CEO Entrenchment and Performance: New Evidence Using Nonlinear Principal Component Analysis.

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ABSTRACT

This study revisits the link between CEO Entrenchment and performance from a sample of 1.040 annual observations concerning 138 CEOs of French-listed firms for the 2000-2013 period. The effect of entrenchment, which seems to represent an illustration of the effectiveness of control mechanisms that CEOs are supposed to undergo within firms, reveals ambiguous findings. The financial woes, suffered by some firms such as France Telecom, Vivendi Universal and Eurotunnel testify to the magnitude of this inefficiency and usefulness to discuss corporate governance principles. The VIENOT reports 1 and 2 and the Bouton report have come forward presenting recommendations aimed at implement a system of corporate governance where moral ethics of different actors, confidence, transparency and respect for the interests of stakeholders are consistent. The purpose of this paper is thus to understand the impact of entrenchment on French firm performance. A key aspect of our study is the use of Nonlinear Principal Component Analysis (NLPCA), which is preferred to standard principal component analysis as a more effective method to distill the complex dimensions of CEO Entrenchment into reliable summary scores. Using fixed/random effect models which control of different source of heterogeneity, we find that CEO Entrenchment has a modest association with operating measures of performance (i.e. ratio of earnings to total

assets, ROA) and with market-based measures of performance (i.e. Tobin's Q). The empirical findings also indicate that the magnitude of the economic significance of the entrenchment proxies in the performance models depends on the method utilized to measure CEO Entrenchment.

Keywords: Entrenchment; Performance; Nonlinear Principal Component Analysis

I. INTRODUCTION

The notion of entrenchment reflected, in general, the idea of not being able to be easily moved from the place where you are. Indeed, the entrenchment of the leader reflects its determination to overcome the control of shareholders to adopt a freedom of action and benefit both from pecuniary and non pecuniary advantages.

First, the entrenchment of leaders is considered one of the important means helping to create business value; on the other hand it can be harmful and has negative effects on performance. He has conducted several empirical and theoretical researches at a time. The idea is that some

mention the existence of a + or - significant link between the rooting and performance. While others emphasize non-significant results. The question of our problem we pose in this regard is: In what measure the performance will be affected by the entrenchment of leaders within French companies?

The entrenchment models presented by previous studies remain limited because they have retained a limited number of variables. Indeed, the studies Morck et al. (1988) and Short and Keasy (1999) did not take into account the personal characteristics of the leader and Pigé model (1998) did not address the relationship between the leaders and the company's various shareholders. In our modeling, we will consider as well as the relationship between the leaders and directors and between the leaders and the various shareholders of the company (mainly by creating two managerial entrenchment indexes by ACP and ACP non-linear).

We use ACP to measure the managerial entrenchment. It allows us to combine a broad set of governance variables in the construction of a primary component of entrenchment. It allows us to combine a broad set of governance variables in the construction of a primary component of entrenchment. To ensure the robustness of our results, we will examine the relationship between entrenchment of leaders and performance, but by constructing another entrenchment measure as: The Nonlinear Principal Component Analysis, NLPCA.

The non-linear principal component is based on auto-associative neural network (auto encoder), Matthias Scholz (2012). NLPCA is preferred to linear extraction methods because it

allows both to reduce the dimensionality and to bring closer the non-linear structures in a specific set of data (see Scholz and Vigário, 2002; Lintingetal.2007).

II- CEO ENTRENCHMENT INDEX CONSTRUCTION AND HYPOTHESES

Following the work of (Bebchuk, Cohen, & Ferrell, 2009; Cai Qian & Liu, 2015; Devos, Elliott, & Warr, 2015; Dikolli, Mayew, and Nanda, 2014; Elyasiani & Zhang, 2015; Florackis & Ozkan 2009; Harjoto, 2009; Jiang, Adams, & Jia-Upreti, 2012; Kesten, 2011; K. Lee & Yeo, 2010; S. Lee, 2012; Pokharel, 2014; Sheu & Lee, 2012; Yuan, 2009) we construct our entrenchment index of 138 French CEOs from a combination of corporate governance variables and variables related to the personal characteristics of leaders using the method of principal component analysis ACP and PCNL.

