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Independent directors: less informed, but better selected? [*] New evidence from a two-way director-firm fixed effect model

Sandra Cavaco [†], *Patricia Crifo*[‡], *Antoine Rebérioux*[§], Gwenaël *Roudaut* [**]

Résumé/abstract

This paper develops a two-way director-firm fixed effect model to study the relationship between independent directors' individual heterogeneity and firm operating performance, using French data. This strategy allows considering and differentiating in a unified empirical framework mechanisms related to board functioning and mechanisms related to director selection. We first show that the independence status, netted out unobservable individual heterogeneity, is negatively related to performance. This result suggests that independent board members experience a strong informational gap that outweighs other monitoring benefits. However, we show that industry-specific expertise as well as informal connections inside the boardroom may help to bridge this gap. Second, we provide evidence that independent directors have higher intrinsic ability as compared to affiliated board members, consistent with a reputation-based selection process.

Mots clés : independent director heterogeneity, information asymmetry, director selection, firm performance, two-way fixed effect model.

Codes JEL : G30, G34

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Introduction

Debates and reforms on boards in listed companies have been largely driven by director independence. It is, at least since the mid-80s, the main criteria to assess the adequacy of board composition, in the U.S.A, the U.K. and in continental Europe. A significant number of independent members should improve board functioning, as it increases the probability for a deficient CEO to be properly sanctioned. However, a large body of theoretical and empirical research has questioned the effective monitoring ability of independent directors. The 'informational gap' argument stresses in particular that CEOs may be reluctant to share critical firm-specific information with directors perceived as 'watch dogs' (Raheja 2005, Adams and Ferreira 2007). In turn, this literature highlights the heterogeneity of independent directors in terms of expertise and informal network affiliation, as both attributes may influence their ability to cope with the informational gap and to intervene in case of CEO deficiencies (see e.g. Dass et al. 2014 or Kramarz and Thesmar 2013). The net effect of independence on board functioning is therefore still ambiguous.

To date however, little attention has been paid to what might be another key issue regarding the effectiveness of independence: the selection of board members and the relative bargaining power of CEOs in this process (Hermalin and Weisbach 1998). Does CEO's power lead to an adverse-selection process regarding the appointment of independent directors? Alternatively, do reputation mechanisms favor the selection of the best individuals as independent members? If effective, these processes will result in distinctive intrinsic ability distributions across groups of directors (independent, affiliated and insiders), hardly observable for the econometrician. The crucial point is that selection considerations will then interfere with board functioning to determine independent board members' overall effectiveness (Adams et al. 2010, Withers et al. 2012). And clearly, there is an empirical challenge to properly distinguish, when examining independent directors' effectiveness, what is related to board functioning and what is related to board selection (White et al. 2013).

In this paper, we take up this challenge with an original empirical strategy that allows disentangling both mechanisms (board functioning and selection process). This strategy rests on the AKM methodology (Abowd et al. 1999) that makes use of (longitudinal) linked employer-employee data to disentangle firm effects and person effects in wage formation. Applied to the corporate governance-firm performance context, this methodology makes it possible to estimate board-related attributes (independence, expertise, etc.) and director fixed effects in firm performance equation, echoing the approach developed by Bertrand and Schoar (2003) for top executives. This empirical strategy has three advantages.

First, controlling for director fixed effects enables to alleviate individual heterogeneity concerns related to selection process when considering the relationship between independence and other board-related attributes on the one hand and performance on the other hand. We are thus able to directly observe the net effect on board functioning of the independence status[1], irrespective of individual intrinsic ability. Our estimation reports a negative significant conditional correlation between the independence status and firm performance, suggesting that the costs of the informational gap may outweigh the benefits of more intense monitoring associated with independence. However, we also show that industry-specific expertise as well as informal connections (from elite institutions) inside the boardroom may help to bridge this gap.

Second, estimating director fixed effects helps to identify the selection process taking place in independent directors' appointment, as it allows a direct test of the difference in intrinsic ability distribution between independent and non-independent board members. Controlling for individual observable attributes and firm fixed effects, quantile regressions show that there is a positive correlation between individual ability and independence within firms. This evidence is consistent with a reputation-based selection, whereby the most talented individuals are appointed as independent directors. In other words, the selection of independent directors seems to be driven more by the interest of shareholders than by the interest of top management.

Third, from a methodological perspective, whereas the standard methods used in the existing literature allow accounting for dynamic endogeneity, they are not well adapted to properly take into account individual heterogeneity and to separate distinct corporate governance mechanisms (board functioning and selection). To our knowledge, our approach is the first one in which the two levels of analysis are emphasized in the same performance equation. Moreover, *ex post* tests confirm that dynamic endogeneity is a little concern in our analysis: in other words firms do not tend to hire independent directors, whatever their intrinsic ability, based on their past performance (good or bad). Furthermore, the exogeneity assumptions of the AKM framework can be fairly supported by our data. These different tests enable us to be pretty confident in our estimation and to validate the AKM framework as an innovative methodological tool to answer our research question.

Our estimations are conducted on a database of 108 French listed firms (among the SBF120 index i.e. the 120 largest listed companies on Euronext Paris, excluding financial companies), mixing firm-level

[1] Here, the term "status" is used to designate the fact of being independent inside the boardroom relative to the fact of being affiliated (or insider). It therefore does not designate *per se* the individual who holds the directorship.

information and individual information for 1,313 distinct directors, over the 2006-2011 period. The French corporate governance model has some important similarities with Anglo-Saxon countries, following a process of convergence over the last 20 years (Martynova and Renneboog 2010). There has been a dramatic growth in stock market capitalization, fuelled by the increasing presence of investment funds and an enhancement of minority shareholder legal protection (Lele and Siems 2007). Unsurprisingly in such an environment, independence has become the conventional wisdom, a decade after the USA or the UK. Yet the French corporate governance model presents its own characteristics, making it an interesting and complementary subject for the literature. In particular, board composition is more diversified in France than in the US or the UK, at least regarding the independence status: in our sample, the average proportion of independent directors is 49%, with a standard deviation of 21% and less than 5% of "super-majority boards" (i.e. with more than 80% of independent board members). Such variation allows a more precise estimation of the independence/performance relationship. In addition, independent board members cohabit with affiliated directors, who account for 42% (the last group is insiders, with a proportion of 9%). The importance of affiliated directors – unusual for Anglo-Saxon standards – is directly related to corporate governance *à la française*, that combines family ownership, cross-holdings in equity capital and labor representation at the board level (albeit to a much smaller extent than in Germany). As such, affiliated directors play a particular role in corporate governance, providing top management with specific resources and strategic advises (Hillman and Dalziel 2003). In our study, the benefits and the costs of independence can therefore be assessed relative to the benefits arising from affiliation of non-executive directors. A second specificity is that French corporate law allows open corporations to choose between a two-tier (German style) board structure and a one-tier (US-UK style) structure (with or without separation between CEO and chairman positions). As highlighted by Belot et al. (2014), this allows drawing conclusions on the benefits and costs of both structures – an open-ended and long-lasting question in the corporate governance literature.[2] Finally, the French corporate system is characterized by the intensity of multiple directorships (or '*cumul des mandats*', see Fanto 1998). It turns out to be a significant advantage from a methodological perspective, as our identification strategy requires sufficient director 'mobility' among sampled firms to accurately differentiate firm and individual fixed effects.

Our paper contributes to two different strands of the literature: the informational gap of independent directors and the role of individual talent in business conduct.

[2] See e.g. Jungmann (2006) for a legal approach, and Adams and Ferreira (2007) for an economic approach.

Regarding the debate on the informational gap and the factors that may mitigate it, our approach allows assessing how independence, expertise and network affiliation relate to performance netted out unobservable individual heterogeneity concerns. It is important insofar as there are good reasons to believe (i) that the independence status is correlated with intrinsic individual ability whenever selection occurs in the appointment process and (ii) that having industry-expertise or belonging to a network from elite institutions is correlated with intrinsic ability.

Regarding the role of individual talent in business conduct, there has been an increasing interest since Bertrand and Schoar (2003) in the way managerial heterogeneity may affect governance structure, firm decision and performance, as well as executive compensation (see e.g. Graham et al. 2012, Coles and Li 2013, Arena and Braga-Alves 2013, Fee et al. 2013). We extend this analysis to (individual) directors and connect our results to board members' selection. While the estimation of director fixed effects has been used as a robustness check for a small subsample of agents by a couple of papers (see in particular Nguyen and Nielsen 2010, Masulis and Mobbs 2014), we are the first to the best of our knowledge to estimate director fixed effects for a comprehensive sample of firms and individuals.[3] We are then able to compare the distribution of individual talents across different groups of directors.

The rest of this paper is structured as follows. Section 2 describes the background and hypotheses of our study. Section 3 develops our identification strategy. Section 4 presents the data. Section 5 details our results. Section 6 examines the endogeneity issue and section 7 concludes the article.

1. Backgrounds and hypotheses

This section presents alternative hypotheses regarding the extent of the informational gap suffered by independent directors on one side, and the selection process of independent board members on the other side.

[3] As a matter of fact an (unpublished) study by Richardson et al. (2003) investigates in detail director fixed effects. There are, however, two key differences with our approach. First, they are not interested in firm performance but in a range of firm policies (regarding governance, financial disclosure and strategic policies). Second, they do not use the AKM method but rather limit their investigation to directors who sit on at least two different boards at the same time, leading to a possibly problematic selection bias. As it will be clear in the empirical strategy section, we are able to estimate individual fixed effects for multi-boards *and* single-board individuals, as long as they belong to a so called 'connected group' (which covers 96% of the directors present in our sample).

1.1. Board functioning: the informational gap

The main benefit expected from board independence is the limitation of collusion between directors and corporate officers, thereby reducing agency costs (Hermalin and Weisbach 1998). However, seminal papers by Raheja (2005) and Adams and Ferreira (2007) stress the fact that corporate executives may be reluctant to share firm-specific information with outside, independent directors. This informational gap may of course impede the ability of independent directors to effectively monitor, but also to advise, corporate executives. If true, independence may have detrimental effect on firm performance, especially when the firm operates in complex environments (Duchin et al. 2010, Faleye et al. 2011). Ultimately, whether being independent brings benefits to the firm is an empirical question. We therefore state the following hypothesis:

Hypothesis 1 (H1): if the benefits of independence (due to reduced agency costs) outweigh the costs (in particular due to the informational gap), we expect a positive conditional correlation between firm performance and the independence status.

Three elements may reduce the informational deficit of independent directors, thereby enhancing their effectiveness: industry expertise, board structure (one-tier *versus* two-tier) and social connections at the board level.

The fact that industry expertise may strengthen board effectiveness has received empirical support in the literature. For instance Dass et al. (2014) report a positive conditional correlation between firm value and the share of "directors in related industries". Yet it has long been recognized that the criteria used in virtually all jurisdictions to define independence do not favor such industry expertise (Baysinger and Hoskisson 1990). This does not mean, however, that all independent directors are amateurish regarding the firm business model. And crucially, a couple of recent papers produce evidence consistent with the argument that such an expertise is specifically important regarding independent board members' effectiveness (see in particular Faleye et al. 2013 and Wang et al. 2013).

The effectiveness of independent directors is also likely to depend on the board structure. Under French corporate law, open corporations are free to choose between a unitary (with or without separation in the positions of chairman and chief executive) and a two-tier board structure. Arguably, the latter tends to exacerbate information asymmetry (between directors and corporate executives), while reducing the extent of private benefices extraction (Belot et al. 2014). The net effect for independent directors is not clear: while it reinforces their monitoring ability, it also enlarges their informational gap.

