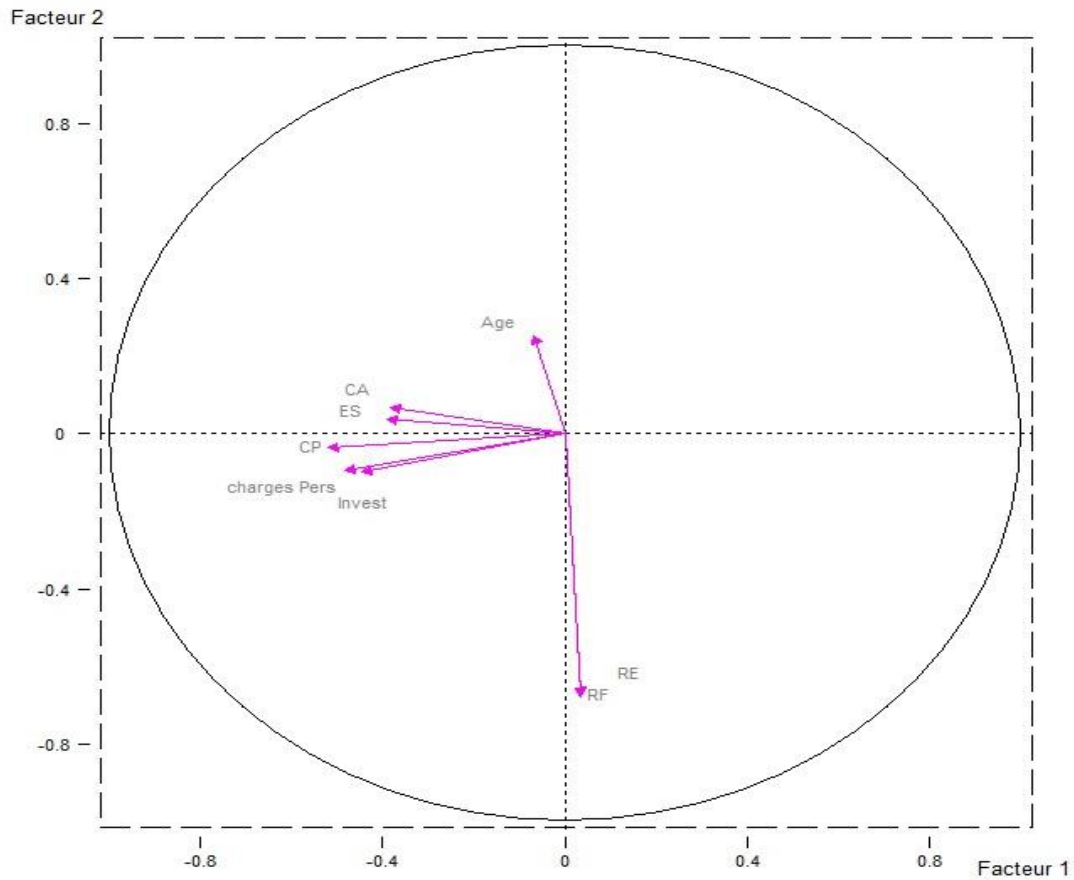
- Insurance
- Other commercial services
- Banks and financial institutions
- Hotels and restaurants
- IT and telecommunications
- Study services
- Transport, Warehouses and Communications

HISTOGRAMME DES 8 PREMIERES VALEURS PROPRES

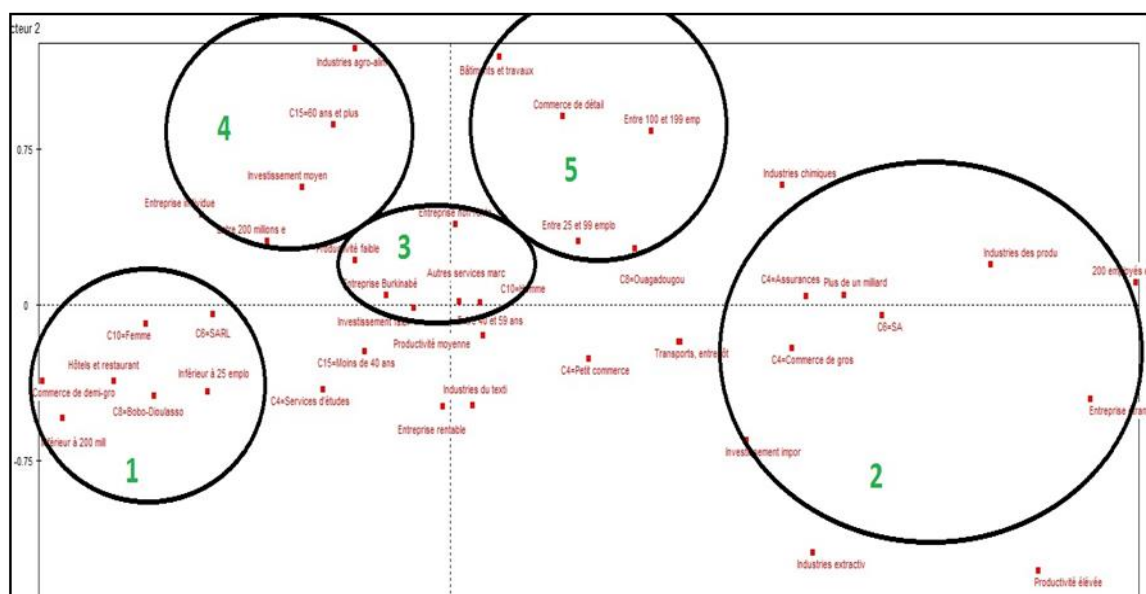
NUMERO	VALEUR PROPRE	POURCENTAGE	POURCENTAGE CUMULE	
1	3.3467	41.83	41.83	*****
2	1.5033	18.79	60.63	*****
3	1.1613	14.52	75.14	*****
4	0.7174	8.97	84.11	*****
5	0.5266	6.58	90.69	*****
6	0.5101	6.38	97.07	*****
7	0.2050	2.56	99.63	*****
8	0.0296	0.37	100.00	*