(Yuan, 2009) constructed an entrenchment index that includes ownership of CEO, duality, its age, its capital and experience. (Florackis & Ozkan, 2009) incorporate in their entrenchment index the percentage of voting rights, the concentration of capital and the compose variables of the administration board and remuneration structure. For (Sheu & Lee, 2012), their entrenchment index was built by five components: the affiliated directors (directors who have business relations with the company), the independent outside directors (directors who seem to have no relationship with the company, except for being a part of its administration board), the percentage of voting rights, duality and a compensation ratio. (Pokharel, 2014) includes in its entrenchment index only three variables related to the number of shares held by the CEO, his duality and seniority. Similarly, (K. Lee & Yeo, 2010) used three variables in achieving the entrenchment index: duality, the seniority of the CEO and the independent outside directors.

Following the work elaborated by Berger and Ofek Yermack (1997), we define our managerial entrenchment index as the measure to which leaders manage to neutralize the discipline of corporate control mechanisms. By this definition, the managerial entrenchment is manifested by the influence or managerial power. In the measure of managerial entrenchment we associate the set of corporate governance characteristics that may be associated with specific capacities of leaders and their discretionary powers which allows them to expropriate the wealth of shareholders (Florackis & Ozkan, 2009). The component variables of our entrenchment index are:

AG + HCAP + TEN + CEOWN + DA +BS + DUAL +IND + NCB + COMIND.

HYPOTHESIS 1. *the entrenchment is harmful: Sleifer and Vishny (1989) and Morck et al. (1990), among others, have argued that the entrenchment is harmful because it allows them to be released in part of the control that shareholders can exercise on their management by linking the profitability of the firm to their presence and that via monitoring the strategy of specific investments that reduces the concurrence on the employment market.*

HYPOTHESIS 2: *the entrenchment is beneficial: entrenchment lead managers to choose riskier projects and therefore more profitable for partners and shareholders in particular. In addition, Castanias and Helfat (1992), focused on managerial income created due to specific capacities related to leaders.*

RESEARCH DESIGN

3.1 Sample Selection and Data Sources

Our sample includes 80 French firms belong to index SBF 120. The financial data are hand collected using annual reports, Paris Market Exchange and websites of selected firms. Our data covers 2001-2013 periods. Overall, we have 80 firms over a period of 13 years (1.040 observations). The use of panel data, we give advantage to benefit from the both, individual and temporal dimensions of the available information.

1. Methodology

This study provides further insights into the CEO entrenchment-performance relationship by showing a new method for measuring CEO entrenchment. Specifically, using Nonlinear Principal Components Analysis (NLPCA) to combine several CEO attributes, such as ownership, age, tenure and board structure…

This method is a non-linear extension of the standard principal components approach and enables the construction of partly robust and reliable entrenchment proxies. This is because, in contrast to linear extraction methods, NLPCA relaxes the assumption that each of the CEO attributes contributes equally to the entrenchment score, automatically producing weights such that the entrenchment proxy explains much of the variance in the group of CEO entrenchment attributes. More importantly, NLPCA enables the extraction of complex features from a high dimensional dataset by allowing for potential nonlinearities across CEO attributes. To this end, the utilization of the specific method can help reduce the measurement error in the obtained entrenchment proxies.

Our empirical analysis sheds additional light on the lack of consensus on the relationship between entrenchment and performance. In particular, our results show that the level of economic significance of the entrenchment indicators in the performance models critically depends on the method employed to measure CEO entrenchment. Overall, the analysis supports the use of NLPCA as a more appropriate way to construct generalized CEO entrenchment metrics. This is mainly the case in studies that are based on large datasets that include both nominal and ordinal variables (see Linting *et al.* 2007).