Beside industry-expertise and board structure, a last important factor may impact the effectiveness of independent directors: the extent of informal connections with corporate executives or other board members. Considering connections with other directors, the expected effect is *a priori* straightforward: for a given director, sharing social networks with at least some other board members should increase her power and effectiveness. Informal connections ease information circulation among network members (Cohen et al. 2008, Coles et al. 2012), and probably increase the strength of conviction for a person belonging to the network. We therefore expect social connections to narrow independent director informational gap: as such, they will be associated with greater firm performance. Regarding informal connections with the CEO, the net effect is more ambiguous. On one side, informal connections may limit the willingness of independent directors to supervise and sanction CEOs. Using French data Kramarz and Thesmar (2013) bring evidence consistent with this hypothesis (see also Hwang and Kim 2009, Nguyen 2012, Coles et al. 2014): they show that social networks (defined through education and career) decrease the probability of CEO dismissal when the company underperforms, and increase CEO compensation. On the other side, being connected to the CEO may enhance the ability of an independent director to extract firm-specific information: informal networks foster a climate of mutual trust that should favor information sharing, thereby reducing the informational gap (Cohen et al. 2010, Schmidt 2014).

1.2. Directors' selection and heterogenity

The previous discussion has focused on board functioning. A full understanding of the economics of independence also necessitates investigating directors' appointment and selection. By selection, we consider any process that contributes to create heterogeneity in terms of talent (or ability) across groups (i.e. independent *versus* affiliated directors). To be clear, let us consider as a starting point that there are two groups of *potential* non-insider directors: affiliated and independent[4]. We may assume that the distribution of talents is strictly similar across these two groups. However, we only observe directors who have been *effectively* appointed at the board. There will be selection if the ability distribution among independent directors is significantly different from the distribution among affiliated directors.

[4] Insider directors may present a selection bias due to the fact that they usually hold the most powerful positions in the firm (CEO, CFO) and should be hired as the most talented directors on a competitive executive labor market.

To understand this selection process, it is important to note that affiliated directors are probably not selected on the basis of their intrinsic ability, but for some specific attributes that are orthogonal with it. Indeed, affiliated directorship is (most of the time) based on a representativeness principle (for instance blockholder representative or worker representative). Accordingly, affiliated directors would be randomly chosen on the (non-observable) distribution of potential affiliated board members: the distribution of talents for this group should reflect the whole ability spectra. The situation may be different for independent directors, as ability (probably correlated with a set of observable attributes) is likely to be the primary criterion of selection.

Shareholders are empowered with the rights to elect and remove directors. However, a number of authors have argued that shareholders' direct influence over board makeup is actually limited, at least in the U.S. (see e.g. Warther 1998). Regarding removal, staggered boards offer to incumbent directors a significant (and rather common) protection. Regarding appointment, the influence of top executives on the slate of nominees is arguably dramatic (Bebchuk and Fried 2004). In addition, the vast majority of elections are uncontested. Arguably, French corporate law gives shareholders more authority over board composition (Armour et al. 2009), particularly considering removal. Shareholders in French listed companies may revoke directors *ad nutum*, at any general assembly meeting, without notice and without reason (Code de commerce, article 225-18). Nevertheless, (minority) shareholders' *de facto* power is quite limited: *ad nutum* revocation is extremely rare, and the slate of nominees is also influenced by top executives. In light of these elements, the involvement of CEOs in directors' selection is hardly negligible.

The crucial question is then the following: what might be the consequences of managerial involvement in director selection regarding board composition, and more specifically regarding the ability of independent directors?

A first possibility is to consider that managerial direct influence is strong enough to allow CEOs to makeup board composition according to their own interests or preferences (Hermalin and Weisbach 1998). There is empirical evidence supporting this argument. In the U.S. case, Shivdasani and Yermack (1999) observe that when the CEO serves on the nominating committee (or when no such committee exists), companies appoint fewer independent directors. Cohen et al. (2012) provide evidence that firms tend to select so-called "cheerleaders" as independent directors, that is individuals who are overly sympathetic to top management. In the French case, Kramarz and Thesmar (2013) show that the probability for a director to be appointed in firm *j* increases when she belongs to the same network as firm's CEO (defined in terms of education or career). Accordingly, just like managerial power may be used to extract rent in the form of soaring compensation (Bebchuk and Fried

2004), CEOs may use their power to reduce the monitoring effectiveness of the board. Consistently with this idea, Carcello et al. (2011) show that firms that experiment the most severe restatements are those where the CEO is involved in the selection process. As board monitoring effectiveness mainly depends on independent directors, CEOs may use their influence to avoid the appointment of 'high ability' individuals as independent. In contrast, no effort should be made to screen (and reject) low ability individuals. This argument is to some extent a simple extension of the Adams and Ferreira (2007)'s argument: while they portray CEOs as voluntarily restricting the share of firm-specific information to limit the monitoring effectiveness of independent directors, it is plausible that CEOs use their influence to avoid the appointment of highly talented persons as independent board members. We end up with the following prediction about the relationship between director status and individual ability:

Hypothesis 2 (H2): if independent directors are adversely selected by CEOs, we expect to observe more frequently the appointment of low ability individuals as independent director, as compared to affiliated director.

The previous story portrays board makeup as being largely shaped by CEOs willingness to reap the benefits of deficient monitoring. Actually, this assertion is not straightforward. In listed companies, shareholders not only hold the right to vote their shares; they also have the opportunity to sell and buy stocks, therefore impacting the firm value. This may induce management and board to best serve shareholders' interests when selecting directors, so as to secure the firm value.

This mechanism may have important consequence regarding board composition, if one condition holds: namely if investors are able to observe, determine or infer director ability through different signs (such as board meeting attendance, behavior in other companies, etc.), before their appointment or renewal. Cai et al. (2009) show for example that directors who attend less than 75% of board meetings receive 14% fewer votes in general assembly. In this case, reputation concerns may become an important driver of director appointment: investors will globally approve or reprove the selection of a particular individual, inducing positive or negative movements in the firm value. A couple of studies yield evidence of such reputation effects that may severely limit managerial discretion regarding board members' selection. In particular, Fich (2005) shows that the cumulative abnormal return following the appointment of a director who is CEO of another firm *j* increases with the (industry-adjusted) ROA of firm *j*. More recent evidence of reputational effects is provided by Masulis and Mobbs (2011) for inside directors, by Ertimur et al. (2012) for outside directors in firms involved in the 2006-2007 option backdating scandal.

What might be the effect of reputation regarding ability distribution among independent directors? CEOs will be willing to avoid low ability individuals and look for talented outside directors who will allow to comply with regulatory requirements on one hand *and* to please investors' expectations on the other hand. The selection process of independent directors will then be such that low ability persons should have a lower probability to enter the boardroom. In light of this argument, we state the following final hypothesis:

Hypothesis 3 (H3): if reputation effects are effective, we expect to observe more frequently the appointment of high ability individuals as independent director, as compared to affiliated director.

Clearly, the two selection mechanisms will have specific observable effects regarding individual ability distribution among independent directors relative to affiliated directors (taken as reference). The first process ("adverse selection") implies a right-truncation for the distribution of talents among independent board members. In contrast, the second process ("reputation-based selection") induces a left-truncation. Figure 1 plots ability distribution for independent directors under these two different processes relative to affiliated directors' distribution (so called "no selection").

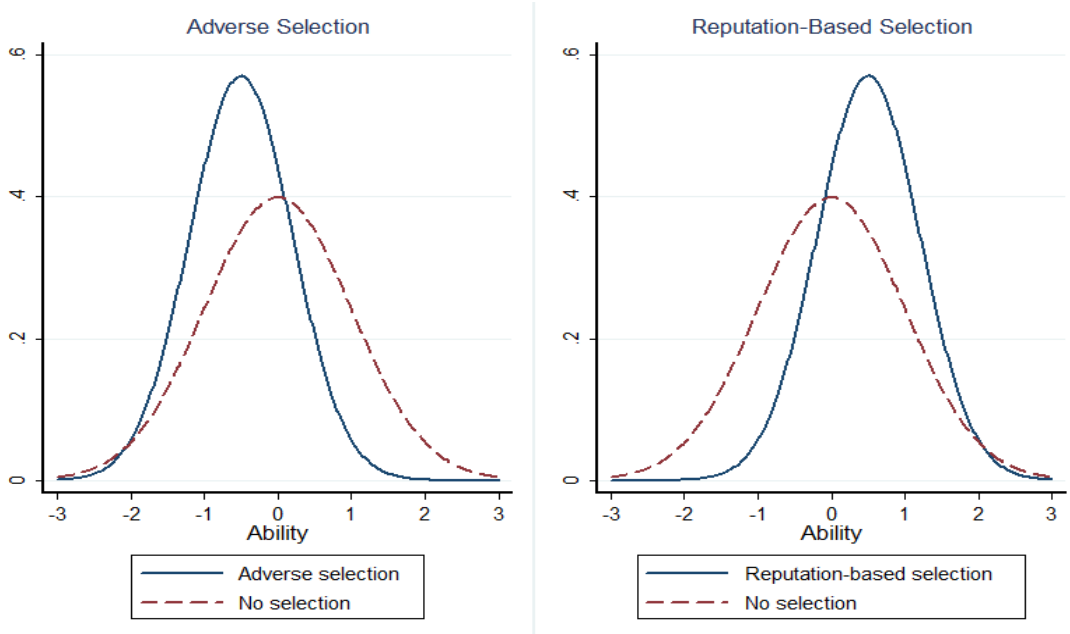

Figure 1: Theoretical independent directors' ability distribution under different selection processes

2. Identification strategy

To test our hypotheses, we need to estimate both the effect of different statuses and board-related attributes (e.g. independent, insider, industry expert, etc.) on firm performance and the (unobservable)

intrinsic ability of different individuals. We therefore disaggregate firm-level performance equation at the individual level: each observation is a triplet (director-firm-year). This approach, while uncommon, extends the analysis conducted by Bertrand and Schoar (2003) that empirically imputes part of firm performance to top-executives' (CEOs but also Chief Financial Officers and other top managers) individual characteristics. Here, we consider director effects rather than managerial effects. Our baseline model is the following:

$$Y_{i,j,t} = \rho + \alpha_1 Independent_{i,j,t} + \alpha_2 Insider_{i,j,t} + \beta X_{j,t} + \gamma Z_{j,t} + \mu_i + \delta_j + \theta_t + \varepsilon_{i,j,t} \quad (1)$$

where $Y_{i,j,t}$ is the performance at time t of the firm j where director i holds a seat, μ_i is a personal identifier (director fixed effect), δ_j is a firm identifier (firm fixed effect) and θ_t is a time dummy. Director fixed effects capture both time- and firm-invariant observable attributes (gender, nationality) and (unobservable) intrinsic ability. $Independent_{i,j,t}$ (resp. $Insider_{i,j,t}$) is a dummy that values 1 if the director i is independent (resp. insider) in firm j at time t. Affiliated status is therefore taken as a reference. $X_{j,t}$ is a vector of board structure variables (including among others board size, proportion of women, but also the proportions of independent directors and of insiders) and $Z_{j,t}$ a vector of firm characteristics (number of employees, financial leverage, etc.). The last component is the statistical residual $\varepsilon_{i,j,t}$.

To estimate model (1), we rely on the approach first proposed by Abowd et al. (1999) in labor economics (AKM), and further developed by Abowd et al. (2002). This method provides a statistical framework for decomposing wage rates into components due to individual heterogeneity (observable and unobservable) and firm heterogeneity (observable and unobservable), using matched (longitudinal) employer-employee data and worker mobility across firms. In the AKM set-up, individual and firm fixed effects are separately identifiable for connected group of workers and firms, through standard methods of covariance analysis. A connected group contains all the individuals who have ever worked for any of the firms which are linked by at least one individual over the period.

