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Abstract – While often criticized, independence remains the ultimate criterion for evaluating board composition, whether for regulators or shareholder activists. In this study, we examine the relationship between board independence and firm operating performance in a panel of French listed companies, paying particular attention to heterogeneity and endogeneity concerns. We take advantage of an original database, with a time-series dimension that can be used to mitigate heterogeneity and dynamic endogeneity issues through GMM estimators. In addition, this database can be disaggregated at the individual (director) level. This design enables us to introduce firm fixed effects and individual fixed effects in (firm) performance equations, thereby controlling for heterogeneity at the firm and individual levels. To our knowledge, this is the first paper so far to provide a systematic account on this issue for France. Our main result is to document a significant negative relationship between accounting performance and the independence status (irrespective of the person). This result supports the argument of an information gap suffered by independent board members, as developed by Adams and Ferreira (2007).

Keywords: board structure, independent directors, informational gap, GMM estimator, director fixed effects, individual heterogeneity

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1. Introduction

Does board composition significantly affect firm performance? Few issues have been more disputed in the corporate governance literature. It has motivated considerable empirical research over the last two decades, the vast majority of which about the U.S. and, to a lesser extent, the U.K. By and large, the answer is positive: most studies exhibit some conditional correlations and/or causal impacts between broadly defined board composition and firm performance. There is, however no consensus regarding the precise relationship between specific dimensions of board composition and firm performance. The best example is independence, the main criterion for assessing the adequacy of board composition at least since the mid-1980s. While some 'classical' studies surprisingly document a negative effect of the proportion of independent board members on firm performance (see e.g. Agrawal and Knoeber, 1996; Bhagat and Bolton, 2008), Nguyen and Nielsen (2010) report a positive impact and Wintoki, Linck and Netter (2012) report no effect. One possible reason for this lack of consensus is that heterogeneity and endogeneity problems are particularly severe in the field of corporate governance, with very few good instruments to cope with them. On one side, firm performance is the result of many factors, some of which are inherently unobservable. On the other side, it is likely that firm performance has some impact on board composition: depending on financial return, top executives will be more or less powerful when negociating with shareholders, with likely consequences regarding the selection of board members (Hermalin and Weisbach, 2003). Taking into account endogeneity and heterogeneity is thus a prerequisite when it comes to accurately measuring the relationship between independence and performance.

Though empirical research has not delivered any clear message so far as to the benefits of independence, the issue remains crucial. In economies with high level of stock ownership dispersion, such as the U.S. or the U.K., conventional wisdom strongly supports independence as a way to reduce agency costs (Bhagat and Black, 1999). As Cunningham (2008) notes, the standard response to corporate crises is to look for independent directors in order to provide greater transparency. The Sarbanes Oxley Act, passed in 2002, is no exception, requiring that audit committees be comprised solely of independent members. Why this emphasis? The argument in favor of board independence has probably been best established by Gordon (2007): in a market-based model of corporate governance, independent board members make sure that (stock) market signals are promptly incorporated into managerial decision-making.[1] As such, they act as watch dogs in the name of dispersed shareholders, in an approach highlighting the disciplinary role of the board.

This argument helps to understand the attractiveness of independence in other OECD countries[2] that tend to converge toward the US-UK style model of corporate governance (Denis and McConnell, 2003). France is a good example. While the comparative literature

[1] "*In this environment* [*where stock prices are taken as the measure of most things*] *independent directors are more valuable than insiders. They are less committed to management and its vision. Instead, they look to outside performance signals and are less captured by the internal perspective, which, as stock prices become more informative, becomes less valuable*" (p.90).

[2] For instance, the *OECD Principles of Corporate Governance*, first published in 1999, have always promoted independent directors.

used to describe France as a typical form a continental model of corporate governance (sometimes referred to as a 'stakeholder' model), a dramatic growth in stock market capitalization took place over the last 15 years, mostly because of the increasing presence of investment funds, both resident and non-resident. This increase in the power of institutional investors in the equity capital of French companies has been accompanied by important changes in securities law and, to a lesser extent, in corporate law. These changes have strongly enhanced minority shareholder protection (Lele and Siems, 2006). Unsurprisingly, in such an environment, independence also became the conventional wisdom, a decade after the USA or the UK. The AFEP-MEDEF Code, to which French listed companies should 'comply or explain', recommends that at least half of the directors be independent[3], as does the UK Corporate Governance Code. Interestingly, references to other director characteristics are made in both codes: in particular, the benefits of individual 'competences' (with no more precision), and of diversity at the board level (including gender) are stressed. This somehow echoes the empirical literature on corporate boards that increasingly investigates those issues (see e.g. Carter, D'Souza, Simkins and Simpson, 2010 or Anderson, Reeb, Upadhyay and Zhao, 2011). But independence is the only attribute for which a specific quantitative threshold is defined in both documents. By and large, while often criticized for being too simplistic or somewhat old-fashioned, independence still remains the ultimate criterion for evaluating board composition, whether for regulators or shareholder activists.

In this study, we examine the relationship between board independence and firm performance in French listed companies, paying particular attention to heterogeneity and endogeneity concerns. To our knowledge, this is the first paper so far to provide a systematic account on this issue for France. Contrary to the U.S., where 'supermajority boards' (i.e. with at least 80% of independent members) are the norm, there are important variations in the share of independent directors among companies listed at Euronext-Paris. Such variations help us estimate the relationship between independence and firm performance. Furthermore, we take advantage of an original database, with a time-series dimension that can be used to mitigate heterogeneity and dynamic endogeneity issues through Generalized Method of Moments (GMM) estimators. In addition, this database can be disaggregated at the individual (director) level. This design enables us to introduce firm fixed effects and individual fixed effects in (firm) performance equations, thereby controlling for (unobservable, time-invariant) heterogeneity at the firm *and* individual levels. This in turn allows us to disentangle whether the independence-performance relationship we estimate is explained by differences in individual ability or by the mandate (status) of independent. Finally, contrary to most papers in the field we use a conservative, non-declarative definition of independence. This is important, since a classical argument against independence is to note that allegedly 'independent' members would in fact not be, due to some hardly observable features not disclosed by companies. We use the measure of independence provided for by Proxinvest, the leading company in France for proxy voting advisory.[4] Independence assessment is but one of its war horses.

[3] One third for firms with controlling shareholders.
[4] http://www.proxinvest.com/index.php/en/page/index.html

Our first result is to document a robust negative relationship between firm accounting performance and the proportion of independent directors. This negative relationship suggests that there might be (unexpected) flaws of independence that could offset the likely benefits of reduced agency costs. Two explanations have been put forward, that point to the particular position that independent directors have *vis-à-vis* the firm and its management. First, independent board members may lack, almost by definition, firm-specific or industry-specific knowledge. Second, CEOs may be reluctant to share (firm-specific) information with independent directors, whose role is precisely to monitor them (Adams and Ferreira, 2007). For one reason or the other, independent directors may therefore suffer from an informational gap that impedes their ability to monitor and/or serve as a source of advice and counsel for corporate executives, with detrimental effect on overall firm performance. Consistent with this argument, we find that our result on independence is robust to controlling for individual heterogeneity: this second result suggests that the negative relationship that we observe is at least to some extent due to the position of the independent director (and not only the person). Taken together, our results show that in the French institutional and legal environment, the costs of independence outweighed its benefits over the last decade.