The Nonlinear Principal Component Analysis Method

Using NLPCA to assemble a wide set of firm- specific characteristics into a smaller set of meaningful and reliable CEO entrenchment summary scores is one of the main contributions introduced by this study. NLPCA is better to linear extraction methods because it permits for both dimensionality reduction and approximation of nonlinear structures in a specific dataset (see Scholz and Vigário, 2002; Linting *et al.* 2007). Any dataset can be written as an $m \times n$ matrix: X_{ij}, where m is the number of observed variables ($1 \leq i \leq m$) and n is the number of observations ($1 \leq j \leq n$). In the context of our study m resembles the number of considered governance attributes and n is the total number of firm-year observations over the period under examination.[2]

the following feature extraction problem is solved by NLPCA: Given X_{ij} as described above and $1 \leq k < m$, find the functions $\varepsilon: \Re^m \rightarrow \Re^k$ and $\gamma: \Re^k \rightarrow \Re^m$, such that the quantity

$MSE = \frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n}\left(Y_{ij} - X_{ij}\right)^2$ is minimized, where for all observations $1 \le j \le n$ the following expression holds: $\underline{Y}_j = (\gamma \circ \varepsilon)\,\underline{X}_j$, with $\underline{X}_j, \underline{Y}_j \in \Re^m$. The operating symbol ◦ means the composition of the functions, i.e. $[\gamma \circ \varepsilon](x) = \gamma[\varepsilon(x)]$. Put simply, function ε maps the original data (Xij) to a (smaller) k-dimensional space and function □ maps this back to the original m- dimensional space while the composite function maps the original dataset to a k-dimensional nonlinear manifold embedded in the m-dimensional space (□ o □ : $\square^m$ **a** $\square^m$) in such a way that the output data (Yij) is obtained by minimizing the mean squared error (*MSE*). In this sense, the output Yij is the optimal approximation, also known as the noise reduced representation, of the original dataset.[3]

the framework of a five-layer feed-forward neural network can solve the nonlinear principle component analysis, which has the so-called bottleneck structure (see Kramer, 1991).[4] The network used to implement NLPCA in our analysis is illustrated in Figure 1. In this symmetric network information is propagating upwards and its structure can be represented

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[2] Each specific column of X_{ij} corresponds to a vector containing all governance attributes for a given company at a specific point in time (jth sample: $\underline{X}_j \in \Re^m$) and each specific row contains information on a particular governance attribute for all firm-year observations (ith variable: $\underline{X}_i \in \Re^n$).

[3] It is interesting to note that LPCA is a special case of NLPCA where the functions ε and γ are restricted to be linear transformations and, thus, they can be represented by matrices (i.e. ε_{ij} is a $k \times m$ matrix while γ_{ij} is a $m \times k$ matrix and $\gamma_{ij} = \varepsilon_{ji}$).

[4] For an introduction to neural networks see Campbell *et al.* (1997) and references therein.

by the notation [9-4-1-4-9], based to the number of neurons in each of the consecutive layers.[5] In general, the first (input) and fifth (output) layers each contain *m* neurons which correspond to the data dimension and the third (bottleneck) layer consists of *k* neurons. The transfer functions of these layers are linear. In order to account for nonlinear transformations, the second (encoding) and fourth (decoding) layers, each with *l* number of neurons, have nonlinear transfer functions, usually hyperbolic

$$tangents\ (\tanh(x) = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}})$$

As shown by Cybenko (1989), by using a three-layer feed-forward neural network with hyperbolic tangent transfer functions in the second layer, one can approximate any continuous function to arbitrary accuracy, given that the number of neurons in the second layer is sufficiently large. The feature extraction problem of NLPCA can then be solved using this result by constructing a five-layer bottleneck structure composed of two three-layer sub-networks sharing a common (bottleneck) layer. The first sub-network (layers 1-3) performs the extraction function ε: $\Re^m \to \Re^k$, which means that each sample is extracted or projected onto the *k*-dimensional space, while the consecutive part (layers 3-5) is responsible for applying the generation function γ: $\Re^k \to \Re^m$. The overall structure of the network employs the composition of these two functions ($\gamma \circ \varepsilon : \Re^m \to \Re^m$), which allows the determination of the network output for the *j*th observation $\underline{Y}_j$, where $\underline{Y}_j = (\gamma \circ \varepsilon)\,\underline{X}_j$ for $1 \le j \le n$. The network parameters (weights and biases) are iteratively adjusted using a conjugate gradient algorithm until the