**Annex 2.** Histogram of eigenvalues.

Source: Study construction on SPAD.



**Annex 3.** Factorial representation of study variables. Age = Age of company; CA = turnover; ES = number of employee; CP = capital; Charges Pers = employee wages; Invest = investments; RE = debt ratio; RF = financial profitability.  
Source: Study construction on SPAD.



**Annex 4.** Multiple correspondence analysis representation.  
Source: Study construction on SPAD.

**Annex 5.** Linktest in the trade sector.

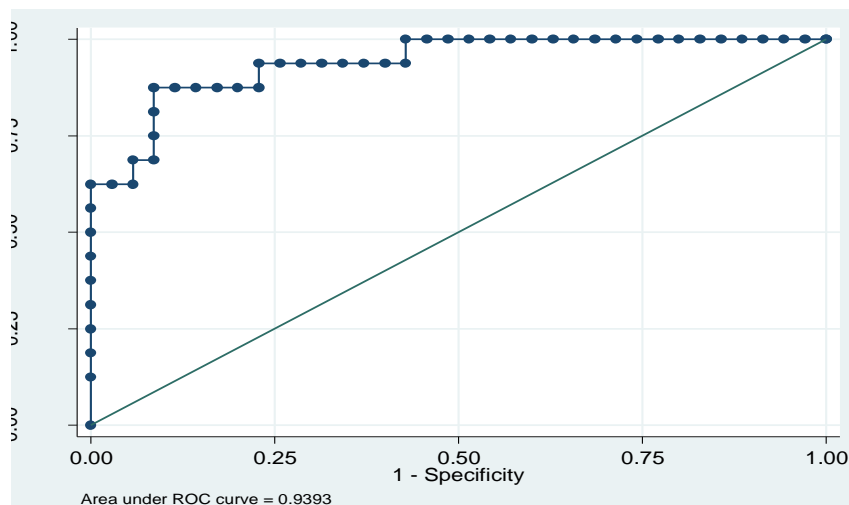
Variable	beta	SE.	z	P	IC
_ hat	1,012	0.2801	3.61	0.000**	0.4630052, 1.561308
_ hat square	0.0175	0.0089	1.95	0.051*	-0.0000793, 0.0351893
constant	- 0.028	0.3611	-0.08	0.937	-0.7362954, 0.6792314
N	56				
$\chi^2$ (15)	30.16				
P	0.0000				
Nickname R <sup>2</sup>	0.3885				

Source: Study construction/Stata.

**Annex 6.** Hosmer-Lemeshow statistics in the trade sector.

Number of observations	56
Number of groups	10
Hosmer-Lemeshow $\chi^2$ (8)	10.90
P value	0.2075

Source: Study construction/Stata.



**Annex 7.** AUC for the model in the trade sector.

Source: Study construction/stata.