The remainder of this paper is organized as follows. Section 2 briefly reviews the main results of the literature on independence and performance. Section 3 describes our data. Sections 4 to 6 are devoted to empirical estimations. Section 4 presents OLS and firm fixed effect regressions, while GMM regressions used to cope with dynamic endogeneity are exposed in section 5. Section 6 discusses the conclusions that can be drawn from our study regarding the independence criterion: to do so, regressions including individual (director) fixed effects are conducted. The last section concludes.

2. The literature

An essential attribute for a board is the propensity of its members not to collude with corporate executives – that is, to be 'objective' (Boot and Macey, 2004). Of course, objectivity is ultimately a *subjective* disposition. However, distant shareholders, as well as regulators, need to be able to rely on clear-cut proxies. Accordingly, virtually all Corporate Governance Codes list a set of *objective* criteria that are expected to minimize the probability of collusion between directors and corporate officers, thereby reducing agency costs. Interestingly, these criteria are highly similar across jurisdictions. The AFEP-MEDEF definition is standard. Independence is assumed to be compromised if the director of a company:

(i) is or has been, within the previous five years, a corporate executive or an employee of that company or of its affiliates

(ii) is employed as an executive of another company where any of that company's executives sit on the board

(iii) has been a director of the company for more than twelve years

(iv) is a representative of a large blockholder (that is, with at least 10% of stock or voting rights)

(v) has a significant business relationship with that company or its affiliates (as customer, supplier, banker or auditor)

(vi) is related by close family ties to an executive director.

On this basis, directors may be divided into three groups according to their relative degree of independence (Clarke, 2007). Executive or inside directors are corporate executives. Affiliated or 'gray' directors are not executives, but they do not meet one of the previous criteria; this category notably includes employees, blockholders or investment bankers in relation with the company. Finally, independent directors are those who meet the previous six criteria. As insiders receive more benefit from the firm management than affiliated directors, it is important, when assessing the effect of independence, to separate between affiliated and insiders: supposing for example that insiders have a detrimental effect, not controlling for their share may lead to overstate the benefits of independent directors (relative to affiliated directors).

A significant part of the empirical research on board composition has been devoted to discrete tasks (for a survey, see e.g. Adams, Hermalin and Weisbach, 2010). The evidence suggests that independent directors behave differently from non-independent ones. For example, independence is associated with a greater CEO performance-turnover sensitivity (Weisbach, 1988; Bhagat and Bolton, 2008). But the fact that independent directors are more prone to dismiss CEOs does not mean that they always better exert their monitoring and disciplinary role. As long recognized (see e.g. Baysinger and Hoskisson, 1990), applying the standard criteria used to define independence (see *supra*) tends to reduce the directors' firm-specific or industry-specific knowledge. This informational gap may hamper the ability of independent directors to detect poorly performing CEOs. Consistent with this argument, Adams (2012) observes that financial companies that were most severely hit by the 2008-2009 financial crisis had, in fact, more independent directors than the average. And even if independent directors were better at monitoring, they may be less efficient at advising, the other important role of the board (Hillman and Dalziel, 2003; Faleye, 2011). Accordingly, their overall impact on performance is *a priori* uncertain.

Since the seminal paper by Baysinger and Buttler (1985), studies examining the relationship between independence and performance have also been abundant. To date, the evidence is mixed. At the end of 1990s, Bhagat and Black (1999) noted the following in a popular survey: "*most studies find little correlation, but a number of recent studies report evidence of a negative correlation between the proportion of independent directors and firm performance – the exact opposite of conventional wisdom*" (p.942). A number of explanations have been put forward to account for this lack of empirical evidence regarding the benefits of independence on performance. As noted above, independent directors are considered to have less firm or industry-specific knowledge as compared to other board members, with detrimental effects both on monitoring and advising. This argument, however, is weakened by the increasing demand for experts at the board level: there is now a large consensus to highlight the potential benefits of independent directors with firm-(or industry) specific expertise. But this does not mean that independent directors, even expert, do not suffer from an informational gap: as argued by Adams and Ferreira (2007) corporate executives (whether board members or not)

may be reluctant to share information with independent members, whose role is precisely to monitor them. Put differently, asymmetric information is inherently related to the position of independent director. A negative correlation between independence and firm performance as mentioned by Bhagat and Black (1999) then suggests two things. First that the benefits of independence (reduced conflict of interests) are outweighed by structural flaws attached to independence. Second that independence flaws are to some extent driven by the *status* of independence, irrespective of the *person*.

Studies conducted in the 2000s on U.S. data again yield diverging results. Bhagat and Bolton (2008) examine the relationship between independence and operating performance (ROA) for a sample of large U.S. companies over the period 1990-2004. They use an instrumental variable approach combined with a system of simultaneous equations to alleviate endogeneity concerns[5]. They find that the proportion of independent directors is negatively and significantly correlated with operating performance (ROA). Bhagat and Bolton (2013) however, offer a different conclusion: while they confirm the negative conditional correlation between independence and performance (ROA) for 1998-2001, they report a positive and significant relationship for the post Sarbanes Oxley Act period (2003-2007).

Wintoki, Linck and Netter (2012) use a dynamic panel GMM approach to mitigate endogeneity concerns (see section 5), for the period 1991-2003. This entails two main differences with Bhagat and Bolton (2008). On one hand, Wintoki *et al.* (2012) control for unobservable heterogeneity at the firm level, through firm fixed effects. On the other hand, they use 'internal' instruments: GMM estimator uses lagged values of the endogeneous variables as their own instruments. They do not report any statistically significant relationship between the proportion of outsiders (that include both independent and affiliated) and operating performance.

Nguyen and Nielsen (2010) apply another empirical strategy, for the 1994-2007 period: they identify the effect of independence by using sudden deaths of directors as an exogenous source of variation. They report a negative stock price reaction following the death of an independent board member (108 occurrences over the period). As a robustness check, they introduce individual (director) fixed effects: the coefficient on independence is then identified on the 30 sudden deaths of directors holding multiple mandates with some variation in the independence status. This obviously severely reduces the power of the estimation. Note that contrary to most studies, they use a market-based measure of performance, rather than an accounting (operating) one. Their result then confirms that independence is valuable for shareholders. If this result is probably what is most important for shareholder activists and independence proponents, this however does not imply that independence is favorable to operating performance. Yet the latter is ultimately what is valued by other stakeholders, and can be considered as a direct measure of the board activity.

[5] They instrument performance with the ratio of treasury stock to total asset and corporate governance variables (including the percentage of independent directors) with the percentage of directors who are currently active CEOs.

To our knowledge, no systematic study on board independence has been conducted on French firms. The only result we are aware of can be found in a paper by Ginglinger, Megginson and Waxin (2011), devoted to employee board-level participation. They use a (comprehensive) sample of companies in the Société des Bourses Françaises (SBF) 120 index, for the 1998-2008 period. The proportion of independent directors is introduced as a control, in OLS regressions: this proportion is negatively and significantly correlated with Tobin's Q, and not correlated with ROA. Note however that they use a declarative definition of independence (as contained in annual reports for instance), and do not control for the share of insiders – once again, independence is not the focus of the research.

In this study, we investigate the relationship between independence and operating firm performance (ROA and ROE), using a three-way classification for directors (independent, affiliated, and insiders) based on non-declarative examination. In addition, we apply a GMM estimation procedure so as to deal with both unobserved heterogeneity and dynamic endogeneity, like Wintoki *et al.* (2012). Finally, we introduce director fixed effects to test the robustness of our results to individual heterogeneity. By so doing, we follow Nguyen and Nielsen (2010). However, our estimation is based on a much larger sub-sample of individuals (609 instead of 30). Incidentally, our empirical strategy offers a direct test of the argument of Adams and Ferreira (2007) that it is the specific position of the independent board member that is a source of concern, rather than (or in addition to) the specific attributes of the individuals endowed with this role – whether these attributes be observable or not.