[5] In the context of our analysis m=9, as there are nine corporate governance attributes examined (see Section 2.2).

mean squared error $MSE = \frac{1}{mn} \sum_{i=1}^{m} \sum_{j=1}^{n} \left(Y_{ij} - X_{ij} \right)^2$ is minimized (see Monahan, 2000).

Such minimization process ensures that the network output matches the network input as closely as possible.[6]

3.2 Variables Measurement

Table 1: Performance variables

Variables	Notation	Mesure
Return On Assets	ROA	ROA= Net income／Total assets
Tobin's Q ratio	Tobin's Q	Tobin's Q = Total Market Value of Firm / Total Asset Value

Table 2: Variables related to personal characteristics of the leader

Variables	Notation	Mesure
Age	AG	Age of CEO in years
Human capital	HCAP	The warrant seniority of a CEO in the firm (as an administrator)
duration in position of leader	TEN	expressed by the number of years in the CEO position in the company
relative power related the property to CEO	OWN	The relationship between managerial property and total property

opportunistic manipulation of earnings	DA	The Discretionary Accruals are the residues of the estimated acruals by the model Kathori et al (2005)

Table 3: Governance variables

Variables	Notation	Mesure
Internal control mechanisms		
The size of the administration board	BS	Total number of administrators on the board
Cumulation of functions of CEO and president of the administration board	DUAL	Variable equal to 1 if the CEO is also the president of the board, and 0 if not
Independence of Administrators	IND	Independence is expressed by the number of independent administrators on the board
The number of Board Committees	NCB	Total number of committees in the board
Independence of Board Committees	COMIND	COMIND = total independent administrators of all committees / total administrators of all committees
External control mechanisms		
Agency cost	AGENCY	The asset turnover ratio defined as the ratio of annual revenue compared to total assets Sales or Revenues / total assets
The market for goods and services	LNSALES	The natural logarithm of annual net sales

Table 4: The variables related to corporate characteristics

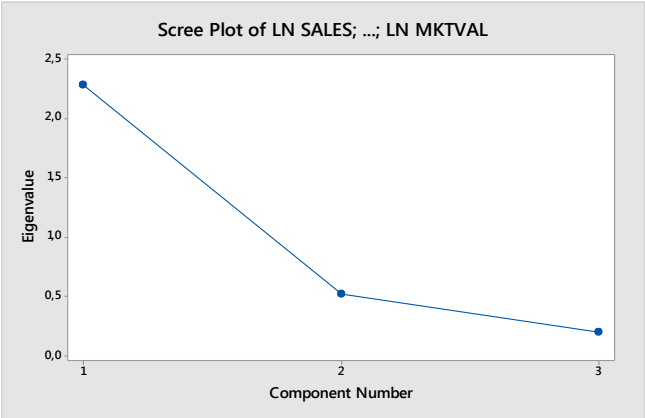
Variables	Notation	Mesure
The corporate size	LNASSET	The natural logarithm of total assets
The market capitalization	LNMKTVAL	The natural logarithm of the market capitalization of the corporate
The age of the corporate	FIRMAGE	The logarithm of the number of fiscal years in practice
Indebtedness	DEBTRATIO	The book value of debts / total assets