We extend this approach to a model of director-firm outcomes, using individual (director) multiple seats and mobility across firms as a source of identification of individual effects and firm effects. Our baseline model (1) is correctly estimated if two conditions hold. First, we need to have sufficient individual mobility, so that the group of connected directors/firms is large enough to consistently estimate firm fixed effects and individual fixed effects. Second, the statistical residual should of course be orthogonal to all variables in the model. In particular, we need to have $\mathrm{E}\left[\delta_j\,;\,\varepsilon_{i,j,t}\right] = 0 \;\; \forall j$ and $\mathrm{E}\left[\mu_i\,;\,\varepsilon_{i,j,t}\right] = 0 \; \forall i$. These orthogonality conditions suppose that the assignment of directors in the

different companies is strictly exogenous. In section 6, we perform several tests in order to valid this 'exogeneous mobility' assumption.

Three further considerations are needed. First, and by definition, there is a direct relationship between our dummy $Independent_{i,j,t}$ and the proportion of independent directors in firm j at date t ($\%\, Independent_{i,j,t}$) included in the $X_{j,t}$ vector. To deal with it, we simply re-compute $\%\, Independent_{i,j,t}$ while excluding individual i. We apply the same treatment for the share of insiders, and (when they are introduced in the following model) for the shares of industry-experts and of industry-expert independent directors. Second, as we have multiple observations per firm-year, we compute standard errors which are robust to this two-dimension within-cluster correlation[5]. Third, individual fixed effects are normalized, summing to zero. This avoids having our estimation driven by the (random) choice of a given person for reference and makes interpretation easier[6].

It is clear from equation (1) that the estimation of coefficients on independence (α_1) is not possible for directors that never change status either across firms or in a given company. Suppose we have an individual *i* that sits in two different boards during our sample period, but always as an independent director. The independent status effect cannot then be separated from her individual fixed effect. Status effects are identified using two sources of variation: variation in status for a director having multiple holdings in different firms (inter-firm variation) and variation in status over successive years for a director in a given firm (intra-firm variation)[7]. Potential selection biases are further discussed. Of course, this coefficient is correctly estimated if *Independent* is exogenous regarding firm performance: we discuss this issue in section 6.

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[5] As discussed by Petersen (2009), multi-dimensional clustering is a critical issue in corporate finance research. Due to the structure of our dependent variable (annual performance of the company in which each director sits), the correlation within firm-year cluster is the most important bias we have to take into account in the estimation of standard errors. Introducing the director dimension in the cluster would correct the standard errors for any correlation within director observations. Nevertheless, the two-ways firm-year and director cluster does not significantly change our result (results available upon request). Introducing year or firm dimension would be redundant with the firm-year cluster chosen in the analysis. The other potential correlations are taken into account by the introduction of director, firm and year fixed effects.

[6] The user-written Stata do file reg2hdfe (Guimaraes and Portugal 2010) allows this normalization, while having clustered standard errors.

[7] While primary surprising, the case of people changing status in the same firm is possible. People who switch from independent to non-independent belong to the following cases: an independent director who passes the 12-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 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 our sample period, only 2% of directors change status within the same firm; as a consequence, α_1 is almost exclusively identified on inter-firm variation.

In extended versions of model 1, we consider the effects of other possible board-related individual attributes, namely industry expertise, relative CEO-director power (as proxied by board structure), and the affiliation to various informal networks. For instance, if we want to measure the correlation between performance on one side, and independence and industry expertise on the other side, we estimate the following model:

$$Y_{i,j,t} = \rho + \alpha_1 Independent_{i,j,t} + \alpha_2 Insider_{i,j,t} + \alpha_3 Industry\ Expert_{i,j,t} + \alpha_4 Independent_{i,j,t} * Industry\ Expert_{i,j,t} + \beta X_{j,t} + \gamma Z_{j,t} + \mu_i + \delta_j + \theta_t + \varepsilon_{i,j,t} \quad (1')$$

While the validity of H1 relies on the estimation of α parameters, testing H2 and H3 requires comparing the ability distribution across two groups, independent and affiliated directors. In our framework, director ability is estimated using director fixed effect. We should however be cautious that our results are not driven by inaccurately estimated person fixed effects (among our connected group). As a consequence, we exclude from our sample, before running any regressions, individuals who appear only once over our sample period (i.e. only one year in one firm). Indeed, for these individuals, our empirical model is unable to distinguish the person fixed effect and the error term. 39% of these individuals are directors who finish their directorships at the beginning of our period (2006) while 42% are newly appointed when our period ends (2011). The probability to induce a selection-bias in our estimation is therefore a minor concern. A second problem arises when considering directors appointed in a single firm (i.e. non movers), arriving and leaving at the same dates. Contrary to a standard AKM model (where wage rate is different for each individual), the statistical structure of our dependent variable does not offer in this case enough variation to accurately distinguish director fixed effects for each of these directors: the fitted director fixed effect is an average (at the firm level) of directors' ability. We therefore exclude *ex post* these directors, after performing regressions, when examining the distribution of individual fixed effects across groups. Selection issues are examined in due time.

With these precautions in mind, the most convenient way to compare ability distribution across groups is to perform quantile regression. Such regression allows observing the conditional correlation between independence and individual effects, for each decile of individual effects (rather than on the mean). It therefore enables drawing conclusion on the whole joint distribution of our dependent (individual effects) and explanatory variables. We estimate the following model at the directorship level:

$$Q_{FE}(\tau | S_{i,j}, D_i) = \omega + \vartheta_1 S_{ij} + \vartheta_2 D_i + \delta_j + \varepsilon_{ij} \quad (2)$$

where $Q_{FE}(\tau)$ stands for the value of director fixed effect at a decile τ, S_{ij} is a vector of statuses (independent, insider and industry expert), D_i is a vector of individual time-invariant observable characteristics (gender, financial expertise, foreigner, age at the beginning of the period or at the moment of the first appointment), and ε_{ij} the residual. Subscript *t* is dropped as person effects are, by definition, stable over time. As the dependent variable is estimated (rather than measured), the regressions are bootstrapped with 100 replications. The individual time invariant variables ensure that the results are not driven by a sorting between the statuses and some individual characteristics which may impact firm performance like gender (Adams and Ferreira 2009), financial expertise (Burak-Guner et al 2008) or age (as a proxy of professional experience, see Anderson et al 2011). We also introduce a whole set of firm identifiers δ_j in model (2): it allows controlling for firm unobservable heterogeneity that may play a role if directors and companies sort on unobservable components (e.g. if directors with high intrinsic quality goes in highly attractive firm for reputation concerns, see Masulis and Mobbs 2014). In this model, H2 (adverse selection of independent directors) is corroborated if the correlation $\widehat{\vartheta_1}$ between the independence status and individual fixed effects is significantly negative and stronger for the highest deciles (truncation on the right). In contrast, H3 (reputation-based selection) is validated if this correlation is significantly positive and more intense for the lowest deciles (left truncation).

3. The Data

3.1. Sample Selection

We have collected linked (longitudinal) director-firm data for the companies belonging in 2011 to the SBF120 index. Dealing with a restrictive group of large listed companies allows having sufficient director mobility and cross-holdings, insofar as board-level networks are a prominent feature of French corporate capitalism. Ethics&Boards, an international board watching agency, provides us with comprehensive individual data on directors over the 2009-2011 period. Additional hand-collections from annual reports and internet researches enable us to expand the database to the 2006-2011 period. We exclude financial companies and use the Infinancial database to obtain economic and financial information for companies, as well as Thomson One Banker (TOBO) to collect detailed ownership structure. We thus start with a unique matched director-firm dataset including 114 firms and 1,622 distinct directors.

To apply the AKM methodology, we first identify 7 disconnected groups[8]. Six of them are single firms, whose directors (mainly blockholder representatives and executives) do not appear in any other SBF120 company over the period; we exclude them from our sample (65 directors). We keep the largest connected group, comprising 108 firms and 1,557 directors (7,637 observations). In order to avoid that our estimates be driven by outliers in terms of return, we then trim our measure of operating performance: we exclude all observations with ROE or ROA belonging to the extreme 1% percentiles (68 observations). Finally, we exclude directors who are present only once in our sample period (244 directors or observations). We end-up with a slightly unbalanced panel of 1,313 directors sitting in 108 distinct firms over the 2006-2011 period (625 firm-year)[9]. As indicated in Table 1, the panel has 7,325 director-firm-year observations corresponding to 1,821 directorships (a triplet of firm-director-independence status).

Table 1: Data distribution

Year	Number of firms	Number of director-firm-year observations
2006	102	1,100
2007	103	1,207
2008	103	1,230
2009	105	1,271
2010	107	1,314
2011	105	1,203
Total	625	7,325

As emphasized in the previous section, the identification power of the AKM approach (in particular, the separate identification of firm and individual effects) depends on having sufficient worker mobility across firms. Similarly, our identification strategy relies on directors sitting in different boards over our sample period. Table 2 below informs on directors' mobility inside our connected group: we observe that 25% of directors (323 out of 1,313) are 'movers' or multiple board holders over the period. Together, these movers represent 45% of our directorships and 43% of our observations. Enlarging our sample to smaller companies, where isolated boards dominated by family and corporate insiders are the norm, would not have increased the precision of our estimations.

[8] To do so, we use the STATA command *felsdvregdm* (Mihaly et al. 2010).

[9] The unbalanced nature of our panel stems from outliers exclusion as well as from a couple of mergers and acquisitions over the period: in 2008, GDF and Suez merged and gave birth to two new companies (GDF-Suez and Suez Environment), Rhodia was merged with Solvay in 2011, Rexel and Eurotunnel group were created in 2007, and finally Edenred and Apream appears in 2010 (as spinoffs from Accor and Arcelor Mittal respectively).

Table 2: Directors' mobility

Nb of boards	Nb of directors	% of directors	Nb of directorships	% of directorships	Nb of observations	% of observations
1	990	75.40	990	54.37	4,162	56.82
2	212	16.15	424	23.28	1,528	20.86
3	63	4.80	189	10.38	784	10.70
4	28	2.13	112	6.15	420	5.73
5	15	1.14	75	4.12	326	4.45
>5	5	0.38	31	1.70	105	1.43
Total	1,313	100	1,821	100	7,325	100

3.2. Board and firm characteristics: individual and aggregate descriptive statistics

For every director, we obtain the following personal information: gender, age, nationality, tenure, past professional experience and educational background[10]. Regarding the status, we also know whether the individual is an insider, an affiliated or an independent board member. We use the standard AFEP/MEDEF code definition: independence is assumed to be compromised if the director of a company (1) is or has been, within the previous five years, a corporate executive or an employee of that company or of its affiliates, (2) is employed as an executive of another company where any of that company's executives sit on the board, (3) has been a director of the company for more than twelve years, (4) is a representative of a large blockholder (with at least 10% of stock or voting rights), (5) has a significant business relationship with that company or its affiliates (as customer, supplier, banker or auditor), (6) is related by close family ties to an executive director.

We use past or current professional experience to define expertise (see Dass et al. 2014). A director is then defined as an industry-expert if she has or has had professional experience in the industry (defined with a one-digit code) of the firm where she sits. She is defined as a financial expert if she has or has had professional experience in the insurance or financial service industry.[11]

[10] All variables are presented in the Appendix section (part 1).

[11] Note that with these definitions, there might be variation across firms for a given individual in the industry expert status, but not in the financial expert status: a director with a past experience in the banking sector is

Finally, we examine network impacts via different measures of informal connections. We first intend to check whether sharing informal networks with other board members impact on director efficiency. We suppose that a director is informally connected to the board if she shares with at least one other board member, excluding the CEO, a particular educational background. Following the sociological literature on business elites in France, as well as empirical evidence brought by Kramarz and Thesmar (2013), we pay particular attention to the two most important French institutions regarding the provision of business elites: the ENA (*Ecole Nationale d'Administration*) and the *Ecole Polytechnique* (the dominant engineer school). We consider director *i* as being (informally) connected if both *i* and (at least) one other board member both graduated from the ENA or both graduated from Polytechnique. Concerning connections with the CEO, we also focus on networks based on educational background. Once again, we consider that a director *i* is informally connected to the CEO if they both graduated from the ENA or both graduated from Polytechnique.[12]

Table 3: Descriptive statistics at the director level

Variables	Obs	Mean	Median	Std. Dev.
Woman	7,325	0.10	0	0.30
Foreigner	7,325	0.22	0	0.41
Age	7,305	58.81	60	10.08
Tenure	7,325	6.88	5	6.56
Independent	7,325	0.49	0	0.50
Insider	7,325	0.09	0	0.29
Industry Expert	7,325	0.55	1	0.50
Industry Expert Independent	7,325	0.19	0	0.39
Financial Expert	7,325	0.57	1	0.49

considered once and for all as a financial expert, this experience providing her with some general competencies transferable across companies. This is the reason why we do not introduce financial expertise in firm performance equation (1 and 1', where only individual-variant statuses can be estimated) – but only as a determinant of director intrinsic ability (equation 3).