3. The data

Every year since the early 2000s, Proxinvest collects comprehensive information on board composition for a sample of large firms listed at Euronext-Paris. All firms included in the SBF 120 index (that regroups the 120 largest companies by market capitalization and by trading volumes on Euronext Paris) and a substantial proportion of the SBF250 index (on average, 78% of the index each year for the 2003-2011 period) are tracked, together with a number of medium-sized companies (belonging to the CAC AllShares, the largest Index at Euronext-Paris). We first exclude financial companies from the sample and then match the Proxinvest database with the InFinancials database to obtain economic and financial data other than board composition. To avoid that our estimates be driven by outliers in terms of return, we trim our measure of performance: we exclude all observations with ROE greater than 75% in absolute value, and all observations with ROA larger than 25% in absolute value. We end up with an unbalanced panel of 2132 firm-years observations from a total 335 distinct firms, over the period 2003-2011 inclusive. The balance of the panel is shown in Table 1. We observe that 50% of our 2,132 observations concern firms that are present over the whole period (nine consecutive years).

INSERT TABLE 1 ABOUT HERE

Proxinvest provides personal information for every director with voting rights as registered in companies' last general meeting of the year. Our sample therefore comprises 4132 distinct directors, holding 19,811 directorships. The following information is available: age, gender, nationality and, regarding directorship, whether the individual is an insider, an affiliated (gray) or an independent director. Proxinvest does not use companies' statement or annual report to categorize directors, but investigate on every director, in order to provide impartial and detailed assessments of independence. Without surprise, Proxinvest's assessment is a stringent, albeit more precise, definition of independence (see below). Note that we do not know exactly how many other mandates a director holds. The latter has proven however to be a non-negligible information: the fact that a director sits in other boards may increase her experience or reduce the time she is ready to spend for the company (Adams, Hermalin and Weisbach, 2010, p.87-88), with distinct consequences on firm performance. As a consequence, we compute for each director the number of boards where she sits in firms included in our sample. This is a crude measure of director busyness, albeit our sample covers every year most of the large listed French companies, where the great majority of multiple mandates are concentrated.

In a first step, we aggregate individual information at the firm-level, as is standard in the governance-performance literature. We obtain the following variables: board size, proportions of insiders, gray and independent directors (summing up to one), proportion of women and foreign directors, proportion of individuals aged under 50 and proportion of busy directors (with at least one other seat in our sample). We also define a dummy variable that takes value 1 if there is separation between the roles of Chief Executive Officer and Chairman of the board, and 0 otherwise.

Regarding firm characteristics, we control for size (as proxied by the number of employees, in log), as well as industry in 12 positions (agri-food industry, energy and mining, consumer goods industry, other manufacturing, construction, wholesale and retail trade, insurance and real estate, IT, media and communication, health and social services, transportations, other business and personal services). Regarding the firm's financial policy, we control for leverage, measured as total debt over total equity. To proxy for the propensity of the firm to innovate and to accumulate intangible capital, we use the ratio of R&D expenditures over total sales. We control for long run stock price volatility, a proxy for firm risk, measured as the standard deviation of the monthly stock returns over the previous 50 months. We also control for common share turnover[6] as a proxy for stock liquidity (which is rather weak in family firms and other companies with large blockholders)[7]. Finally, we use a dummy that takes value 1 if the firm belongs to the CAC40 index (the 40 largest companies by market value on Euronext-Paris), and 0 otherwise. Summary statistics are presented in Table 2.

[6] Defined as the number of shares traded in a given year divided by the total number of outstanding shares.

[7] Both stock price volatility and stock turnover rate are extracted from the Proxinvest database. They are missing for some observations (see Table 2). To avoid reducing the sample size, we set missing observations of both variables equal to zero and include for each variable a dummy that equals one if the information is available, zero otherwise. This dummy allows the intercept term to capture the mean of both variables for missing values.

INSERT TABLE 2 ABOUT HERE

The proportions of independent directors and insiders are respectively 26.70% and 16%. It is instructive to compare the share of independent directors using the official definition (as stated in the AFEP-MEDEF Code, see section 3), and the Proxinvest approach. In addition to being non-declarative, Proxinvest uses slightly more stringent criteria: a director is no more considered as independent after 9 consecutive years (instead of 12) and a shareholder is considered as a blockholder if it holds more than 3% of the voting rights (instead of 10%). Every year, the annual AMF (*Autorité des Marchés Financiers*) Report on Corporate Governance computes an average figure for the share of independent directors, based on statements of a sample of firms and using the AFEP-MEDEF definition. This sample includes 60 companies belonging to the SBF120. Comparing the two definitions yields striking differences: in 2009 for example, the AFEP-MEDEF definition indicates a proportion of 55% of independent (above the recommendation of the Code) while the Proxinvest definition leads to 34% of independent for the same sample. This gap, while remarkable, is of the same magnitude as the gap observed by Gregory-Smith (2012) for British listed companies, when comparing a declarative definition of independence with an impartial, Proxinvest-like, definition. Relying on such a stringent definition of independence is an important advantage of our empirical study. Indeed, managers may take the opportunity to comply with regulatory (or listing) requirements to select *prima facie* independent directors that in fact have masked relationships with corporate insiders. Using Proxinvest definition (rather than a declarative one) allows us to capture 'true' independence, netted out window-dressing strategies that went along with the diffusion of numerical targets (Romano, 2005).

The proportion of independent directors is stable over the period. Sample averages however hide the fact that we observe significant time variations in board composition at the firm level. Variance decomposition shows that the variations in our board composition variables are not only 'between' (cross section) variations with no change in time for a given firm. For instance, considering the share of independent directors, 'between' standard error is 0.18 while 'within' standard error is 0.10 (see Table 2). This is important insofar as our fixed effects regressions will use the within variation to estimate coefficients.

While on average the proportions of women and foreign directors are very similar (slightly more than 10%), they present markedly distinct evolutions over the period. French boards exhibit a substantial feminization, with the share of women going from 8.8 in 2003 to 14.9% in 2011 (and from 6.9 to 19.3% for the CAC40 companies). This movement is the direct consequence of the Law of January 27, 2011, mandating 40% of women at the board-level of French listed companies in 2014. In contrast, the proportion of foreign directors is stable over the period.

Regarding performance, summary statistics presented in Table 2 hide striking evolutions over the period, marked by the subprime crisis that negatively impacts firm income statements in 2008 and 2009. Accordingly, profitability ratios are subject to macroeconomic conditions, independent of board composition and other firm-level characteristics. These types of variation will be taken into account by introducing year fixed effects in all our regressions.

4. OLS and within estimators

We first estimate multivariate regressions using panel data methods to test the relationship between board composition and firm performance. The unbalanced nature of our panel implies the presence of heteroscedasticity: the variance of the error term depends on the number of times each firm is observed in time. We therefore perform robust regressions with clusters, in which observations are clustered by firm and the variance-covariance matrix is estimated using the Huber-White estimator.