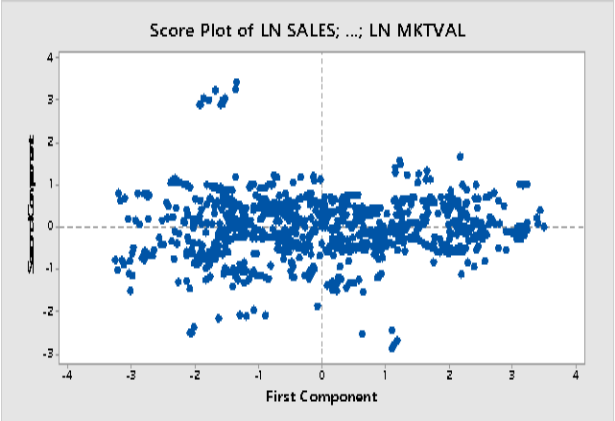
IV. RESULTS

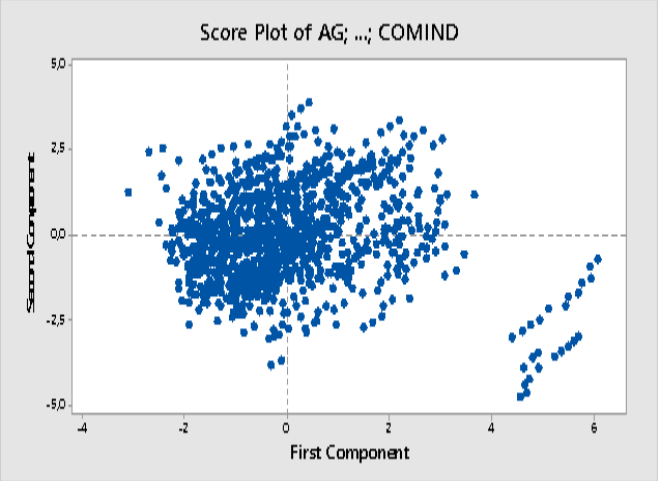
We start the empirical results when using PCA then, we focus on results using NLPC.

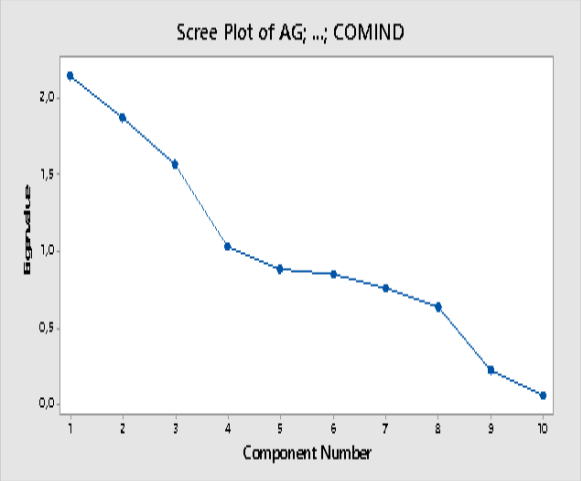
For our four model, we did not find any mutlicolliniarity problem and Hausman tests indicated that fixed effect is always preferred to random effect due to the presence of correlated specific effect in our panel.

PCA results


Scree Plot of LN SALES; ...; LN MKTVAL
Eigenvalue
Component Number


Score Plot of LN SALES; ...; LN MKTVAL
Second Component
First Component


Score Plot of AG; ...; COMIND
Second Component
First Component


Scree Plot of AG; ...; COMIND
Eigenvalue
Component Number

Firm Size Component = 0,586 * **LN (Sales)** + 0,614* **LN (Assets)** + 0,529 * **LN (Mktval)** : The first component is significant (Eigenvalues = 2.2881) and explains 76% of the variance of the variables.

ENTINDEX = 0,161137***AG +** 0,479732***HCAP +** 0,514526***TEN +** 0,377202***CEOWN +** 0,0862454***DA -** 0,364733***BS +** 0,240802***DUAL -** 0,275087***IND -** 0,224016***NCB +** 0,112086***COMIND. :** The first four components are significant (Eigenvalues [PC1, PC2, PC3, PC4] = [2.1411; 1.8705; 1.5616; 1.0290]) and explains 66% of the variance of the variables.