[12] To test the robustness of our results, we use two alternative definitions for informal networks. The most restrictive definition follows the argument made by Kramarz and Thesmar (2013), by considering high-ranking civil servant network, that is former or current civil servants with high position. Note that they all graduated from the ENA or to a lesser extent the *Ecole Polytechnique*. We consider director *i* as being (informally) connected if both *i* and (at least) one other board member (or the CEO) share the same high-civil servant career (i.e. both graduated from the ENA or both graduated from *Polytechnique*, with a subsequent career as high-civil servant). The broadest definition includes graduation from the three leading French business schools (HEC-ESSEC-ESCP) or from the IEP (*Institut d'Etudes Politiques*, specialized in politic sciences, public and international affairs), together with graduation from the ENA or *Polytechnique*. Here, a director *i* is connected if she/he shares one of these four educational backgrounds with at least one other board member or the CEO (*ENA* or *Polytechnique* or *Business schools* or *IEP*). These two definitions do not alter our conclusion (results available upon request).

Directors connected with other board member(s) through X-ENA network (*BoardNet*)	7,325	0.23	0	0.42
Directors connected with CEO through educational network (*CEONET*)	7,325	0.10	0	0.30

Summary statistics for directors are presented in Table 3. The proportions of independent directors and insiders inside the boardroom are respectively 49% and 9%, with affiliated directors representing 42%. Regarding expertise, we have 55% of industry experts (and 57% of financial experts). As we stressed previously, combining expertise and independence may help reduce independent directors' informational gap. In our sample, 19% of the directors are industry expert independent. Controlling for age, gender, nationality and firm industry, the propensity to be an independent director is negatively correlated with industry expertise and non-significantly associated with financial expertise.[13] Our data therefore confirm the idea that independence definition does not favor industry expertise. Finally, directors connected with the CEO through educational network represent 10% of our observations, while connections with other board members represent 23% of observations.

Our model uses a mix of individual and aggregate (firm-level) data. Summary statistics for aggregate variables are presented in Table 4[14]. We define the following new variables: board size, supervisory board (two-tier board), Chairman/CEO separation, average board tenure, the proportion of busy directors (with at least one other seat the same year in our sample period), and the proportion of young directors aged under 45.

Table 4: Descriptive statistics for board variables

Variables	Obs	Mean	Median	Std. Dev.
Board Size	7,325	13.13	13	3.40
Supervisory Board	7,325	0.22	0	0.41
Chairman/CEO Separation (one-tier board)	7,325	0.27	0	0.44
Average tenure	7325	6.79	6.36	3.37
% of Women	7,325	0.10	0.09	0.09
% of Foreigner Directors	7,325	0.22	0.18	0.20
% of Independents	7,325	0.48	0.45	0.20
% of Insiders	7,325	0.09	0.08	0.09
% of Industry Experts	7,325	0.54	0.55	0.21
% of Industry Expert Independents	7,325	0.18	0.17	0.17

[13] We report a point estimate of -0.937 for industry expertise, with a standard error of 0.074 (clustered by director). Controlling for firm fixed effects rather than industry effects increases the point estimate to -1.129 (standard error 0.081). Full results are available upon request.

[14] For the sake of clarity, we have decided to present all the descriptive statistics on a director-firm-year basis (7,325 observations). Statistics on a firm-year basis (625 observations) are very similar (available upon request).

% of Financial Experts	7,325	0.57	0.58	0.22
% of Busy Directors	7,325	0.37	0.36	0.19
% of Young Directors	7,325	0.19	0.16	0.16

Regarding firm characteristics, we control for size (proxied by the number of employees, in log) as well as financial 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 ownership structure, with the share of outstanding shares held by significant owners (defined as owner with 5% or more of the equity capital). Regarding firm performance, we use in all our regressions two different measures, as a way to test the robustness of our results: Return On Equity (ROE) and Return On Assets (ROA). Summary statistics for firm characteristics are presented in Table 5[15].

Table 5: Descriptive statistics for firm variables

Variables	Obs	Mean	Median	Std. Dev.
Number of Employees	7,325	60,019	25,637	81,000
Leverage	7,325	0.90	0.69	1.09
R&D Investment	6,920	0.02	0	0.04
Stock Volatility	7,055	0.54	0.32	2.52
Ownership (float)	7,325	0.40	0.41	0.23
ROA	7,257	0.04	0.04	0.05
ROE	7,283	0.11	0.11	0.13

3.3. Selection bias

Our empirical strategy leads to exclude the non-connected firms (6 out of 114) as well as directors with one single observation (244 observations). These exclusions might restrict the relevance of our results. Moreover, both the estimation of coefficients on the independence status and the comparison of individual fixed effects across groups (independent and affiliated) raise selection issues. In the first case, the coefficients are estimated on directors who have some variations in the status (27% of the directorships in our sample). In the second case, we exclude directorships for which director fixed

[15] Both stock price volatility and R&D expenditures on sales are missing for some observations. To avoid reducing the sample size in regressions, we set missing values 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.

effects are not accurately estimated (38% of directorships). We discuss all these issues in Appendix (part 2, Table A.1 and A.2).

4. Empirical results

4.1. The independence status and the informational gap

Table 6 presents the results of our baseline model. Columns (1) to (4) use ROE as dependent variable, while Columns (5) to (8) use ROA. Whatever our measure of firm performance, Table 6 tells a consistent story about the relationship between independence and performance. Column (1) does not account for independent director heterogeneity, whether observable (industry expertise) or unobservable (director fixed effect). We simply account for unobservable heterogeneity at the firm level (through firm fixed effects), while controlling for firm-level and board-level time-variant characteristics. In this set-up, we do not observe any conditional correlation between the *Independent* dummy and ROE. Results dramatically change when we control for unobservable individual heterogeneity through director fixed effects (Column 2): the association between independence and performance becomes negative and slightly significant (with a corresponding point estimate of -0.011 and a standard error of 0.006).[16] The fact that independence netted out individual ability is negatively related with operating performance tends to infirm H1. It is indicative of a dark side of the independence status: while we do not directly test it, we suspect that this dark side is somehow imputable to an informational gap experienced by independent directors, as compared to affiliated board members. Another potential explanation for the negative correlation we observe between independence and performance relies on incentives. Affiliated board members have necessarily a strong involvement with the company (as a major blockholder, a business partner, a worker representative, etc.). This is not the case for independent directors, even considering meeting fees and remuneration. It is therefore possible for agents with multiple statuses to be less incentivized when serving as independent director, than when serving as affiliated – with contrasted effect on firm performance.

In order to test more directly the informational gap explanation, we finally introduce in Column (3) industry expertise, in isolation and interacted with independence. Point estimate on *Independent* more

[16] The adjusted R-square is slightly reduced (from 0.505 to 0.449), as the number of regressors significantly increase.

than doubles (from -0.011 to -0.028) and become significant at the 1% level. Independence alone, netted out expertise, is negatively related with performance: this result is more consistent with independent directors suffering from an informational gap, than with independent members lacking proper incentives. Furthermore, the coefficient on the interaction *Independent*Industry Expert* is positive (+0.038) and significant at the 1% level (standard error: 0.013). This result echoes the increasing contention that, contrary to 1990s' conventional wisdom, independence alone is not the ultimate solution or criteria regarding board composition: industry-expertise might be as important. To refine this conclusion, we test directly whether the total (net) effect of an independent expert is significantly different from 0 (and positive): the result is not conclusive. However, we find that the total effect of an independent non expert is significantly negative (point estimate=-0.027, t-value=-2.97. Full Table available upon request): the lack of information and expertise seem to impede these board members to efficiently fill their duties.

Columns (5) to (7) show a pattern of results very similar for ROA: the more we control for individual heterogeneity (through director fixed effects and industry expertise), the higher is in absolute value the coefficient on the *Independent* dummy (from 0.001 to 0.004 and 0.008, with rather stable standard errors of respectively 0.002, 0.002 and 0.003). We also exhibit a positive and significant (at the 5% level) conditional correlation between ROA and the interaction term *Independent*Industry Expert*, with a point estimate of 0.008 (standard error of 0.004).

With respect to board-level variables, we find consistent results: the coefficient on the proportion of independent directors is negative albeit non-significant at conventional levels in most specifications, while the share of industry expert independent directors is positively correlated with firm performance.

We test the robustness of our results in different manners. In Columns (4) and (8), we introduce director-year fixed effects (instead of director and year fixed effects). In this case, the estimation of coefficients on independence only rests on variation of statuses across companies (rather than inter-firm *and* intra-firm variation). It takes also into account temporal changes in directors' ability and avoids any temporal spurious correlation (simultaneity issue). As previously noted, we excluded from other regressions (Columns 1, 2, 3, 5, 6 and 7) individuals who appear only once over our sample period (as our empirical model cannot in this case separate the individual fixed effect and the residual). To be coherent, we only keep in Columns (4) and (8) individuals who sit in at least two boards over a given year: for the others, our model is not able to distinguish the director-year fixed effect from the error term. We observe that most of our coefficients are fairly stable (for ROE, the coefficient on the *Independent* dummy goes from -0.028 in Column (3) to -0.032 in Column (4), and for ROA from -0.008 in Column (7) to -0.009 in Column (8)). Finally, our results are robust to the elimination of all

the observations corresponding to the first year of the directorship (as the influence of newly appointed directors might not be significant during the first months), as well as to the elimination of all the observations corresponding to directors who stay less than three consecutive years in the same company (for a similar approach, see Bertrand and Schoar 2003).[17]