One issue with simple OLS models is that estimates may be flawed by endogeneity related to unobserved heterogeneity across companies. A typical example is the competence of the managerial team, which is hardly captured by observable factors: it is likely that this competence influences both firm performance and board composition. We therefore control for unobserved (time-invariant) heterogeneity at the firm level by including firm fixed effects in our regression models[8]. When doing so, it is important to check that the variation in our board composition variables is not only a 'between variation', as we have done before. We estimate the following equation:

$$y_{jt} = X_{jt}\,\alpha + Z_{jt}\,\beta + \eta_j + \mu_t + \varepsilon_{jt} \qquad (1)$$

where y_{jt} is the performance of firm j at time t, X_{jt} a vector of board composition variables, Z_{jt} a vector of (other) firm characteristics, η_j is a firm fixed effect, μ_t a time dummy and ε_{jt} an error term. In this model, firm industry and the CAC40 dummy are dropped, as they are time invariant.

Table 3 presents the estimation results, without (models 1 and 2) and with (models 3 and 4) firm fixed effects. Regarding the proportion of independent directors, both OLS and within estimates are significantly negative, and more pronounced for ROE than for ROA. This stronger correlation of independence with ROE is common to all our estimations (including GMM estimates and models with director fixed effects, see below). This result is consistent with the idea that financial returns (reflecting both financial policy and the use of corporate assets) are more sensitive than ROA to contemporaneous decisions taken or validated by boards. Note also that we do not observe any significant relationship between the share of independent directors and Tobin's Q. This empirical evidence suggests that investors do not consider (or anticipate) independence has having detrimental effect on growth opportunity despite the negative conditional correlation with operating performance that we observe.

INSERT TABLE 3 ABOUT HERE

[8] We performed Hausman test to choose between random (individual) effects and fixed (individual) effects: as expected, the test reject random effects, as most of our regressors are likely to be correlated with the individual (unobservable) effect.

The impact of having "within" rather than classical OLS estimates is mostly apparent for the proportion of women and board size. We observe a positive, significant conditional correlation between the proportion of women and performance with the OLS model, which does not hold any more when controlling for time-invariant heterogeneity: best performing firms are more likely than other firms to select women in the boardroom, without any causal relationship. In contrast, introducing firm fixed effects dramatically increases (in absolute value) the coefficient estimates on board size, which become negatively significant at the 1% level for both ROA and ROE. This suggests that the absence of a significant relationship under the OLS models is due to an unobservable factor that is correlated with both large board and high performance. Once this factor is netted out through firm fixed effects, we observe a negative conditional correlation between board size and performance. This is also a somewhat classical result in the literature on U.S. firms (see for example Yermack, 1996, with performance measured by average Tobin's Q[9]). A common explanation points to the coordination costs that would be associated with large boards, as well as agency problems such as director free-riding.

The proportion of foreign directors is negatively correlated with ROA (with or without fixed effects). A couple of explanations have been offered to account for the detrimental effect that foreign directors may have on performance. In particular, distance would strengthen information asymmetry, thereby reducing the ability of foreign board members to control and/or advise CEOs (see Masulis, Wang and Xie, 2012). However, we should be particularly careful here: we do not exhibit any relation with ROE and most robustness tests and GMM regressions do not preserve the negative correlation between the proportion of foreign directors and ROA (see *infra*).

Finally, note that other board composition variables (proportions of insiders and busy directors, board age and separation) do not appear to be correlated with firm performance, whatever the estimation method being used.

In sum, at this stage, our investigation of the relationship between board structure and firm performance (whether ROA or ROE) delivers two main results: we find negative correlations between accounting performance on one side, and board size and board independence on the other side (once controlling for unobserved heterogeneity). We perform two additional checks to test the robustness of these two results. Table 4 summarizes these tests. First, we address the selection bias that may be caused by the unbalanced nature of our sample. To do so, we follow Verbeek and Nijman (1992), who suggest to introduce three variables to test and (if necessary) correct the selection bias: a dummy variable (*FULL*) that equals 1 one if the firm *j* is observed over the whole period (9 consecutive years), the number of years of presence of the firm j (from 1 to 9; *NYEARS*), and a dummy variable equals to 1 if the firm was present in the previous period (*BEFORE*). Note that because *FULL* and *NYEARS* are time-invariant, we only perform OLS estimations here: clearly, our main conclusion regarding the (negative) correlation between independence and performance is preserved (see models 1 and 2, Table 4).

[9] For a different result, stressing a positive relation between size and performance for certain types of firms, see however Coles, Daniel and Naveen (2008).

INSERT TABLE 4 ABOUT HERE

Second, in all our regressions with firm fixed effects we control for the board turnover rate. Indeed, the negative conditional correlation we observe for the proportion of independent directors might simply reflect the fact that the arrival and exit of new members disorganize boards in the short run, with negative consequences in terms of performance. While we do control for board size, the size may be stable despite important changes in the composition. Our individual data enable us to compute, for a firm *j* in year *t*, a turnover rate, defined as the sum of arrival and exit of board members between *t-1* and *t* divided by the total number of directors in *t-1*. We are therefore able to capture the correlation between performance and independence, for a given size and a given turnover rate, contrary to the vast majority of empirical analysis that relies on aggregate data. We obtain an average turnover rate of 24.86% over the whole sample, with a standard error of 34.8%. Introducing this statistic in our regressions bears no consequence for the point estimates on the proportion of independent (see models 3 and 4: point estimates are even slightly augmented in absolute value). This means that the cross variation or the time variation in the share of independent directors *per se*, rather than the turnover at the board level, is negatively correlated with firm performance. The same comment applies to board size: the introduction of the turnover rate reduces point estimates to a very small extent.

5. Dynamic endogeneity and System GMM estimators

Fixed effects models, contrary to OLS models, avoid estimation biases related to unobservable heterogeneity. There is, however, another important source of endogeneity that may bias within estimators: dynamic endogeneity. This sort of endogeneity arises when (past) performance has some impact on board composition (reverse causality), which in turn affects future performance (see Wooldridge, 2010; Wintoki, Linck and Netter, 2012).

In the case of board composition, this endogeneity is a major issue, as emphasized by Adams, Hermalin and Weisbach (2010) in their survey: it is likely that board structure and composition are chosen at some point, and therefore reflect the environment (the bargaining set or conditions) at that moment. Arguably, these bargaining conditions are to a significant extent captured by the past and present performance of the firm. Taking the case of independence, a couple of arguments come to mind. As stressed by Adams *et al.* (2010), good performance may negatively affect the share of independent directors in subsequent years, as CEOs become more powerful in their negotiations with shareholders. By contrast, poor performance may lead to more independent directors, as CEOs struggle to please shareholders and secure the value of company shares (see e.g. Hermalin and Weisbach, 1988). In all these cases, the fact that board composition may depend on performance raises endogeneity concerns that can hardly be ignored when empirically examining the relationships between composition and performance.

To be more specific, suppose that we want to test, just like in equation (1), the model below:

$$Performance_{jt} = \alpha.Board\_composition_{jt} + \eta_j$$

While the data generating process is such that:

$$Board\_composition_{jt} = \theta.Performance_{jt-1}$$

Then the within estimate $\hat{\alpha}$ will be biased as soon as the OLS estimator $\hat{\theta}$ is significantly different from 0 (that is, there is dynamic endogeneity). More precisely, we have the following:

- if $\hat{\theta} > 0$, then $\hat{\alpha}$ is negatively biased. For example, if past performance positively affects contemporaneous board size, then $\hat{\alpha}$ is likely to overstate the negative conditional correlation between board size and performance;
- if $\hat{\theta} < 0$, then $\hat{\alpha}$ is positively biased.