ENTINDEX :

Variable	Obs	Moyenne	Ecart type	Min	Max
ENTINDEX	1040	13.54288	8.255597	-1.385639	52.70869

Table 1 : Fixed effect model PCA

VARIABLES	ROA	TOBINSQ
AGENCYCOST	0.01498***	-0.06676***
	(0.00213)	(0.02333)
ENTINDEX	0.00174***	0.02298***
	(0.00048)	(0.00525)
PCFS	0.00920***	-0.12972***
	(0.00185)	(0.02030)
FIRMAGE	-0.02038***	-0.03201
	(0.00312)	(0.03422)
DEBTRATIO	0.06849*	-0.50198
	(0.03670)	(0.40257)
Constant	0.05349	4.30382***
	(0.03337)	(0.36604)
Observations	1,040	1,040
R-squared	0.22942	0.15318

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We can say that a positive relationship between performance and entrenchment is very obvious to our sample and for whatever performance proxy. The coefficient of the entrenchment variable is positive and significant at the 1% for our two models. This proves that the entrenchment is beneficial to shareholders' wealth, highlights the role of skills and incomes generated by the management team and corroborating the results of Castanias and Helfat (1992). by entrenchment within the corporate, the leader sufficiently entrenched or rooted seeks to implement strategies to enhance the company.

NLPC results

Figure 1 NLENTINDEX
Bottleneck auto-associative network performing symmetric NLPCA
This Figure presents the bottleneck network used in our study which can be represented by the notation [10-4-1-4-10] according to the number of neurons in consecutive layers. This structure has ten inputs and outputs as well as one bottleneck unit corresponding to a transformation from a ten dimensional (m=10) space into a one-dimensional one (k=1)

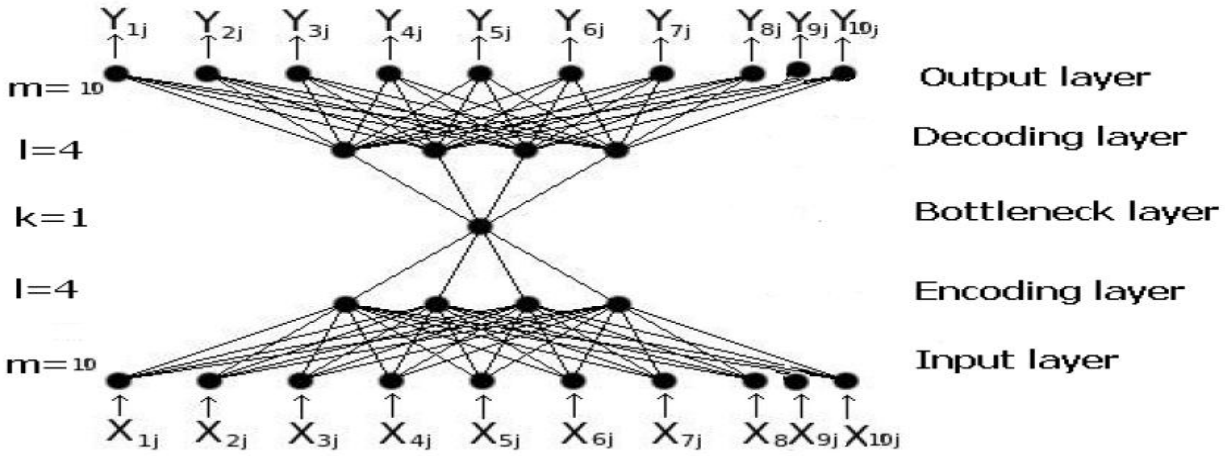
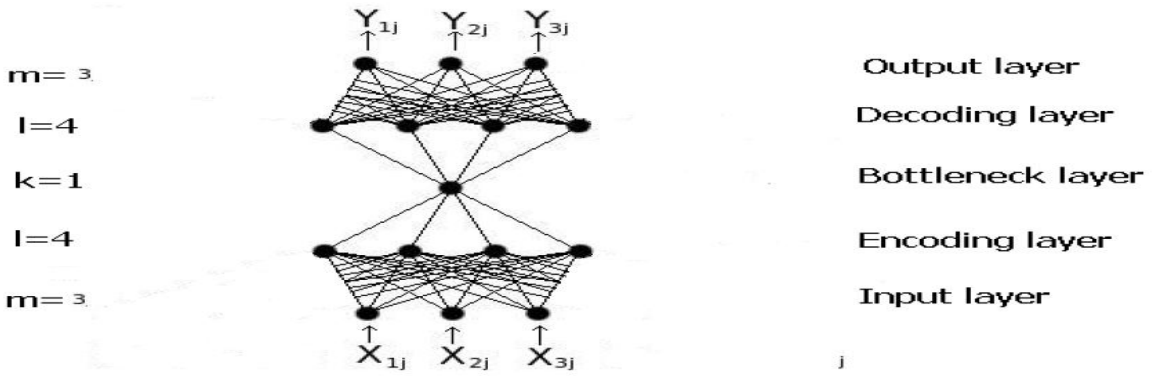