Table 6: Independence status and operating performance

Variables	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROA	(6) ROA	(7) ROA	(8) ROA
Independent	**-0.002**	**-0.011***	**-0.028*****	**-0.032*****	**-0.001**	**-0.004****	**-0.008****	**-0.009*****
	(0.005)	(0.006)	(0.009)	(0.010)	(0.002)	(0.002)	(0.003)	(0.003)
Insider	0.011	0.003	0.007	0.023	0.004	0.001	0.002	0.007*
	(0.011)	(0.013)	(0.014)	(0.015)	(0.005)	(0.005)	(0.005)	(0.004)
Industry Expert			-0.008	-0.012			-0.002	-0.003
			(0.008)	(0.010)			(0.003)	(0.003)
Industry			**0.038*****	**0.040*****			**0.008****	**0.008****
Expert*Independent			(0.013)	(0.013)			(0.004)	(0.004)
% of Independents	-0.026	-0.024	-0.178*	-0.326***	-0.008	-0.007	-0.038	-0.079***
	(0.055)	(0.067)	(0.096)	(0.090)	(0.018)	(0.020)	(0.026)	(0.024)
% of Insiders	0.138	0.136	0.199	0.448***	0.048	0.032	0.045	0.104**
	(0.122)	(0.131)	(0.143)	(0.152)	(0.052)	(0.050)	(0.051)	(0.042)
% of Industry Experts			-0.065	-0.125			-0.014	-0.043*
			(0.087)	(0.087)			(0.025)	(0.023)
% of Industry Expert Independents			0.389***	0.563***			0.075**	0.110***
			(0.121)	(0.121)			(0.033)	(0.032)
Tenure (log)	0.000	-0.000	0.000	-0.002	0.001	0.001	0.001	-0.000
	(0.002)	(0.003)	(0.003)	(0.004)	(0.000)	(0.001)	(0.001)	(0.001)
Chairman/CEO Separation	0.011	0.010	0.009	0.004	0.003	0.003	0.002	0.001
	(0.016)	(0.016)	(0.016)	(0.019)	(0.004)	(0.004)	(0.004)	(0.004)
Supervisory Board	0.010	0.020	0.017	-0.006	-0.003	-0.002	-0.001	-0.004
	(0.041)	(0.040)	(0.041)	(0.029)	(0.014)	(0.013)	(0.013)	(0.009)
Board Size	0.003	0.002	0.002	0.003	0.002	0.002	0.002	0.002**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
% of Women	-0.199**	-0.199**	-0.166*	-0.231**	-0.054**	-0.047	-0.042	-0.056**
	(0.090)	(0.096)	(0.096)	(0.102)	(0.027)	(0.029)	(0.029)	(0.028)
% of Foreigners	0.015	0.008	-0.036	-0.072	-0.025	-0.030	-0.039	-0.042*
	(0.095)	(0.103)	(0.100)	(0.090)	(0.031)	(0.030)	(0.030)	(0.022)
% of Busy Directors	0.040	0.055	0.047	0.062	0.014	0.015	0.013	0.027*
	(0.048)	(0.052)	(0.053)	(0.057)	(0.015)	(0.015)	(0.016)	(0.016)
% of Young Directors	-0.172***	-0.180***	-0.178***	-0.238***	-0.040**	-0.037**	-0.036**	-0.052***
	(0.060)	(0.063)	(0.062)	(0.069)	(0.016)	(0.018)	(0.018)	(0.018)
Average Board Tenure (log)	0.002	-0.003	-0.003	-0.040*	0.003	0.005	0.005	-0.005
	(0.020)	(0.022)	(0.023)	(0.021)	(0.006)	(0.006)	(0.006)	(0.005)
Number of Employees (in log)	0.005	0.007	0.015	0.008	0.001	0.001	0.002	-0.001
	(0.026)	(0.028)	(0.028)	(0.028)	(0.008)	(0.008)	(0.008)	(0.008)
Leverage	-0.039	-0.039	-0.039	-0.004	-0.007**	-0.007**	-0.007**	-0.007**

[17] Results availabe upon request.

	(0.032)	(0.036)	(0.035)	(0.037)	(0.003)	(0.004)	(0.003)	(0.003)
R&D on Sales	-0.653***	-0.644***	-0.657***	-0.692*	-0.246**	-0.232**	-0.235**	-0.265***
	(0.209)	(0.223)	(0.221)	(0.377)	(0.110)	(0.116)	(0.116)	(0.102)
Stock Volatility	0.002	0.002	0.002	-0.001	0.001	0.001	0.001	0.001*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Ownership	-0.097	-0.094	-0.077	-0.080	0.010	0.006	0.009	0.004
	(0.068)	(0.070)	(0.067)	(0.074)	(0.023)	(0.023)	(0.024)	(0.020)
Observations	7,283	7,283	7,283	2,589	7,257	7,257	7,257	2,585
Nb of firms	620	620	620	586	619	619	619	586
R^2-adj	0.505	0.449	0.463	0.523	0.655	0.618	0.622	0.710
Director fixed effect	No	Yes	Yes	No	No	Yes	Yes	No
Director-year fixed effect	No	No	No	Yes	No	No	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	No	Yes	Yes	Yes	No

Notes: (1) Dependent variable: Return On Equity (columns 1 to 4) or Return On Assets (columns 5 to 8). (2) Directors' controls include: the statuses (independent, insider, industry specific expert) and the interaction term (industry expert*independent), tenure (in log) (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, average board tenure (in log), a dummy that takes value 1 in the case of a two-tier board (Supervisory Board) and a dummy that takes value 1 in case of separation between CEO and chairman positions in a one tier board (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) Column 1 includes firm and year fixed effects. Columns 2 and 3 include director, firm and year fixed effects. Column 4 includes firm and director-year fixed effects. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1

So far, our results are consistent with the informational gap story. We may ask whether the extent of this informational gap depends on board organization. We investigate this point, by introducing in our baseline model two supplementary interaction terms: being independent in a dualistic structure and being independent in board of directors with Chairman/CEO separation (the reference is then being independent in a one-tier structure with no separation). Results are presented in Table 7, Columns (1) and (2) (for ROE and ROA respectively). We observe that the separation principle in a one-tier board appears favorable to independent board members, with a positive and significant coefficient on the interaction term *Independent*Separation* for ROE. In contrast, we do not observe any statistical correlation between independence in a two-tier structure and operational performance. These results suggest that supervisory boards are not especially advantageous for independent board members, as it goes with a high level of information asymmetry.

Table 7: Independence status, board structure and operating performance

Variables	(1) ROE	(2) ROA
Independent	-0.033***	-0.008***
	(0.009)	(0.003)
Insider	0.004	0.002
	(0.014)	(0.005)
Industry Expert	-0.007	-0.002
	(0.008)	(0.003)
Industry Expert*Independent	0.037***	0.009**
	(0.013)	(0.004)
Independent*Supervisory Board	0.002	-0.005
	(0.012)	(0.004)
Independent*Chairman/CEO Separation	0.018**	0.003
	(0.007)	(0.002)
Observations	7,283	7,257
Nb of firms	620	619
R^2-adj	0.463	0.622
Firm and board controls	Yes	Yes
Director fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (columns 1) or Return On Assets (columns 2). (2) Directors' controls include: the statuses (independent, insider, industry expert), the interaction term (industry expert*independent), tenure (in log), the board structure interaction term (being independent in supervisory board and being independent in a board with Chairman/CEO separation). (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 45, average board tenure (in log), a dummy that takes value 1 in the case of a two-tier board (Supervisory Board), and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All regressions include director, firm and year dummies. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1

We finally examine the potential role of informal connections (defined with educational background). Results are presented in Table 8. We simultaneously test the role of informal connections with the CEO and with other board members. To examine the role of informal connections with the CEO, we introduce two new regressors: a dummy that takes value 1 if the director belongs to the CEO network (*CEONET*) and an interaction term *Independent*CEONET*. Connections with other directors are captured with two more variables: a dummy that takes value 1 if the director is connected with at least

one other board member (*BoardNet*), and an interaction term *Independent*BoardNet*. Column (1) is for ROE and Column (3) for ROA. We report a significant and positive coefficient for *Independent*BoardNet* with both measures of performance: sharing informal network with other board members appears to increase independent directors' effectiveness. In contrast, we do not have evidence of any statistical relationships between independent director efficiency and informal connection with the CEO. A possible reason has been previously exposed: while sharing social network with the CEO may increase the extent of firm-specific information sharing (thereby implying a positive relationship with operating performance), it also strengthens potential conflict of interests (implying a negative association with performance). Our (non) result might suggest that these effects offset each other.

In Column (2) and (4), we test whether the importance of informal connections depends on board structure. We introduce two regressors indicating whether the independent board member operates in a one-tier board with separation or in a supervisory board (the reference being a unitary board without separation), and interact them with *CEONET* on one side, and with *BoardNet* on the other side. For instance, the triple interaction term *Independent* BoardNet*two-tier Board* measures the effect of sharing informal network (with other board members) for an independent director in a supervisory board. Actually, we observe that for an independent director, sitting in a supervisory board annuls the positive effect of informal connection (as compared to a unitary board structure): the coefficients on *Independent* BoardNet*two-tier Board* is negative and significant (at the 5% level) both with ROE and ROA (-0.040 and -0.016). This result is consistent with the idea that connections primarily matter when the influence of top executives (and the CEO in particular) is important, that is in a unitary structure.

Table 8: Independence status, informal networks and operating performance

VARIABLES	(1) ROE	(2) ROE	(3) ROA	(4) ROA
Independent	-0.034***	-0.044***	-0.010***	-0.012***
	(0.010)	(0.011)	(0.003)	(0.004)
Insider	0.005	0.001	0.002	0.001
	(0.014)	(0.014)	(0.005)	(0.005)
Industry Expert	-0.008	-0.008	-0.002	-0.002
	(0.009)	(0.009)	(0.003)	(0.003)
Industry Expert* Independent	0.039***	0.039***	0.009**	0.009**
	(0.013)	(0.013)	(0.004)	(0.004)
Independent in One-tier Board with Separation		0.021***		0.005**
		(0.008)		(0.002)
Independent in Supervisory Board		0.013		-0.000
		(0.012)		(0.004)
Director in the CEO network (CEONET)	0.007	0.005	0.002	0.001
	(0.012)	(0.012)	(0.003)	(0.003)
Independent*CEONET	-0.016	-0.025	-0.003	-0.005
	(0.012)	(0.018)	(0.003)	(0.004)
Independent*CEONET*One-tier*Separation		0.022		0.003
		(0.030)		(0.005)
Independent*CEONET*Supervisory Board		0.023		0.009
		(0.036)		(0.008)
Director from the X-ENA network (BoardNet)	-0.020*	-0.019*	-0.003	-0.003
	(0.012)	(0.012)	(0.002)	(0.002)
Independent*BoardNet	0.021**	0.034***	0.008***	0.012***
	(0.008)	(0.011)	(0.002)	(0.003)
Independent *BoardNet*One-tier* Separation		-0.017		-0.005
		(0.011)		(0.004)
Independent *BoardNet*Two-tier Board		-0.040**		-0.016**
		(0.020)		(0.008)
Observations	7,283	7,283	7,257	7,257
Nb of firms	620	620	619	619
R^2-adj	0.463	0.463	0.622	0.622
Director fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Return On Equity (columns 1 to 2) or Return On Assets (columns 3 to 4). (2) Director controls include: the statuses (independent, insider, industry expert), the interaction term (industry expert independent), the board structure interaction term (being independent in supervisory board and being independent in a one-tier board with Chairman/CEO separation) and the network variables (directors belonging to the same educational network - X-ENA- as the CEO –CEONET-, as other board members -BoardNet) with the interaction term (independent, network connections and board structure), tenure (3) Board controls include: % of independent directors, % of insiders, % of industry expert directors, % of industry expert independent, board size, % of women, % of foreigners, % of busy directors (with at least one other directorship the same year), % of young directors aged less than 50, average board tenure, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board)and a dummy that takes value 1 in case of the separation between CEO and

chairman position (0 otherwise). (4) Firm controls include: size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership. (5) All models include director, firm and year dummies. (6) Robust standard errors, clustered on firm by year, in parentheses. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Summing up, we have tested a model that uses individual inter- (and to a lesser extent intra-) firm variation in status to estimate the relationship between independence and firm performance, netted out personal intrinsic ability and other time-invariant characteristics. We report evidence of a negative conditional correlation between independence and operating performance that was unobservable when individual heterogeneity was not accounted for. This result is robust to the definition of performance, as well as to a more stringent definition of individual identifiers (director-year fixed effects instead of director fixed effects) and to different methods of standard errors correction. Overall, our findings support the view that, in the French corporate system, the position of independent is a difficult one, fraught with a strong informational gap. We further evaluate the propensity of a set of individual and board-level characteristics to moderate or to magnify the extent of this informational gap. We report evidence that industry expertise significantly helps independent directors to bridge the informational gap. We reach a similar conclusion for a split in CEO and chairman positions, as well as for informal connections with other board members in a unitary board structure.