To investigate this issue of dynamic endogeneity, we test the following model that relates board composition to past performance (Wintoki *et al.*, 2012):

$$x_{jt} = \theta\ Performance_{jt-1} + \gamma\ x_{jt-1} + Z_{jt-1}\ \beta + \mu_t + \varepsilon_{jt}, \qquad (2)$$

where x_{jt} (resp. x_{jt-1}) denotes alternatively board size (in log) or the percentage of independent directors in firm j at time t (resp. $t-1$), Z_{jt-1} is a vector of firm characteristics at time $t-1$ (our baseline: firm size, industry, CAC40, leverage, R&D on sales, stock price volatility and share turnover), μ_t a time dummy and ε_{it} an error term. We are primarily interested in $\hat{\theta}$, that is, the relation between past performance and present board structure.[10]

Table 5 shows the results of estimating equation (2) with board size and the proportion of independent directors as alternative dependent variables. Models (1) and (3) define performance through ROA and models (2) and (4) through ROE.

INSERT TABLE 5 ABOUT HERE

We have the following three results. First, both board size and the share of independent directors are serially correlated (estimated coefficients on *L.x,* with *x* as a dependent variable, are significant and positive). Second, when using ROA for performance, the relationship between past performance and contemporaneous size is significantly positive (model 1): good performance in *t-1* leads companies to increase the size of their board in the following year. For lagged ROE, the coefficient goes the same way, although it is non-significant at conventional level (p-value of 0.14 in model 2). Altogether, these results on ROA and ROE suggest that within (fixed-effect) estimates of the relationship between board size and performance in equation 1 (Table 3, models 3 and 4) are negatively biased. Put differently, the negative relation we found previously could simply be due to dynamic endogeneity, rather than to an adverse impact of board size on performance. Third, there is no relationship

[10] Note that in this set up, it is crucial to control for the lagged value of *x*, as we have previously shown that there is a significant relation at time *t* between performance and independence or board size (see Table 4). In the case of independence for instance, ignoring this relation would lead to a negative bias for $\hat{\theta}$ in (2), if (as it is likely) the x_{it} are (positively) serially correlated (that is *x* depends on its own past realizations).

between past performance (ROA or ROE) and the present share of independent directors: French companies do not seem to react to a degradation in performance by increasing the share of independent members so as to please stock market investors (contrary to U.S. companies, see e.g. Wintoki *et al.*, 2012), nor to call for more independent directors to change their strategy. All in all, this suggests that our previous estimates of the relationship between independence and performance (negative, recall) go in the correct direction.[11]

Summing up, the estimation of the relationship between board structure and firm performance is subject to two endogeneity concerns: the first relates to (time invariant) unobserved heterogeneity, the second to dynamic endogeneity. The Generalized Method of Moment provides a framework for dealing with both issues in a short panel framework: GMM estimation corrects the dynamic endogeneity problem by allowing present performance to depend on past performance, while controlling for unobservable heterogeneity through firm fixed effects. Suppose that we want to estimate the following equation:

$$y_{jt} = \gamma\, y_{jt-1} + X_{jt}\,\alpha + Z_{jt}\,\beta + \eta_j + \mu_t + \varepsilon_{jt}, \qquad (3)$$

where y is performance, X (resp. Z) the vector of board composition (resp. firm characteristics) variables, η a firm fixed effect, μ a year fixed effect and ε the error term. The introduction on the right hand side of the lagged value of the dependent variable should alleviate dynamic endogeneity issues. However, it makes standard within estimators inconsistent, as early recognized by Nickel (1981). Arellano and Bond (1991) provide a 'difference GMM' estimator for this model: the original equation (3) is first differenced, and lags of the lagged dependent variable (y_{jt-2} and further lags) are used as an instrument for Δy_{it-1}. These "GMM style" instruments lead to moment conditions in which lagged levels of the dependent variable are orthogonal to first differences of the residual term ε. In order to increase efficiency, Arellano and Bover (1995) and Blundell and Bond (1998) have proposed to use additional 'GMM style instruments': extra additional moment conditions are introduced, based on the original equation (in level) in which lagged differences of the dependent variable are orthogonal to levels of the error term. The estimator, which therefore combines two equations (one in difference, one in level), is known as 'system GMM'. We use such an estimator, with the following specifications:

- In the transformed (first differentiated) equation, we instrument Δy_{jt-1} by y_{jt-2} and further lags. In the original equation, we instrument y_{jt-1} by Δy_{jt-2} and further lags;
- All regressors (included in X and Z) are treated as predetermined rather than exogeneous (except industry and CAC40). This means that an idiosyncratic shock at time t on performance may impact the future values $s > t$ of these regressors. They are therefore instrumented using "GMM style" instruments, just like performance. Results

[11] Note that using the first difference of board size or the first difference of the proportion of independent directors as dependent variables (rather than their level) does not change these conclusions (results available upon request): in particular, we have evidence of dynamic endogeneity in the case of board size (performance in *t-1* is positively correlated with the variation of board size between *t-1* and *t*), but not in the case of independent board members.

are similar if only board variables (*X* vector) are treated as predetermined, with firm controls considered as exogeneous;

- To avoid instrument proliferation, and as suggested by Roodman (2009), we use two different techniques. In models (1) and (2), we restrict the lag range used in generating instruments for predetermined variables to one. In models 3 and 4, we do not limit this lag range. However, the GMM instrument matrix is "collapsed".[12]

Table 6 reports the estimates of GMM regressions for board structure variables. AR(2) tests and Hansen tests, which allow for checking the exogeneity of the entire set of instruments as a group, are presented. For all four models, both diagnostic tests are satisfied.

INSERT TABLE 6 ABOUT HERE

As expected, point estimates on board size are severely reduced (in absolute value) as compared to the simple fixed-effects model: the negative relationship we observed between board size and performance in equation 1 is no more effective, with estimated coefficients close to zero. In contrast, we still observe a significant, negative relationship between the share of independent directors and firm performance: system GMM estimates are even larger (in absolute value) than within estimates (-0.029 for ROA and -0.110 for ROE in models 3 and 4, as compared to -0.019 and 0.077 respectively with within estimates). The share of independent directors is the only board structure variable correlated with performance, once controlling for unobservable firm-level heterogeneity and dynamic endogeneity.

6. Director fixed effects

How to account for the negative relationship we observe between the proportion of independent board members and operating firm performance? Standard explanations highlight potential flaws inherently associated with the independent mandate (or status), that may outweigh the benefits stemming from reduced agency costs. As previously discussed, a first reason why being independent in a firm *j* may be associated with lower performance (as compared to being 'gray') is the lack of firm-specific (or industry-specific) knowledge (Baysinger and Hoskisson, 1990). A second reason relates to the nature of the interaction between independent board members on one side and corporate executives on the other side. The main role attributed to independent directors is the assessment of management, that is, the monitoring of managerial actions and the determination of the intrinsic ability of top executives (Hermalin and Weisbach, 1998). Accordingly, corporate executives (whether board members or not) may be reluctant to share information with independent members, thereby exacerbating the informational dearth of independent directors (Adams and Ferreira, 2007).

[12] Basically, this means creating one instrument for each variable and lag distance, rather than one instrument for each time period, variable, and lag distance. For more details, see Roodman (2009).

These explanations suggest that the issue with independent directors is to some extent related to the nature of their mandate, as opposed to the intrinsic ability of the agents holding the mandate. The *position* of independent member is a difficult one, characterized by a strong informational gap regarding the business conduct. If true, we expect that a given individual with some variation regarding independence (across firms or across time) be efficient as a gray director, and less efficient when serving as an independent director whatever his/her intrinsic ability. In a regression setting, the negative coefficient on independence should hold even after controlling for intrinsic individual (director) ability.