Figure 2 NLPCFS
Bottleneck auto-associative network performing symmetric NLPCA
This Figure presents the bottleneck network used in our study which can be represented by the notation [3-4-1-4-3] according to the number of neurons in consecutive layers. This structure has three inputs and outputs as well as one bottleneck unit corresponding to a transformation from a three dimensional (m=3) space into a one-dimensional one (k=1)



NLPC ENTRENCHMENT INDEX	
Moyenne	56.71844
Ecart type	2.272813
Minimum	52.01817
Maximum	60.81515

Table 2 : Fixed Fffect model NLPC

VARIABLES	**ROA**	**TOBINSQ**
AGENCYCOST	0.02400***	-0.04413***
	(0.00761)	(0.01038)
NLENTINDEX	0.00443***	0.03557*
	(0.00170)	(0.01914)
NLPCFS	-0.00585	-0.53971***
	(0.00432)	(0.10623)
FIRMAGE	-0.01515***	-0.05470***
	(0.00540)	(0.02072)
DEBTRATIO	-0.13057***	-1.03316***
	(0.02007)	(0.29020)
CONSTANT	-0.04194	5.43831***
	(0.09255)	(0.98710)
Observations	1,040	1,040
R-squared	0.15229	0.21020

*Standard errors in parentheses ? *** p<0.01, ** p<0.05, * p<0.1*

Stata displays, for both models, a pseudo R2 of 15% for the model of ROA and 21% for Tobin's Q model. The coefficient of the managerial entrenchment index extract CPA nonlinear (NLENTINDEX) is positive and significant for models of ROA and Tobin's Q (respectively 0.00443 and 0.03557) at the 1% and 10%. This proves that the entrenchment is beneficial to shareholders' wealth and creates significant managerial incomes for the company. This thus disavowing the results of Morck et al (1988) and confirmed our results based on managerial entrenchment index extract of the CPA.

V. CONCLUSION

The coefficients of the managerial entrenchment indexes extracted either CPA or nonlinear ACP are positive and significant. This proves that the leader sufficiently entrenched or rooted seeks to implement strategies to enhance the company. Our finding corroborates that of Stiglitz and Edlin (1992) stipulating that the impact of entrenchment on the company's performance is positive.

It will be more interesting if we follow Bebchuk et al (2009) to build an Entrenchment index for the French SBF 120 companies (2001- 2013) which includes six dispositions that were most strongly opposed by investors institutional:

- Classified Board 1- When this disposition named Classified or Staggered Board exists, the board is generally divided into three groups, one is replaced each year.

- 2 Golden Parachutes: Golden parachutes (Golden Parachutes) are severance agreements that provide significant benefits to the leaders when the administration board terminates their employment, or when they have to resign as a result of a change of control.

-3- Poison Pill: Poison pills or diets of rights are allocation plans of subscription rights that give their holders special opportunities when an event occurs such as a hostile takeover bid.