4.2. Independent directors' selection

Our results provide evidence that the status of independent is associated with a lower level of operating performance *only once* individual time-invariant heterogeneity is taken into account through director fixed effects. This evidence, in turn, suggests that independent directors have specific attributes positively related with performance. Figures 2 and 3 below confirm this idea, by plotting the distribution of fitted individual fixed effects for independent and non-independent directors derived from the full model (Table 8, Columns 2 and 4), with ROE (fig. 2) and ROA (fig. 3). As detailed in the Appendix (part 2), we only consider individual fixed effects that are accurately estimated. If anything, both figures indicate that fixed effects distribution for independent board members is left-truncated. However, this observation is not sufficient to confirm that independent directors' appointment is characterized by a selection process based on intrinsic ability – in this case, a reputation-based selection process. Estimated fixed effects capture all time-invariant individual attributes, including intrinsic ability, and are influenced by some observable characteristics like gender, financial expertise, etc., some of which are likely to be correlated with operating performance. Regarding these characteristics, independent director and non-independent director populations may significantly differ due to the director labor market structure for independent directors. In this case, the distribution

pattern of individual fixed effect would be driven by other observable director attributes more than by intrinsic ability or talent.

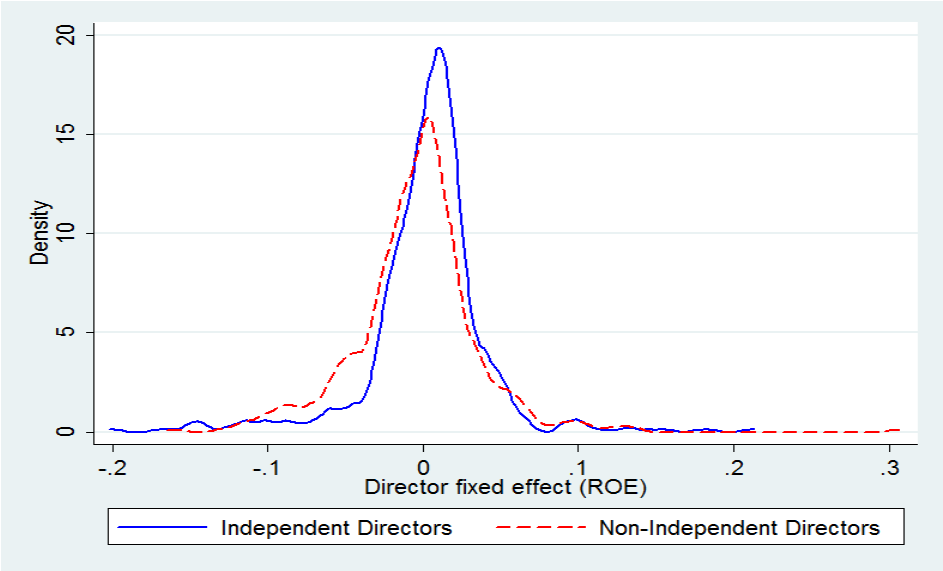

Figure 2: Director fixed effects' distribution (ROE)

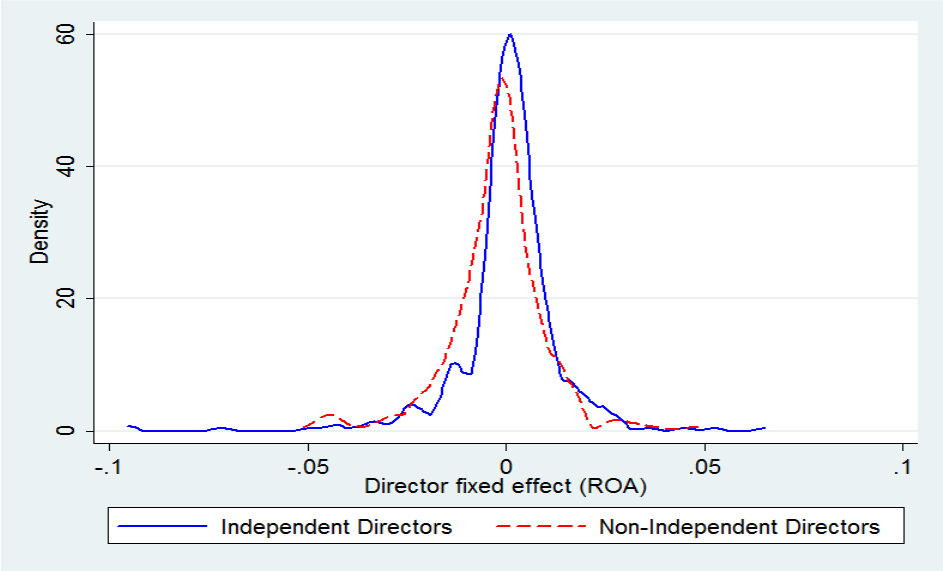

Figure 3: Director fixed effects' distribution (ROA)

To refine our conclusion, we perform multivariate quantile estimations, where fixed effects are regressed on the independent and insider statuses, gender, nationality, expertise (industry and financial), a dummy that takes value 1 if the individual has more than one directorship over the period[18] and firm fixed effects[19]. We choose the full model with independence, industry expertise,

[18] We introduce this dummy to avoid having a spurious relationship between the independent status and director ability. Indeed, we suspect (and test the fact) that the most talented directors have a higher propensity to be appointed inside a boardroom as independent directors. At the same time, these directors are likely to have a good external reputation, and therefore to be appointed in multiple boards over the period (see Masulis and Mobbs 2011 for a similar analysis about insider directors). Due to our estimation methodology, these latter directors are more likely to have their fixed effect accurately estimated than directors with a single-directorship.

board structure and education network variables (Columns 2 and 4, Table 8) to extract directors' fixed effects, as it allows cleaning any board-related effect. Results are presented in Table 9, panel A for ROE and panel B for ROA. In this Table, the lowest deciles put together directors with the lowest ability to perform their duties whereas the highest deciles represent the most talented directors.

We observe that, whatever the measure of performance, there is a positive conditional correlation between individual fixed effects and the independent status that diminishes when climbing the deciles. Put differently, each decile of the independent directors' distribution is on average more "talented" (higher individual intrinsic ability or director fixed effect) than the corresponding decile of the affiliated directors' distribution, and this difference is decreasing for the highest deciles. For ROE, the point estimate is 0.016 for the first decile and 0.007 for the last decile, with rather similar standard errors (0.003 and 0.002). The same pattern is observable for ROA, with a coefficient that goes from to 0.005 to 0.003, and a stable standard error (0.001). Clearly, this decrease in point estimates along the distribution is suggestive of a left-truncation for the distribution of independent directors' ability, as compared to the distribution for affiliated board members. This result, consistent with a selection process driven by reputation, corroborates H3. As a robustness check, we re-run our quantile regressions keeping all directorships: the results are consistent (see Appendix, Table A.3).

[19] Firm fixed effects enable to control for prestige or firm-reputation effects (see Masulis and Mobbs 2014). The most talented independent directors may have a greater incentive to work for the most visible and prestigious firms. However, our main question is to investigate whether within the same firm, there is a significant difference between independent and non-independent directors in terms of intrinsic ability.

Table 9: Director fixed effects and independence (quantile regressions)

Panel A: ROE

	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.016***	0.011***	0.010***	0.009***	0.009***	0.008***	0.007***	0.007***	0.007***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Insider	0.018***	0.013***	0.015***	0.011***	0.010***	0.011***	0.011***	0.018***	0.018***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Industry Expert	0.001	-0.001	-0.000	0.000	-0.000	-0.001	-0.002	-0.003	-0.003
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Woman	-0.006	-0.006	0.001	0.004	0.003	0.004	0.007**	0.008*	0.011**
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)
Foreigner	0.002	-0.001	0.002	0.002	0.001	-0.002	-0.003	-0.004	-0.002
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Age	0.003	0.010	0.011	-0.001	-0.006	-0.018	-0.015	-0.014	-0.021*
	(0.014)	(0.012)	(0.012)	(0.011)	(0.012)	(0.011)	(0.011)	(0.012)	(0.013)
Financial Expert	0.003	0.004	0.003	-0.000	-0.001	-0.002	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Multi-directorships	0.009**	0.008***	0.007***	0.006***	0.006***	0.002	-0.001	-0.005**	-0.008***
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Observations	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: ROA

	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.005***	0.004***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Insider	0.004**	0.003**	0.002**	0.002**	0.002***	0.002**	0.003***	0.004***	0.005***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry Expert	-0.001	-0.001	0.000	0.001	0.001	0.000	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Woman	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.005**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Foreigner	0.003***	0.002**	0.002*	0.002*	0.002**	0.002**	0.001	0.002**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.007	0.005	0.003	-0.003	-0.003	-0.005*	-0.004	-0.004	-0.005
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Financial Expert	0.001	0.001	0.001	0.001	-0.000	-0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Multi-directorships	0.004***	0.003***	0.003***	0.002**	0.001*	0.001	-0.001	-0.002**	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,079	1,079	1,079	1,079	1,079	1,079	1,079	1,079	1,079
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Director fixed effect computed with Return On Equity (Panel A) or Return On Assets (Panel B). (2) Director controls include: the statuses (independent, insider, industry expert, financial expert), the age, the gender and foreigner dummies, as well as a dummy for multi-directorships (3) All models include firm fixed effects. (4) Robust standard errors in parentheses. (5) Significance: *** p<0.01, ** p<0.05, * p<0.1.

Interestingly, we note that the insider status is also positively related with individual fixed effect. It indicates that, in contrast with affiliated directors, a selection process based on ability is also at stake concerning insiders: it confirms that individuals that become top executives are rather high ability agents, able to manage large and complex companies. For women, from the 70th quantile, at least in the case of ROE, director fixed effects are slightly higher than male director fixed effects, suggesting a positive selection effect for female directors (maybe due to a rather low demand relative to supply[20]). For foreigners, director fixed effects computed with ROA are on average slightly higher than for the French directors, suggesting that firms selects abroad rather high ability individuals. For the multi-directorships directors, the results show both a left-truncated distribution (significant positive coefficients for the lowest deciles) and a right-truncation (negative significant coefficients for the highest deciles). We suspect that the left-truncation occurs as a result of a reputation-based selection process, while the right-truncation occurs as the most talented individuals might not share their time in multiple boards or may be an executive in another firm.

Overall, our results are consistent with the idea that independent directors are (positively) selected on the basis of their individual intrinsic ability, as the appointment process is under strong scrutiny by shareholders (reputation-based selection).

5. Endogeneity issues

In this paper, we use an AKM-style empirical model to identify three separate factors of firm operating performance, in addition to traditional time-varying covariates (see model 1): a firm component δ_j , a director component μ_i and a status component $Independent_{i,j,t}$ (and others such as industry-expertise). The firm component is a time-invariant factor of performance, homogenous across directors. Likewise, the director component is a time-invariant performance factor, homogenous across companies. The status component is a time-invariant performance factor, homogenous across directors and firms. For these parameters of interest to be correctly estimated, the three following orthogonality conditions should hold:

$$\mathrm{E}\left[\delta_j\,;\ \varepsilon_{i,j,t}\right] = 0 \ \ \forall j$$

$$\mathrm{E}\left[\mu_i\,;\ \varepsilon_{i,j,t}\right] = 0 \ \forall i$$

$$\mathrm{E}\left[Independent_{i,j,t}\,;\ \varepsilon_{i,j,t}\right] = 0 \ \forall i, \forall j$$

[20] Women represent 15% of directors belonging to the 70th and higher quantiles whereas they represent only 10% in the rest of the director population.

The first two of these conditions rest on one key identifying assumption, namely an "exogenous mobility" assumption (Card et al. 2013). Intuitively, if the data-generating process is such that some directors bring more value to certain types of firm, then our empirical strategy will fail to capture time-invariant firm and director components. In this case, the additive separability of firm and director effects should be abandoned: the error term $\varepsilon_{i,j,t}$ would consist of two distinct components, a match component $\varphi_{jI(j,t)}$ and a pure error term $r_{j,t}$, so that $\varepsilon_{i,j,t} = \varphi_{jI(j,t)} + r_{i,j,t.}$ The match component represents an idiosyncratic performance effect brought by director *i* at firm *j*, relative to the baseline level $\mu_i + \delta_j$.

We perform two distinct tests of the additive separability assumption, following Card, Heining, and Kline (2013) and Flabbi et al. (2013).