**Annex 8.** Linktest of the industry sector.

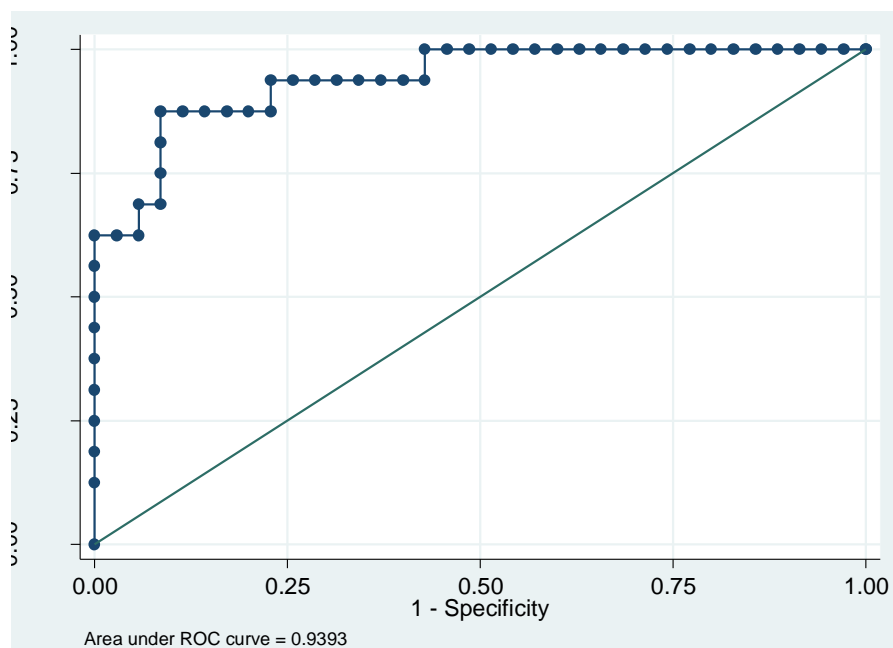
Variable	beta	SE	z	P	IC
_ hat	1,008	0.347	2,910	0.004	0.3281328, 1.686867
_ hatsq	0.005	0.003	1,540	0.124	-0.0013788, 0.0114223
_ cons	-0.007	0.483	-0.020	0.988	-0.9547472, 0.9399244
N			51		
$\chi^2$ (15)			35.32		
P			0.000		
Nickname R <sup>2</sup>			0.5567		

\*Significant at 10%; \*\*Significant at 5%; P: P value; IC: confidence interval; SE: standard error.  
Source: Study construction.

**Annex 9.** Hosmer-Lemeshow Statistics in the Industry Sector.

Number of observations	51
Number of groups	10
Hosmer-Lemeshow $\chi^2$	6.47
pvalue	0.5953

Source: Study construction / stata.



**Annex 10.** AUC in the industry sector.

Source: Study construction on stata.

**Annex 11.** Linktest in the service sector.

rf 1	beta	SE	z	P	IC	
_ hat	1,014	0.266	3.82	0.000	0.4931945	1.534832
_ hatsq	0.016	0.008	1.94	0.053	-0.0001852	0.0322439
_ cons	-0.026	0.335	-0.08	0.939	-0.6820239	0.6305759
N	64					
$\chi^2$ (2)	33.83					
Prob> chi <sup>2</sup>	0.0000					
Nickname R <sup>2</sup>	0.3824					

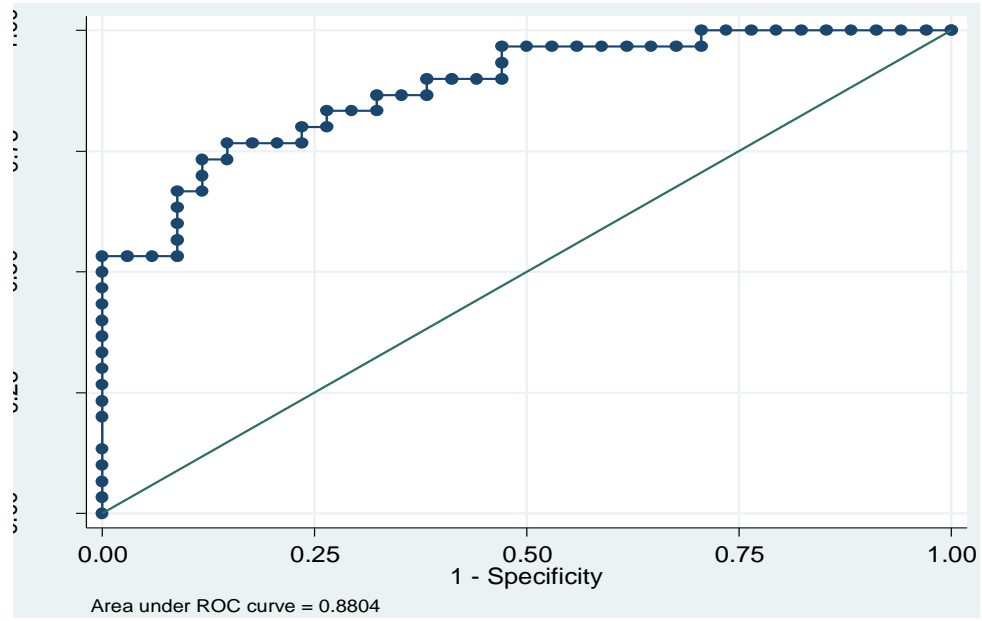
\*Significant at 10%; \*\*Significant at 5%; P: P value; IC: confidence interval; SE: standard error.  
Source: Study construction.

**Annex 12.** Statistics of Hosmer Lemeshow in the services sector.

Number of observations	64
Number of groups	10
Hosmer-Lemeshow $\chi^2$	5.85
P value	0.6635

Source: Study construction /Stata.





**Annex 13.** AUC in the services sector.  
Source: Study construction on stata.

**Related Journals:**