- 4- supermajority - mergers in percent: Qualified majority (supermajority) device that increases the proportion of votes required to approve a fusion , or sometimes the replacement of directors. This MPPC allows leaders to make fail an offer or ensure that it is sufficiently high.

-5- Vote % Required to Amend ByLaws.

-6- Vote % Required to Amend Charter.

5 and 6 are the limits for the modification possibilities to the statutes (charters limits to Amend) or internal rules (limits to Amend bylaws). Such dispositions limit the possibilities for shareholders to amend the constitutional documents of companies.

List of CEO

Alain Dinin	Alain Mérieux	Alex J. Mandl	Alexandre de Juniac
Alexis Kniazeff	Amedeo d'Angelo	André Navarri	André-Jacques Auberton-Hervé
Antoine Zacharias	Antonio Truan	Arnaud Lagardère	Benoît Potier
Bernard Bourigeaud	Bernard Charlès	Bernard Fontana	Bernard Michel
Bruno Bich	Bruno Lafont	Bruno Rousset	Carlos Ghosn
Carlos Tavares	Christian Lefèvre	Christian Streiff	Christophe Clamageran
Christophe de Margerie	Christophe Kullmann	Christophe Bonduelle	Daniel Bernard
Daniel Julien	David Jones	Denis Hennequin	Denis Ranque
Denis Thiery	Didier Michaud-Daniel	Didier Truchot	Dominique Schlissinger
Fernando Rodés Vilà	Franck Riboud	François David	François Enaud
François Feuillet	François Pinault	François-Henri Pinault	Frank Piedelièvre
Frédéric Vincent	Frédéric Vincent	Georges Plassat	Gérard Buffière
Gérard Mestrallet	Gilles Gobin	Gilles Martin	Gilles Michel
Gilles Pélisson	Gilles Schnepp	Giovanni Ferrario	Henri de Castries
Henri Proglio	Hubert Sagnieres	Jacques Aschenbroich	Jacques Bacardats
Jacques Berrebi	Jacques de Chateauvieux	Jacques Tordjmann	Jean-Bernard Lévy

Jean-Charles Decaux	Jean-Charles Naouri	Jean-Charles Pauze	Jean-Claude Marian
Jean-Cyril Spinetta	Jean-Dominique Senard	Jean-François Decaux	Jean-François Dubos
Jean-François Roverato	Jean-Georges Malcor	Jean-Louis Beffa	Jean-Louis Gérondeau
Jean-Luc Bélingard	Jean-Marie Sander	Jean-Pascal Tricoire	Jean-Paul Agon
Jean-Pierre Clamadieu	Jean-Pierre Michel	José Luis Duran	Lars Olofsson
Laurent Burelle	Laurent Mignon	Louis Gallois	Louis Schweitzer
Luc Vigneron	Marc Ladreit de Lacharrière	Mario Guevara	Martin Bouygues
Maxime Lombardini	Michaël Boukobza	Michel Rollier	Olivier Piou
Olivier Zarrouati	Patrick Buffet	Patrick Kron	Patrick Sayer
Paul Hermelin	Philippe Berterottière	Philippe Camus	Philippe Crouzet
Philippe Darmayan	Philippe Depoux	Philippe Germond	Philippe Houzé
Philippe Lazare	Philippe Lemoine	Philippe Salle	Philippe Varin
Pierre Bergé	Pierre Gadonneix	Pierre Pringuet	Pierre-André de Chalendar
Pierre-Henri Gourgeon	René Carron	Robert Brunck	Rudy Provoost
Sébastien Bazin	Serge Grzybowski	Serge Kampf	Serge Tchuruk
Simon Azoulay	Thierry Breton	Thierry Lemaitre	Thierry Morin
Thomas Enders	Vincent Bolloré	Vincent Rouaix	Wilfried Verstraete
Xavier Fontanet	Xavier Huillard	Yann Delabrière	Yannick Bolloré
Yves de Chaisemartin	Yves Le Masne		