A primary convenient way to assess the soundness of an empirical model is to look at residuals: high residuals, specifically related to some covariates, are a first indication that something goes wrong. In our case, we are mainly interested in the relationships between residuals and fitted (firm and director) fixed effects when additive separability is assumed. Using our baseline regression, we only keep observations for which individual fixed effects are correctly estimated and trim these fixed effects at the 1% and 99% levels. We then sort directors and firms into deciles according to their fitted fixed effects, and cross these deciles to obtain 100 groups or matches. Figures 4 and 5 present the average residuals for each of these groups $\overline{\varepsilon_{i,j,t}}$. If our additive separable model is erroneous, we expect to observe high values of (mean) residuals being concentrated on particular matches. We do not have evidence of such pattern. Looking at ROE first (figure 4), we see that in only 8 times out of 100 are residuals greater than 0.02 (in absolute value), less than half of the standard deviation of estimated fixed effects. Moreover, important deviations do not appear to be concentrated on particular matches; they rather seem to be randomly disseminated over the all distribution. The same comment applies for ROA (figure 5), with deviations greater than 0.005 (in absolute value) in only 14 cases out of 100, and no systemic pattern in their occurrence.

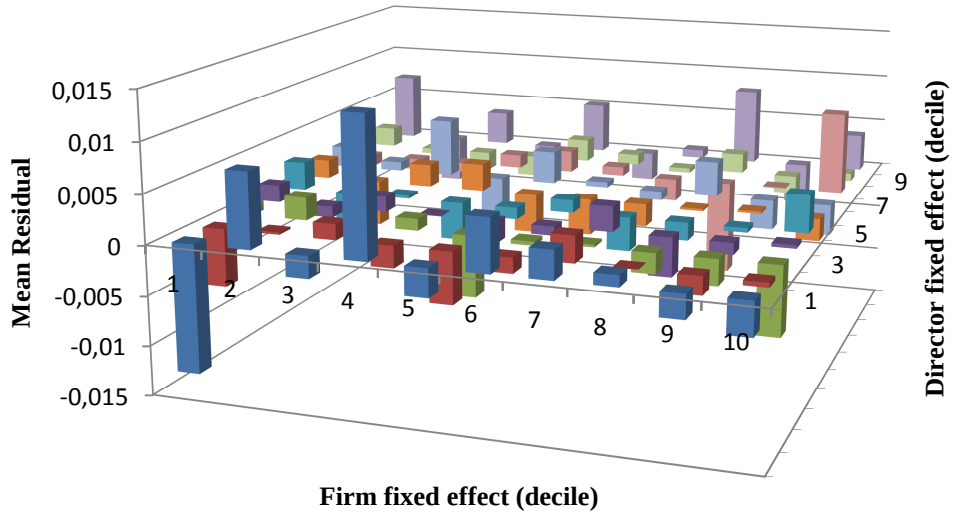

Figure 4: Mean residuals by director and firm fixed effect deciles (ROE)

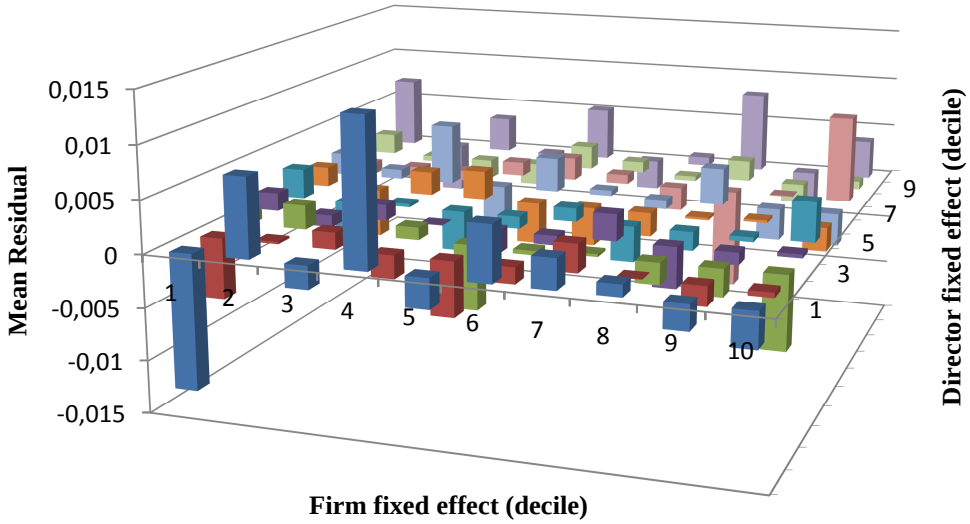

Figure 5: Mean residuals by director and firm fixed effect deciles (ROA)

As a second test we fit a fully saturated model that includes a separate dummy for each director-firm match. Does this saturated model outperform our baseline, additive separable model? The answer is negative. Estimating our baseline model (Columns 2 in Table 8, for ROE) with director-firm fixed effects (instead of directors fixed effects and firm fixed effects) only increases the R-square by 0.019 (from 0.571 to 0.590), and slightly decreases the adjusted R-square (from 0.463 to 0.453). In comparison, the inclusion of firm and director fixed effects increases R-square by 0.432. Evolutions in

R-square are of the same magnitude regarding ROA. These results clearly suggest that omitting the match component does not undermine the explicative power of our model.

The last orthogonality condition, namely $[Independent_{i,j,t};\ \varepsilon_{j,t}] = 0$, makes sure that the fitted coefficient on *Independent* actually measures the net effect of the independence status on performance, irrespective of firm and director identifiers. A possible violation of this condition will occur in case of so called 'dynamic endogeneity', that is if firms typically hire more (or less) independent directors (with more or less intrinsic ability) depending on their past or current performance (see Wintoki et al. 2012). We perform two distinct tests to refute the validity of the dynamic endogeneity assumption: each of these tests consider the relationship between firm performance and the independence status.

A first possible test for the existence of dynamic endogeneity has been performed in section 5, with the introduction of director-year fixed effects (instead of director fixed effects). We observed in Table 6, Columns (4) and (8) that the coefficients on *Independent* are not reduced: this means that the effect of *Independent* is netted out personal ability *and* business cycle effects that may impact firm performance.

A second, more direct test, consists in observing whether there is a relationship between firm performance in *t-1* and the probability P_{ijt} for a director *i* to be appointed in firm *j* in year *t* as independent (rather than as a non-independent director). A significant correlation would strongly suggest the presence of dynamic endogeneity. In Column (1) (resp. 2) in Table 10 we run a logit regression of P_{ijt} on ROE (resp. ROA) in *t-1* and a set of firm (board and financial variables) and individual (age, gender, nationality, industry expertise and financial expertise) covariates. Point estimates on lagged performance are not significant at conventional levels.

In Columns (3) and (3'), we split the independent category between high ability independent directors and low ability independent directors, and run a multinomial logit regression with ROE as dependent variable. We do not have evidence of firms appointing more high ability independent board members when performance is low or the opposite (low ability when performance is high). The same is true when using ROA instead of ROE (Columns 4 and 4'). In light of these results, we believe that dynamic endogeneity is unlikely to drive our estimates.

Table 10: Dynamic endogeneity, independent director selection and operating performance

VARIABLES	(1) Independent	(2) Independent	(3) Low ability independent	(3') High ability independent	(4) Low ability independent	(4') High ability independent
Lagged ROE	-0.327		-0.364	-0.272		
	(0.534)		(0.508)	(0.765)		
Lagged ROA		0.215			0.916	-0.511
		(1.611)			(1.967)	(2.066)
Age	0.070***	0.070***	0.077***	0.063***	0.078***	0.063***
	(0.013)	(0.013)	(0.014)	(0.015)	(0.014)	(0.015)
Woman	0.945***	0.942***	1.027***	0.907***	1.025***	0.897***
	(0.281)	(0.281)	(0.341)	(0.300)	(0.343)	(0.303)
Foreigner	0.406	0.422	0.750**	-0.034	0.763**	-0.018
	(0.284)	(0.286)	(0.308)	(0.321)	(0.308)	(0.323)
Industry Expertise	-1.512***	-1.512***	-1.612***	-1.421***	-1.613***	-1.422***
	(0.215)	(0.214)	(0.248)	(0.286)	(0.244)	(0.286)
Financial Expertise	-0.042	-0.028	0.007	-0.102	0.032	-0.101
	(0.198)	(0.200)	(0.239)	(0.236)	(0.241)	(0.240)
Observations	620	620	620		620	
R^2-adj	0.237	0.236	0.186		0.186	
Firm fixed effects	Yes	Yes	Yes		Yes	

Notes: (1) Dependent variables: a dummy that takes value 1 if director *i* is appointed as independent (0 otherwise) in Columns 1 and 2, a variable that takes value 1 if director *i* is appointed as a low ability director, 2 as a high ability director, and 0 otherwise (columns 3 and 4). (2) Director controls include: age, gender and foreigner dummies, financial and industry expertise (3) Board controls include: lagged % of independent directors, lagged % of insiders, lagged % of industry expert directors, lagged board size, lagged % of women, lagged % of foreigners, lagged % of busy directors (with at least one other directorship the same year), lagged % of young directors aged less than 45, a dummy that takes value 1 in the case of a two-tier board (Supervisory Board), and a dummy that takes value 1 in case of separation between CEO and chairman positions (0 otherwise). (4) Firm controls includes: lagged ROE or ROA, size (number of employees, in log), financial leverage, R&D on sales, stock price volatility, % of float ownership (5) Robust standard errors, clustered on director, in parentheses. (6) Method: logit (1 and 2) and multi-nominal logit (3 and 4) regressions. (7) Significance: *** p<0.01, ** p<0.05, * p<0.1.

6. Conclusion

Our study brings new insights into the governance/firm performance context. Most of the papers blame so-called "dynamic endogeneity" (i.e. the appointment of independent directors when the firm experiences poor performance) to explain the lack of strong results regarding board independence and performance. We highlight here another reason: the heterogeneity of independent directors in terms of board-related attributes and in terms of intrinsic ability, whereas we observe a small influence of dynamic endogeneity in our data and analysis.

Our empirical strategy consists in applying the AKM statistical framework to matched director-firm data so as to separately identify firm (fixed) effects, director (fixed) effects, and status effects (e.g. independence and expertise) in firm performance equation. To our knowledge, this is the first systematic application of the AKM approach, initially developed in labor economics, to the board/performance context. We obtain three main results, on a representative sample of large non-financial French listed companies (the SBF120) for the 2006-2011 period.

First, we find evidence that independence, netted out individual heterogeneity (both observable and unobservable), is negatively correlated with operating performance. This result is robust to alternative definitions of fixed effects (director-year or firm-director effects) or corrections of standard errors (firm-year *versus* two-ways firm-year and director clusterisation), as well as to sample variations (elimination of short term directorships, for instance). We interpret this observation as an (indirect) evidence of an informational gap experienced by independent board members, as CEOs may be reluctant to share firm-specific information.

Second, we identify a set of (board-related) attributes that may help independent directors to reduce the magnitude of this informational gap. In particular, we find that industry-expertise, while not so common among independent board members, is a key ingredient in this perspective, just like informal connections with other board members. In the same vein, we provide evidence that the separation of Chairman and CEO positions in a one-tier structure increases independent directors' effectiveness.

Third, while independent directors appears to be less informed, we show that they are also probably better selected than affiliated board members, at least in term of individual intrinsic ability. We derive this conclusion from a careful comparison of fixed effect distributions across both groups of directors: netted out observable individual attributes and firm (unobservable) heterogeneity, we find that the independent directorship fixed effects distribution is left-truncated. We argue that this left truncation occurs as a result of a reputation-based selection process that comes to play in the appointment of independent board members. We are not aware of any other papers in corporate finance using individual fixed effects to compare distributions across groups and to derive results on selection.