Contrary to most studies in the field, our database may be disaggregated at the individual level, with each observation being a directorship (that is, a director i in firm j for year t): we have 19811 directorships, with 4132 individuals (and 335 companies). We are thus able to introduce individual (director) fixed effects, invariant across time *and* companies, in firm performance equation. Doing so, we somehow consider that firm performance is a proxy of director performance. This approach, while uncommon, extends the analysis conducted by Schoar and Bertrand (2003) that empirically directly imputes part of the firm performance to top-executives (CEOs but also CFOs and other top managers) individual characteristics. Just like firm fixed effects or manager fixed effects are usually considered as capturing intrinsic managerial ability, director fixed effects capture board members individual intrinsic ability (whether observable or unobservable). This empirical approach therefore allows observing directly the effect of the independence status, irrespective of individual ability.

We test the following model:

$$y_{ijt} = X_{jt}\,\alpha + Z_{jt}\,\beta + \varphi.Indep_{ijt} + \gamma.Insid_{ijt} + \psi_i + \eta_j + \mu_t + \varepsilon_{ijt} \qquad (4)$$

where y_{ijt} is the performance at time t of firm j where director i holds a sit, X_{jt} a vector of board composition variables (including the proportion of independent directors), Z_{jt} a vector of firm characteristics, $Indep_{ijt}$ (resp. $Insid_{ijt}$) is a dummy that takes value 1 if director i is independent (resp. insider) in firm j at time t (0 otherwise), η_j a firm fixed effect, μ_t a time dummy and ε_{ijt} an error term. Finally, ψ_i is a director fixed effect: it evaluates the effect on performance of across firm-invariant, time-invariant, individual characteristics.[13] For a part, these are observable characteristics such as gender and age. For another part, fitted ψ reflects the intrinsic individual ability, unobservable (to the statistician) almost by definition. Of course, there is some selection, as the coefficient on *Indep* is estimated on individuals that do have some variation regarding the status. But this concern is consubstantial to fixed-effects estimates: considering for instance the decomposition of log hourly wages into person effects and firm effects, the fixed-effect estimate relies on movers between firms of different characteristics (see e.g. Abowd, Kramarz and Roux, 2006). Our approach is not a substitute to the previous approaches (OLS, within estimator with firm fixed effects and GMM estimator):

[13] Note that we do not intend to use variation in independence status across companies *for a given year* as a source of variation. To do so, director-year fixed effects (ψ_{it}) should be introduced in equation 4 instead of director fixed effects (ψ_i). We do not follow this strategy for two reasons. First, using director-year fixed effects (ψ_{it}) dramatically increases the number of variables on the right hand side of equation 4, thereby reducing the precision of the estimates: even aggregate variables that where significant in equations (1) and (3) loose their explicative power. Second, business cycles are captured in equation 4 by year fixed effects μ_t.

it rather complements the results we have observed on aggregate data for the whole sample, by taking into account individual heterogeneity.

As we have multiple observations per firm-year, we compute standard errors which are robust to this two-dimensions within-cluster correlation. To avoid multicolinearity between the percentage of independent director in firm *j* at time *t* and director *i* being independent in *j* at *t* ($Indep_{ijt}$), we orthogonalize both variables: we perform a univariate regression of the share of independent members on *Indep*, and then introduce residuals in equation 4 instead of the proportion of independent board members.

As previously stated, Nguyen and Nielsen (2010) follow a somewhat similar strategy, in a cross-sectional setup: they use sudden deaths of directors holding multiple mandates with some variation in their independence status to identify the effect of independence netting out individual (observable and unobservable) heterogeneity on market-based performance. However, while the coefficient on independence is fitted on 30 sudden deaths, we identify 609 distinct directors (holding 5838 mandates) with variation in the independence status. Moreover, as we have a time-dimension in our data, our model uses two different kinds of variations to identify φ: on individuals *who have multiple directorships* (i.e. in different firms over the whole period) with some variation regarding independence (inter-firm variation); and on individuals *whose independence status within the same firm has changed over the period* (intra-firm variation, usually between independent and gray). Out of 609 individuals, 135 are concerned by pure inter-firm variation, while 474 are concerned by intra-firm variation (including 166 with both intra and inter-firm variation). Intra-firm variation encompasses a variety of cases. People who switch from independent to non-independent belong to the following cases: an independent director who passes the 9-year threshold for seniority, someone who becomes involved in a business relationship with the company, and finally someone who becomes a corporate executive or a worker. Alternatively, the switch from non-independent to independent encompasses the following: a director classified as gray because she/he was a corporate executive within the previous five years but for whom the criterion no longer applies; and a gray director that terminates a business relationship with company. In all these cases of intra-firm variation, it is not so easy to figure out how a simple change in status in the same company may affect the ability of the agent to monitor or advice top executives, with some impact on performance. For instance, an independent member who passes the 9-year seniority threshold will probably not see her/his informational gap shrink just because she/he becomes non-independent.

Accordingly, our hypothesis according to which a variation in status for a given person impacts performance should be true mainly (or only) for inter-firm variation. In the previous empirical setting, this means that the coefficient on *Indep* (the individual dummy in equation 4) should be driven by inter-firm rather than intra-firm variation in status. We check this. In Table 8, models (1) and (2) present regressions where the *Indep* dummy simply indicates the status (and the coefficient is estimated on agents having multiple directorships with variety in status). In models (3) and (4) we break up the *Indep* variable into two distinct dummies: agents with pure inter-firm variation (*Inter*) and agents with intra-firm variation (*Intra*):

$$y_{ijt} = X_{jt}\,\alpha + Z_{jt}\,\beta + \varphi_0\, Inter_{ijt} + \varphi_1\, Intra_{ijt} + \gamma.Insid_{ijt} + \psi_i + \eta_j + \mu_t + \varepsilon_{ijt} \qquad (4')$$

We expect the conditional impact of independent directorship to be better observed through inter-firm variation, so that $|\widehat{\varphi_0}| \geq |\widehat{\varphi_1}|$.

INSERT TABLE 7 ABOUT HERE

In Table 7, models (1) and (2) report estimates of φ (the coefficient on the dummy *Indep*), together with the coefficient on the (orthogonalized) proportion of independent directors. $\hat{\varphi}$ is negative and significant, both for ROA and ROE: thus, the negative relationship we observed between independence and operating performance holds even when controlling for individual heterogeneity. We may note that the proportion of independent board members is also significantly and negatively correlated with performance, with a magnitude similar to what we obtained in previous regressions (-0.0198 for ROA and -0.0782 for ROE). In addition, and as expected, the distinction between pure inter-firm (*Inter*) and intra-firm (*Intra*) variation in status allows observing that the value of $\hat{\varphi}$ is mostly driven by inter-firm variation: we have $|\widehat{\varphi_0}| \geq |\widehat{\varphi_1}|$ for both ROA and ROE. Our conclusion is that in the French case, the negative relationship between independence and firm performance is to some extent related to the position of independent directors *vis à vis* corporate executive officers. This is consistent with the view of Adams and Ferreira (2007), who emphasize the reluctance of managers to share information with independent board members.