At last, our empirical investigation suggests that the main issue in current corporate governance is board functioning rather than selection. From a policy point of view, this consideration paves the way for a reflection on regulatory mechanisms able to narrow the informational gap. Three comes in mind: industry expertise requirements, information disclosure (albeit it has gained considerable importance over the last two decades, at least in France) and the separation between chairman and CEO positions

in a one-tier board system (that we found positively correlated with independent director effectiveness).

To conclude, we wish to underline that our results are not inconsistent with an equilibrium model, once taken into account that large companies appoint independent board members (not only but) primarily to fulfill regulatory or market requirements, at least in the U.S., the U.K or France. In this context, independent board members are better selected than affiliated ones, as shareholders have a set of observable attributes to assess *ex ante* the ability of these directors. Reputation-based selection is but one part of the story, as it stops at the gate of the boardroom: beyond, shareholders do not have direct, visible signs to assess board functioning adequacy. And as highlighted by several studies, firm-specific information retention by CEOs is a rational (game-theoretic) equilibrium (Adams and Ferreira 2007). Now, given our result on industry expertise and informal network affiliation, the key questions are the following: how expertise and connection currently matter in the director selection process and why do not all firms appoint expert and connected independent directors? Different answers might be provided. It is possible that shareholders are not still aware that these criteria have substantial impact regarding independent director efficiency (with a focus by regulators on financial expertise), or that finding high ability independent directors with expertise and connection is a costly process (narrowness of the pool of potential directors and increase in the demand). It is also possible that the appointment of such independent board members is part of strategic behavior by top executives to circumvent regulatory or market requirements. At this stage, we are not able to discriminate between these different hypotheses; at least, it calls for a careful examination of the characteristics of firms and boards that appoint expert or connected independent members.

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APPENDIX

1. Variables

Panel A	Director Variables
Directorship	Triplet (director; firm; status)
Woman	Dummy equals to 1 if the director is a female
Foreigner	Dummy equals to 1 if the director is not a French citizen
Age	Director's age in year
Tenure	Number of years the director has seated in the boardroom
Independent	Dummy equals to 1 if the director complies with the AFEP/MEDEF definition (Corporate Governance code) of independent director.
Insider	Dummy equals to 1 if the director is an executive of the firm
Industry Expert	Dummy equals to 1 if the director is or has been employed in the same industry as the firm where she sits in (one-digit code)
Industry Expert Independent	Dummy equals to 1 if the director is independent regarding AFEP/MEDEF criteria and is or has been employed in the same industry as the firm where she sits in (one-digit code)
Financial Expert	Dummy equals to 1 if the director is or has been employed in the financial industry
Directors connected with other board member(s) through X-ENA network (BoardNet)	Dummy equals to 1 if both the director and at least one other director graduated from ENA or graduated from Ecole Polytechnique
Directors connected with CEO through educational network (CEONET)	Dummy equals to 1 1 if the director belongs to the CEO network (i.e. they share one of these two types of graduation: ENA, Ecole Polytechnique)
Multi-directorships	Dummy equals to 1 if the director has at least one other directorship over the period in the SBF120 index

Panel B	Board Variables
Board Size	Size of the board
Average Board Tenure	Average tenure of the board members
Supervisory Board	Dummy equals to 1 if the board is a two-tier board
Chairman/CEO Separation	Dummy equals to 1 if the board is a one-tier board with a separation between the Chief Executive and the Chairman of the board positions
% of Independents	Proportion of independent directors, excluding the director of interest (in the regressions only)
% of Insiders	Proportion of inside directors, excluding the director of interest (in the regressions only)
% of Industry Experts	Proportion of industry expert directors, excluding the director of interest (in the regressions only)

% of Industry Expert Independents	Proportion of industry expert independent directors, excluding the director of interest (in the regressions only)
% of Financial Experts	Proportion of financial expert directors, excluding the director of interest (in the regressions only)
% of Women	Proportion of female directors
% of Foreigner s	Proportion of non-French directors
% of Busy Directors	Proportion of directors who have at least one other directorship during the same year in the SBF120 index
% of Young Directors	Proportion of directors who are less than 45 years old

Panel C	**Firm Variables**
Number of Employees	Number of employees
Leverage	equals to total debt over total equity
R&D investment	equals to the ratio of R&D expenditures over total sales
Stock volatility	equals to the standard deviation of the monthly stock returns over the previous 50 months
Ownership (float)	equals to the share of outstanding shares held by significant owners (defined as owners with 5% or more of the equity capital).
ROA (Return on Assets)	equals to the ratio between EBITDA (Earnings before interest, taxes, depreciation and amortization) and beginning-year total assets
ROE (Return on Equity)	equals to the ratio between net income and total equity

2. Selection bias

Our identification strategy necessitates excluding non-connected firms and directors, as well as directors who have a single observation in the sample period. The comparison between connected and unconnected firms shows that for financial variables, disconnected firms do not differ significantly from connected ones. Regarding board composition, unconnected firms have a slightly smaller board with less foreigners, more insiders and less independent directors: the board is dominated by company owners, as well as top executives, explaining firm isolation. There is therefore no major concern for the relevance of our sample regarding general conclusion. Concerning directors who appear only once in our database, the only apparent selection bias stems from a significant higher proportion of female: indeed, 42% of these 'unique' directors have been appointed in our last year (2011). At this moment, the pressure for hiring female director was significantly higher, due to the forthcoming gender quota. This selection bias is more the consequence of a new regulation requirement than an endogeneity issue.

Tests of hypothesis H1 rely on the estimation of status effects α, and in particular on the estimation of the independent status effect. These parameters are fitted using individuals with a diversity of statuses

over our sample period (for instance, independent in two firms and affiliated in a third, or independent for a while in a firm and then affiliated). Out of a total of 1,821 directorships (director-firm-status observations), 497 (27%) fill this condition. These 497 directorships correspond to a total of 174 distinct directors and 1,921 director-firm-year observations. The other directorships are held by directors with the same status whatever the directorship (never independent for 39% and always independents for 34%). The number of directorships, directors and observations used to identify the effect of industry expertise are only slightly lower.

Table A.1: Identification strategy and selection bias

	All directorships (1,821 obs.)		Directorships held by individuals with at least one independent directorship (1,107 obs.)		Independent identifying directorship (497 obs.)		chi2	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Identifying directorships vs the rest	Identifying dir. vs indep. dir.
Woman	0.12	0.32	0.13	0.33	0.09	0.29	1.22	9.39***
Foreigner	0.22	0.42	0.23	0.42	0.10	0.30	1.07	93.00***
Age	58.25	10.13	60.39	9.11	59.91	9.69		
Financial Expertise	0.56	0.50	0.59	0.49	0.61	0.49	8.5***	1,7
Industry-Expertise	0.53	0.50	0.44	0.50	0.54	0.50	87.19***	34.23***

Note: Chi-square tests (p-values) for equality of distributions between the groups are given. Reading: considering all directorships, 12% are held by women over our sample period. This share is 13% if we consider individuals with an independence status. Finally, the share of female is 9% if we only consider individuals used to identify the coefficient on Independence (that is, individuals with a variation in the independence status).

Table A.1 provides evidence on the possible selection bias produced by our strategy of identification. Among the independent directors, the sub-group of identifying directors has a significant lower proportion of foreigners and women than the sub-group of other independent directors. The main reason is the lower occurrence of multiple directorships for foreigners and female directors: for instance, only 22% of foreign directors have multiple directorships, against 52% for French directors. The geographical distance may partly explain this pattern; for women, this may reflects their rather marginal role in the traditional French corporate system. These observations suggest that individuals used to identify the independence status coefficient are more involved in this system, with a greater experience of French boards' functioning.

Finally, the structure of our dataset, with a common output for directors sitting the same year in a given company, imposes some restrictions when analyzing individual fixed effects. As previously

argued, fixed effects for non-mover directors arriving and leaving at the same dates in the same firm are not accurately estimated. This is actually the case for 683 directorships, out of 1,821; we exclude them when comparing fixed effects distribution across groups. Table A.2 compares individual characteristics and status between directorships with accurate fixed effects (group A) and directorships with non-accurate fixed effects (group B). The share of women as well as the age are not significantly different between the two groups. We see however that the group B includes significantly more foreigners. The share of industry experts is also greater, this being related with a lower proportion of independent directors. Finally, there are substantially less financial experts in the excluded group. Of course, we cannot exclude the possibility of a selection bias in our estimation. But the pattern of this potential bias is far from clear: why would a foreign director with industry expertise be of a lower or higher intrinsic quality than a French one with financial expertise? In addition, the selection plays for the two groups we compare, independent and non-independent directors. We are therefore confident that this selection does not produce a substantial bias when examining the relationship between independence and individual fixed effects. As a way to check the robustness of our results, we also implement our quantile regressions on the full sample (1,821 directorships, see Table A.3).

Table A.2: Director fixed effects and selection bias

	Directorships with accurate fixed effect (1,081)		Excluded directorships (740)		Tests	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Student test	chi2
Women	0.12	0.33	0.12	0.32	-0.001	0.01
Foreigner	0.18	0.38	0.29	0.46	-0.12***	35.68***
Age	58.35	9.87	58.08	10.57	0.27	
Financial Expert	0.59	0.49	0.51	0.5	0.08***	11.76***
Independent	0.52	0.5	0.43	0.49	0.09***	14.13***
Insider	0.07	0.26	0.08	0.27	-0.01	0.12
Industry Expert	0.43	0.5	0.49	0.5	-0.06*	6.35**
Industry Expert*Independent	0.19	0.39	0.17	0.37	0.02	1.82

Note: Student and Chi-square tests (p-values) for equality of distributions between the two comparison groups are given.

3. Supplementary results

Table A.3: Director fixed effects and independence (quantile regressions on all directorships)

Panel A: ROE

	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.017***	0.016***	0.014***	0.013***	0.013***	0.014***	0.013***	0.010***	0.012***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Insider	0.018***	0.017***	0.015***	0.013***	0.013***	0.013***	0.014***	0.014***	0.015***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Industry Expert	0.002	0.002	0.001	0.001	0.001	-0.001	-0.002	-0.002	-0.003
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Woman	-0.006**	-0.003	-0.001	0.000	0.000	-0.000	0.002	0.007	0.011***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
Foreigner	0.001	-0.000	-0.000	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Age	0.009	0.011	0.003	0.002	-0.000	-0.006	-0.007	-0.011	-0.015
	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)	(0.006)	(0.007)	(0.008)	(0.010)
Financial Expert	0.001	0.000	0.000	-0.000	-0.001	-0.002	-0.003*	-0.003	-0.004*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Multi-directorships	0.001	0.001	0.002	0.002	0.003*	0.001	0.001	0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Observations	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812	1,812
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: ROA

	(1) 10th	(2) 20th	(3) 30th	(4) 40th	(5) 50th	(6) 60th	(7) 70th	(8) 80th	(9) 90th
Independent	0.006***	0.004***	0.005***	0.005***	0.005***	0.005***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Insider	0.004***	0.003***	0.003***	0.003***	0.002***	0.002***	0.002***	0.002**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry Expert	-0.000	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.001	-0.002***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Woman	-0.001	0.000	-0.000	-0.000	0.000	0.000	0.000	0.001	0.004**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)
Foreigner	0.002**	0.001	0.001	0.001	0.001	0.001	0.001*	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.003	0.001	0.000	-0.000	-0.001	-0.001	-0.001	-0.004	-0.004
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Financial Expert	0.000	0.001**	0.001	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Multi-directorships	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Observations	1,814	1,814	1, 814	1, 814	1, 814	1, 814	1, 814	1, 814	1, 814
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Dependent variable: Director fixed effect computed with Return On Equity value (Panel A) or Return On Assets (Panel B). (2) Director controls include: the statuses (independent, insider, industry expert, financial expert), the age, the gender and foreigner dummies as well as a dummy for multi-directorships (3) All models include firm fixed effects. (4) Robust standard errors in parentheses. (5) Significance: *** p<0.01, ** p<0.05, * p<0.1.