7. Conclusion

Independence has become the primary criterion for evaluating board composition in the US, the UK or France. It is perceived both by regulators and minority shareholders as a direct way to increase managerial accountability. A body of empirical research in Anglo-Saxon countries confirms that independence is generally valuable for shareholders, with a positive impact of the proportion of independent directors on market value (Tobin's Q). The effect on operating firm performance is far less clear. This study provides the first systematic account of the impact of board independence on firm operating performance in French companies. We use a three-way decomposition of status (insider, gray, independent) based on a non-declarative, impartial assessment: the independence definition we rely on is a stringent one that leaves few room for superficially independent members. We also take advantage of an original database, with a time-series dimension that can be used to mitigate heterogeneity and dynamic endogeneity issues through GMM estimators. In addition, this database can be disaggregated at the individual (director) level. This design enables us to introduce firm fixed effects and individual fixed effects in (firm) performance equations, thereby controlling for heterogeneity at the firm and individual levels.

Our main result is to document a significant negative relationship between accounting performance and independence. This relation is not due to unobservable firm heterogeneity, nor to the fact that past values of firm performance would affect the current share of

independent directors (dynamic endogeneity). This relationship holds even when controlling for individual intrinsic ability: the data supports the view that the *position* of independent directors *vis-à-vis* the management and the firm in which they hold a directorship is a difficult one, fraught with informational asymmetries. On the one hand, independent directors have less firm or industry-specific knowledge as compared to other board members (gray or insiders). On the other hand, corporate executives may be reluctant to share information with independent members, whose role is precisely to monitor them. Our result therefore shows that in the French context, the inefficiencies resulting from this informational gap outweigh the benefits of independence. At this stage, we can only provide highly tentative explanations for this observation. A likely possibility is that the French institutional environment (stock market activity and financial law, corporate law, etc.) does not allow independent director to fully play their role of intransigent watch dog: as compared to the US or the UK, opportunities for directors to replace Chief Executive Officers may not be numerous. Hostile takeovers remain rare, and the managerial turnover rate is low. At least, this interpretation calls for a careful examination of the interdependencies between the broadly defined institutional environment and board structure efficiency.

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Table 1: Data distribution

Year	Data observations (number of firms)	% of total		Number of yearly data observations	Number of firms	% of total
2003	162	7.60		1	8	0.38
2004	178	8.35		2	40	1.88
2005	202	9.47		3	102	4.78
2006	217	10.18		4	144	6.75
2007	241	11.30		5	155	7.27
2008	271	12.71		6	156	7.32
2009	288	13.51		7	231	10.83
2010	289	13.55		8	216	10.13
2011	284	13.32		9	1,080	50.66
Total	2,132	100.00		Total	2,132	100.00

Table 2: Descriptive statistics

Variable	Mean	Std. Dev.	Std. Dev. between	Std. Dev. within	Min	Max	Obs
Board size	9.29	4.04	3.88	1.21	1.00	27.00	2132
% independent	0.27	0.20	0.18	0.10	0.00	1.00	2132
% insiders	0.16	0.20	0.20	0.08	0.00	1.00	2132
% women	0.10	0.13	0.12	0.06	0.00	0.75	2132
% foreigners	0.11	0.16	0.14	0.06	0.00	1.00	2132
% busy	0.22	0.23	0.21	0.08	0.00	1.00	2132
% less than 50	0.20	0.21	0.18	0.11	0.00	1.00	2132
Chairman/CEO duality	0.48	0.50	0.43	0.27	0.00	1.00	2132
Number of employees	25090	56475	49386	9726	1.00	479072	2111
Leverage	0.85	1.32	1.12	0.82	-13.13	14.95	2122
R&D/sales	0.08	1.20	0.84	0.87	0.00	46.18	2119
Stock volatility	0.63	0.57	0.60	0.39	0.00	9.61	2102
Stock turnover rate	0.03	0.17	0.16	0.12	0.00	2.83	1983
ROA	0.03	0.06	0.06	0.04	-0.24	0.25	2108
ROE	0.09	0.16	0.14	0.11	-0.75	0.72	2101

Table 3: OLS and within estimates

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Board size	0.009	0.003	-0.021***	-0.069***
	(0.006)	(0.014)	(0.008)	(0.023)
% independent	-0.028**	-0.084**	-0.019*	-0.077**
	(0.013)	(0.035)	(0.010)	(0.031)
% insider	0.005	-0.023	0.005	-0.057
	(0.013)	(0.031)	(0.013)	(0.042)
% women	0.043**	0.070*	-0.003	0.004
	(0.017)	(0.037)	(0.019)	(0.063)
% foreigners	-0.029**	-0.063*	-0.042**	-0.055
	(0.013)	(0.038)	(0.021)	(0.065)
% busy	-0.002	-0.023	0.012	0.035
	(0.011)	(0.028)	(0.011)	(0.032)
% less than 50	0.019*	0.033	0.009	0.006
	(0.011)	(0.029)	(0.010)	(0.034)
Chairman/CEO duality	0.008*	0.005	0.001	0.009
	(0.005)	(0.011)	(0.004)	(0.010)
Firm size (employees)	0.001	0.010***	-0.004**	-0.009**
	(0.002)	(0.004)	(0.002)	(0.004)
Leverage	-0.008***	-0.016**	-0.007***	-0.036***
	(0.002)	(0.007)	(0.002)	(0.010)
R&D/Sales	-0.037***	-0.017***	-0.042	-0.003***
	(0.007)	(0.005)	(0.030)	(0.001)
Stock volatility	-0.006*	-0.013**	0.002*	0.004
	(0.003)	(0.006)	(0.001)	(0.004)
Stock turnover rate	-0.013	-0.038	0.000	-0.003
	(0.010)	(0.023)	(0.008)	(0.022)
Observations	2,071	2,069	2,071	2,069
R-squared	0.169	0.149	0.134	0.133
Year dummies	yes	yes	yes	yes
CAC40 and industry	yes	yes	no	no
Firm fixed effects	no	no	yes	yes

Notes: (1) Dependent variable: Return On Asset (models 1 and 3) or Return On Equity (models 2 and 4). (2) Independent variables regarding the board include: board size (in log), % of independent directors, % of insiders, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of directors aged less than 50, and a dummy that takes value 1 in case of chairman/CEO duality (0 otherwise). (3) Independent variables regarding the firm include: size (number of employees, in log), industry (12 positions), a dummy that takes value 1 if the firm belongs to the CAC40 index (0 otherwise), financial leverage, R&D on sales, stock price volatility, common stock turnover rate. (4) All models include year dummies. (5) Robust standard errors, clustered on firms, in parentheses. (6) Method: OLS estimation in models (1) and (2), fixed-effects estimation in models (3) and (4). (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: robustness checks

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Board size (log)	0.007	-0.000	-0.020**	-0.067***
	(0.006)	(0.014)	(0.008)	(0.023)
% independent	-0.028**	-0.085**	-0.019*	-0.080**
	(0.013)	(0.035)	(0.010)	(0.031)
FULL	-0.006	-0.012		
	(0.009)	(0.022)		
NYEARS	0.006***	0.010*		
	(0.002)	(0.006)		
BEFORE	-0.003	-0.018		
	(0.010)	(0.026)		
Board turnover rate			-0.001	-0.005
			(0.004)	(0.009)
Tobin's Q (log)				
Observations	2,071	2,069	2,071	2,069
R-squared	0.184	0.156	0.136	0.135
Year dummies	yes	yes	yes	yes
CAC40 and industry	yes	yes	no	no
Firm fixed effects	no	no	yes	yes
cor. selection bias	yes	yes	no	no

Notes: (1) Dependent variable: Return On Asset (models 1 and 3) or Return On Equity (models 2 and 4). (2) Independent variables regarding the board include: board size (in log), % of independent directors, % of insiders, % of women, % of foreigners, % of busy directors (with at least one other directorship), % of directors aged less than 50, and a dummy that takes value 1 in case of chairman/CEO duality (0 otherwise). Models (3) and (4) also include board turnover rate (sum of arrival and exit of board members between *t-1* and *t* divided by the total number of directors in *t-1*.). (3) Independent variables regarding the firm include: size (number of employees, in log), industry (12 positions), a dummy that takes value 1 if the firm belongs to the CAC40 index (0 otherwise), financial leverage, R&D on sales, stock price volatility, common stock turnover rate. Models (1) and (2) also include a dummy (*FULL*) that takes value 1 if the firm *j* is observed over the whole period (0 otherwise), the number of years of presence of the firm in our panel (*NYEARS*), and a dummy variable (*BEFORE*) equals to 1 if the firm was present in the previous period (0 otherwise). Models (5) and (6) also include Tobin's Q (in log). (4) All models include year dummies. (5) Robust standard errors, clustered on firms, in parentheses. (6) Method: OLS estimation in models (1) and (2), fixed-effects estimation in models (3) and (4). (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: dynamic endogeneity

	(1) Board size	(2) Board size	(3) % indep.	(4) % indep.
L.board size	0.900***	0.902***		
	(0.017)	(0.017)		
L.% indep			0.839***	0.842***
			(0.016)	(0.016)
L.ROA	0.182**		-0.010	
	(0.083)		(0.059)	
L.ROE		0.049		-0.018
		(0.033)		(0.026)
Observations	1,685	1,682	1,685	1,682
R-squared	0.897	0.897	0.727	0.729
Year dummies	yes	yes	yes	yes
CAC40 and industry	yes	yes	yes	yes
Firm fixed effects	no	no	no	no

Notes: (1) Dependent variable: board size (in log) (models 1 and 2) or % of independent directors (models 3 and 4). (2) Independent variables (all lagged one year): board size (in log) (models 1 and 2), % of independent directors (models 3 and 4), ROA (models 1 and 3), ROE (models 2 and 4), firm size (number of employees, in log), industry (12 positions), a dummy that takes value 1 if the firm belongs to the CAC40 index (0 otherwise), financial leverage, R&D on sales, stock price volatility, common stock turnover rate. (3) All models include year dummies. (4) Robust standard errors, clustered on firms, in parentheses. (5) Method: OLS estimation. (6) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: system GMM estimates

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
Board size	0.000	-0.035	-0.000	-0.005
	(0.008)	(0.033)	(0.012)	(0.032)
% independent	-0.029*	-0.130***	-0.029*	-0.110**
	(0.015)	(0.047)	(0.015)	(0.047)
% insider	-0.002	-0.100	0.015	0.021
	(0.025)	(0.077)	(0.029)	(0.074)
% women	-0.011	-0.020	0.013	0.014
	(0.024)	(0.082)	(0.038)	(0.113)
% foreigners	-0.016	-0.018	-0.034	-0.076
	(0.020)	(0.062)	(0.026)	(0.070)
% busy	0.009	0.024	0.009	0.006
	(0.012)	(0.036)	(0.014)	(0.045)
% less than 50	0.031**	0.059	0.013	0.022
	(0.015)	(0.053)	(0.018)	(0.058)
Chairman/CEO duality	0.005	0.010	-0.001	-0.003
	(0.006)	(0.023)	(0.005)	(0.018)
L.ROA	0.441***		0.371***	
	(0.060)		(0.070)	
L.ROE		0.305***		0.213***
		(0.065)		(0.072)
Observations	1,668	1,669	1,668	1,669
Number of instruments	252	252	147	147
Hansen test (p-value)	0.223	0.540	0.815	0.320
AR(2) test (p-value)	0.996	0.943	0.871	0.803
Year dummies	yes	yes	yes	yes
CAC40 and industry	yes	yes	yes	yes
Firm fixed effects	yes	yes	yes	yes
Lag range for instruments=1	yes	yes	no	no
Collapse	no	no	yes	yes

Notes: (1) Dependent variable: Return On Asset (models 1 and 3) or Return On Equity (models 2 and 4). (2) Independent variables: lagged ROA (models 1 and 3), lagged ROE (models 3 and 4), board size (in log), % of independent directors, % of insiders, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of directors aged less than 50, and a dummy that takes value 1 in case of chairman/CEO duality (0 otherwise), firm size (number of employees, in log), industry (12 positions), a dummy that takes value 1 if the firm belongs to the CAC40 index (0 otherwise), financial leverage, R&D on sales, stock price volatility, common stock turnover rate. (3) All models include year dummies. (4) GMM-style instruments: all regressors except industry, the dummy for CAC40 and year dummies. Standard instruments: industry, the dummy for CAC40 and year dummies. (5) In the differenced equation, we instrument ΔROA_{jt-1} (resp. ΔROE_{jt-1}) by ROA_{jt-2} (resp. ROE_{jt-2}) and further lags. In the original equation, we instrument ROA_{jt-1} (resp. ROE_{jt-1}) by ΔROA_{jt-2} (resp. ΔROE_{jt-2}) and further lags. (6) To avoid instruments proliferation, we restrict in models (1) and (2) the lag range used in generating GMM instruments (for regressors other than performance) at one. In models 3 and 4, the GMM instrument matrix is "collapsed". (7) Robust standard errors, using the Windmeijer (2005) finite sample correction, in parentheses. (8) Method: (two steps) system GMM estimation. (9) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: individual fixed effect regressions

	(1) ROA	(2) ROE	(3) ROA	(4) ROE
% independent	-0.020**	-0.078***	-0.020**	-0.078***
	(0.009)	(0.029)	(0.009)	(0.029)
Indep	-0.003*	-0.013**		
	(0.002)	(0.006)		
Inter			-0.005**	-0.015**
			(0.002)	(0.007)
Intra			-0.003	-0.013**
			(0.002)	(0.006)
Observations	19,311	19,275	19,311	19,275
Adjusted R-squared	0.641	0.534	0.641	0.534
Year dummies	yes	yes	yes	yes
CAC40 and industry	no	no	no	no
firm fixed effects	yes	yes	yes	yes
individual fixed effects	yes	yes	yes	yes

Notes: (1) Dependent variable: Return On Asset (models 1 and 3) or Return On Equity (models 2 and 4). (2) Independent aggregate variables regarding the board include: board size (in log), % of independent directors (orthogonalized with the individual dummy *Indep*), % of insiders (orthogonalized with the individual dummy *Indep*), % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of directors aged less than 50, and a dummy that takes value 1 in case of chairman/CEO duality (0 otherwise). (3) Independent aggregate variables regarding the firm include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility and common stock turnover rate. (3) In models 1 and 2, independent individual variables include: a dummy (*Indep*) that takes value 1 if director is independent (0 otherwise) and a dummy that takes value 1 if director is an insider (0 otherwise) (4) In models 3 and 4, independent individual variables include: a dummy that takes value 1 if the director is independent and only concerned by inter-firm variation in status (*Inter*), a dummy that takes value 1 if the director is independent and concerned by intra-firm variation in status (*Intra*), and a dummy that takes value 1 if director is an insider (0 otherwise). (5) All models include firm fixed effects, individual fixed effects and year dummies (6) Robust standard errors, clustered on firm-year, in parentheses. (7) Method: fixed-effects estimation. (8) Significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.